CONSUMER ACCEPTANCE AND WILLINGNESS TO PAY FOR BEEF PRODUCTS DERIVED FROM RNA INTERFERENCE TECHNOLOGY

by

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Abstract

Recent predictions estimate that the global population will reach more than 9 billion by the year 2050 (Kochhar, 2014). Coupled with this challenge, environmental issues and climate change influence agricultural production over the globe (Jacobsen et al., 2013). Changes in the food chain have been in response to consumers becoming interested in how their food is produced as it relates to food safety. Some of these changes have come in the form of labeling of production methods and the increasing volume of organic products in the marketplace. In the livestock sector, production methods include administration of antibiotics and hormones to prevent disease, increase gains and increase the health of animals (Allen et al., 2013; Thornton, 2010). A potential solution of decreasing the amount of antibiotics and hormones in the future is the use of ribonucleic acid interference (RNAi). RNA interference is a method of silencing a targeted gene and suppressing expression (Bradford et al., 2016). The focus of this research is to explore the determinants of acceptance and willingness to pay for beef products utilizing RNAi technology in the food system.

Through the means of a national survey, consumers were asked their demographic, food purchasing habits, and food safety concerns to identify potential acceptors of the technology. Respondents received information treatments and external articles regarding RNAi technology as well as information about governmental labeling regulations of the beef steaks. Choice experiment questions, and a dichotomous choice sequence were utilized to determine willingness to pay estimates of beef steak attributes by consumers.

Results showed that respondents likely require a discount for beef steaks produced with RNAi technology. In some instances, some consumers would be willing to pay a premium for beef steaks with RNAi in certain label settings. These results of this study could be used in the

realm of animal science to help with the introduction of this technology in the food system. The survey results could assist with future promotion and framing of the technology to a wide variety of consumers.

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Dedication

This thesis is dedicated to all of my family, especially my late grandfather Richard Wayne Evans, mom Tara, siblings McKenna, Garett and Lane, and grandmother Wanda. Without their constant support, love, and sacrifice, my education would never have been possible. I have had numerous teachers and role models in my education, but nothing will ever come close to the lessons and values I have learned from my family. Thank you for being my biggest fans in life, comforting me when I was doubtful, and reminding me I can reach my dreams regardless of the given constraints.

Nihil Sine Deo

Chapter 1 - Introduction

Various factors influence the behavior of consumers and their purchasing decisions. In recent years, consumers have become increasingly interested, aware of and concerned about the methods of production and associated attributes of food products. In the agriculture industry, farmers and ranchers have utilized technology and other resources to increase yields as well as mitigate production risks. In recent decades, biotechnology has been used to aid in production efforts. In the livestock sector, changes in the supply chain have been prompted not only by consumers but producers as well. To reduce risks, increase growth efficiency and improve the health of animals, producers have utilized growth hormones and administered antibiotics to livestock.

This study was conducted as part of a Global Food Systems (GFS) seed project at Kansas State University. The purpose of the grant project is to explore the potential of RNA interference (RNAi) for applications in the agriculture industry. The GFS team comprised several academic areas in an attempt to approach this topic from a multidisciplinary mindset. These potential applications in study are focused around the livestock sector. Advances in technology could potentially allow producers to cut down on costs tied to raising livestock. RNAi is the process of inserting RNA into the nucleus of an organism's cells to suppress the expression of a gene. The technology was discovered by scientists Andrew Z. Fire and Craig C. Mello at the Carnegie Institution of Washington and University of Massachusetts Medicine, respectfully. Their groundbreaking research was published in 1998, and the researchers were awarded a Nobel Prize in Physiology or Medicine 2006 (Zamore, 2006). With the use of RNAi, livestock producers could potentially inject small interfering RNA and suppress the protein production of an undesired gene that influences a disease, such as fatty liver disease. The main aim of this

technology is to improve overall health of livestock, which could influence carcass yield per animal. Another potential benefit of this technology is higher quality products. Beef products, such as beef steaks, are graded according to quality, marbling and other characteristics. The results of this technology could potentially yield higher meat quality. In addition, benefits include decreased long-term costs incurred by producers which are then passed on down the supply chain to cause decreased prices paid by consumers. While the potential benefits are promising, there could be adverse economic consequences for implementing this technology in the food system if consumers are not accepting of it. Consumers might not easily desire products derived from RNAi technology due to lack of trust, moral values, fear, health concerns, eating habits, or other reasons.

To address some of these knowledge gaps, a national survey was conducted, composed of a series of questions to collect demographic information, household food expenditures, and food purchasing habits to identify potential consumers of food products derived from RNAi technology. To assess the acceptance of RNAi technology, an assortment of Likert-scale questions about respondents' perceptions of the technology were asked. To analyze the willingness to pay for these products by consumers, choice experiments with varying attributes of beef products and dichotomous choice models with varying claims were administered. In addition, several information treatments regarding RNAi technology from a variety of sources were provided to respondents. The impact of these pieces of information on consumers' acceptance and willingness to pay were also analyzed.

1.1 Objectives

The main objective of the study is to examine acceptance of RNA interference technology being used within the food system. The specific objectives for the research were as follows:

- Determine which consumers will be more likely to accept RNAi technology in the food system in the form of beef products
- Determine the amount consumers are willing to pay for beef steaks derived from RNAi technology
- Determine the amount consumers are willing to pay for beef steaks with varying price, technology and production attributes across different label settings
- Explore consumers' use of information provided to them in regards to RNAi technology

1.2 Motivation

The research is motivated by the potential benefits this technology boasts. There is potential application of RNAi technology within the livestock industry by farmers and ranchers, if consumers accept its use. In order to assess the future profitability of adopting RNAi technology, consumer acceptance and willingness to pay for the technology must be determined.

1.3 Format

The format for the rest of this thesis research as it relates to RNAi technology is as follows: Chapter 2 – survey development and data; Chapter 3 – consumer acceptance; Chapter 4 – consumer willingness to pay; and Chapter 5 – duration of information use. Chapter 6 provides a conclusion of the findings, implications, and a discussion of the results as well as limitations of the study and suggestions for future research. Chapter 7 provides a list of references used in the

study. Appendices are included afterward and include the survey instrument, survey design, summary statistics, approval letter from the KSU Institutional Review Board, and diagrams of the framework used for the choice experiment designs.

Chapter 2 - Survey Development and Data

2.1 Survey Methods

The full survey instrument can be found in **Appendix A**. The survey instrument was distributed to consumers from all across the United States by the programming company Focus Vision. Focus Visions' survey product, Decipher, was used to develop an online form of the survey as well as hosted and collected the initial data set. A soft launch of the survey was conducted to examine if the survey worked and variables desired were being collected. In the soft launch period, 300 respondents. Survey links were emailed out by the company on February 9, 2016. Within three days, February 12, 2016, the survey was closed due to a desired response rate of more than 3,000 individuals. There was a total of 5,216 individuals who responded to the online survey. Out of those 3,000 were usable in the analysis after filtering out respondents with relatively quick response times and survey dropouts.

Parameters used in the study included age, state of residence, highest level of education, range of household income, and frequency of meat purchases, weekly household food expenditure, number of adults and children in the household, primary source for news stories, previous purchases of beef products, willingness to pay for beef products with certain labels and knowledge of antibiotic and beef quality grades.

2.1.1 Development and Organization

The survey instrument was constructed to not only identify potential consumers of RNAi technology through socio-demographic characteristics, but also assess willingness to pay of respondents and the effects of various forms of information treatments. Using methodology from previous studies (Lusk, 2003; Lusk and Coble, 2005; Cox and Evans, 2008; Liaukonyte, et al.,

2013) regarding the adoption and concerns with new technology in the food system, the questions in these studies were modified to reflect RNA interference and new beef technologies. These primarily came in the form of Likert-scale questions, which are mainly discussed in Chapter 3 of this thesis. Respondents first encountered questions to identify socio-demographic information and food purchasing habits. Next, respondents went through the choice experiment scenarios asking their preference between two options of beef steaks with varying attributes or opting out. After the choice experiment, respondents were asked different questions assessing their acceptance and concerns about RNAi technology. Included in these questions, respondents provided feedback on the desirability of various applications of RNAi technology in the livestock sector. Respondents also ranked their preference in what form of technology should be used to make improvements in varying objectives in the livestock sector. Lastly, respondents were put through a restaurant selection situation in the form a double-bounded dichotomous choice sequence to assess the role of RNAi use in food service.

2.1.2 Food Values

Lusk (2013) presents general food values and issues which motivate consumer behavior. Modifying the food items presented in the Oklahoma State University Food Demand Survey to identify important issues to consumers when new technology is implemented in the beef sector, the following issues were examined: animal welfare, food safety, price, taste, naturalness, antibiotic use, hormone use and labeling of food products. These items were used in this study to assess if the levels of concern for food values hold true for consumers in regards to the introduction of RNAi technology.

2.2 Survey Results

Full tables of summary statistics of socio-demographic variables can be found in **Appendix C**. The states were categorized into regions as according to the U.S. Census Bureau. Within the 3,000 sample, 1,057 were from the South, 557 from the Northeast, 700 from the West and 686 from the Midwest. Fifty-one percent of respondents were female. The sample is comparable to the U.S. population, as 50.8 percent of the population are female (U.S. Census Bureau, 2014a).

Household size was measured by the number of adults and number of children. A majority of respondents indicated 2 adults and 1 child. Since the questions in the survey were open-ended, respondents were able to provide exact numbers. The average number of adults was 2.21 and the number of children were 0.71.

The average age of respondents was 42. Age categories were dispersed in intervals between 18 and 55. Through an open-ended question, respondents provided the number of years old they were. The comparison between U.S. and survey age ranges can be shown in **Table 2.1**.

Table 2.1. Comparison of U.S. Population and Survey Sample by Age

Range of Ages	**U.S. Population[a]**	**Survey Population[b]**
18-24	12.86%	15.3%
25-34	17.66%	21.0%
35-44	16.62%	20.0%
45-54	17.66%	23.8%
55+	35.20%	20.0%
Average Age		41.9

Notes:
[a] Data from U.S. Census Bureau (2014a). Percentages adjusted by taking out children under 18.
[b] Survey excluded persons under the age of 18.

Respondents were asked the highest level of education they had completed on a scale of 1 (did not graduate from high school) to 5 (graduate or advanced college degree earned). Comparisons of the education levels of U.S. and survey populations can be found in **Table 2.2**.

Table 2.2. Comparison of U.S. Population and Survey Sample by Education

Education Level	U.S. Population[a]	Survey Population
Did not graduate from high school	13.1%	3.5%
High school diploma	27.7%	41.2%
Associate's or trade degree	29.1%	20.6%
Bachelor's degree	18.7%	25.0%
Graduate or advanced college degree	11.4%	9.7%

***Note*:**
[a] Data from U.S. Census Bureau (2014b).

Respondents were asked about their frequency of meat consumption in the survey. These meat products included groundbeef (hamburger), steak, pork, chicken, and fish on a scale of 1 (never) to 5 (at least every day of the week). For the survey sample, chicken was the most frequently consumed meat product. Groundbeef and hamburger were second, followed by steak. A small portion of respondents identified themselves as vegan and vegetarian, about 0.67 percent (20 respondents).

Through an open-ended question, Question 9, respondents provided their average weekly expenditure on total food consumption. The average weekly food expenditure per household was $258. Respondents were also asked their willingness to pay for beef products with varying labels, on a scale from 1 ($0) to 10 (over $16), Question 15 in the survey. Within the question, a $7.79 average price of beef steaks was provided to respondents to serve as a base reference price. The price was based on the Bureau of Labor Statistics average for November 2015 (BLS, 2016a). Respondents indicated they would be willing to pay more for beef products labeled as USDA choice. **Table 2.3** provides the values for the willingness to pay for the respective labels.

Table 2.3. Willingness to Pay for Beef Products by Label			
Label	**Value[a] (USD)**	**Mean**	**Rank**
Organic	1.33	6.64 (3.96)	6
Natural	1.31	6.71 (3.51)	7
Animal Welfare Assured	1.10	6.05 (3.81)	8
Grass Fed	1.39	6.72 (3.61)	4
Antibiotic Free	1.40	6.49 (3.68)	3
Hormone Free	1.44	6.52 (3.67)	1
Choice	1.40	6.78 (3.14)	2
Select	1.35	6.71 (3.22)	5
Notes: * Numbers in parentheses are standard deviations. a Values were calculated by taking the mean of each range multiplied by the percentage selection for that respective range. Values were rounded to the nearest hundredths.			

To assess respondents' knowledge and perceptions of the livestock industry as well as antibiotic use and quality grades, they were asked to predict the U.S. cattle given antibiotics and what percentage range of cattle were graded as USDA choice during Questions 16 and 17. With the results of these two questions, the knowledge level of respondents was assessed. Results of this question can be found in **Table 2.4**.

Table 2.4. Respondents Estimate of Percentage of Antibiotic Use and Choice Grade		
Percentage Range	**Percentage of Respondents**	
	Antibiotic Use	**Choice Grade**
10% or less	5.30	5.13
11-30%	10.70	16.40
31-50%	23.17	30.57
51-70%	28.67	27.70
71-90%	23.93	14.30
91% or more	8.23	5.90

Respondents were asked their primary source of news information. The largest share of respondents, 44 percent, indicated they received news from television broadcast, followed by social media with 26.2 percent.

Table 2.5. Frequency of Primary Source of Information.		
Source	**Percentage of Respondents**	**Rank**
Physical newspapers	3.77	5
Online newspapers	17.83	3
Popular magazines	0.77	7
Social media	26.20	2
Radio broadcast	4.33	4
TV broadcast	43.97	1
Other	3.13	6
Note: Respondents were allowed only to choose one primary source.		

In Question 16, respondents were asked about their concern of beef attributes and production methods. The values were on a scale from 1 (not at all concerned) to 7 (very concerned). The results of this question can be found in **Table 2.6**. Food safety is the greatest concern of respondents.

Table 2.6. Respondent Concern of Beef Attribute and Production Methods		
Attribute/Production Method	**Mean**	**Rank**
Animal welfare	4.83	7
Food safety	5.92	1
Price	5.67	3
Taste	5.87	2
Naturalness	4.73	8
Antibiotic use	4.91	6
Hormone use	4.97	5
Labeling of beef products	5.07	4
Note: All attributes and production methods concerns were on a scale from 1 = not at all concerned to 7 = very concerned.		

The results of the survey pertaining to the acceptance of RNAi technology and the choice experiment questions and dichotomous choice sequence will be discussed in Chapter 3 and Chapter 4, respectfully.

Chapter 3 - Consumer Acceptance

3.1 Introduction

Consumers have become increasingly concerned about how food is produced in recent years (Gillman, 2012). Some of these concerns have come in the form of safety in regards to the use of genetically modified organisms (GMOs), use of herbicides and pesticides, and use of chemical fertilizers, among other subjects within the food supply (Fatka, 2015). These production practices have increased efficiency in the supply chain as well as cut down the costs consumers pay in the marketplace (Dorward, 2013). Consumers may seek alternative products not derived from these methods, such as organic, natural, hormone free, etc., to avoid the perceived negative effects from these kinds of products (Lee & Yun, 2015). Specifically, in the livestock industry, consumers have voiced concerns about the use of hormones and antibiotics. These production methods are used for the purpose of increasing growth and preventing disease (Thornton, 2010). Some retailers, wholesalers and restaurants will provide products labeled as grass-fed or natural. While these alternative products may be more expensive due to the increased production costs, some consumers may be willing to pay more to purchase these products (Smith and Lin, 2009).

The key to consumer acceptance of biotechnology is perceived risks and benefits (Bruhn, 2003). In this chapter, the acceptance of RNAi technology by consumers is examined. Using conditional logit models, consumer acceptance of RNAi technology is estimated through the use of data obtained from Likert-scale questions. Responses to individual questions are analyzed to determine the attitudes and perceptions of RNAi technology by consumers. Through the summation of Likert-scale questions regarding the acceptance of RNAi, an index of RNAi acceptance was developed. With the summated RNAi acceptance index, conditional logit models

are used with demographic and other variables. Predicted results include negative reactions and apprehension of RNAi technology by respondents. The results of the conditional logit models generally yield negative reactions toward adoption of the technology in the beef industry, but a positive reaction of the technology being targeted to protect animals from disease and increase overall animal health.

3.2 Literature Review

3.2.1 Advantages of RNA interference technology

The literature provides evidence of the benefits of RNAi technology use on the supply side of the food and agriculture system. RNAi is the process in which "intracellular double-stranded RNA triggers a conserved response that leads to cleavage and degradation of complementary mRNA strands, thereby prevention production of the corresponding protein" (Bradford et al., 2016). Bradford et al. (2016) points out the different methodologies of the technology using exogenous RNA. These approaches include DNA microinjections, embryonic stem cell-mediated gene transfer, somatic cell nuclear transfer, retrovirus-mediated gene transfer and other methods. For example, with the DNA microinjection approach, the exogenous RNA carried on a transgene is inserted into the nucleus of a fertilized egg. Results of this technology within the livestock sector are expected to alter muscle development, alter sex ratios, support the transition between physiological states, and combat infectious diseases (Bradford et al., 2016).

While not currently applied in the livestock sector of the food and agriculture industry, RNAi technology has been used in fruits and vegetables. For example, scientists used RNAi technology to support the production and longevity of papayas (Gonsalves, et al., 2004). In the early 1990s, the U.S. papaya supply had been drastically impacted by the *Papaya ringspot virus*

(PRSV) (Gonsalves et al,, 2004). The virus causes growth deficiencies in the papaya plant and its fruit. Through the use of RNAi technology, scientists were able to develop transgenic papayas which were resistant to PRSV. After the introduction of transgenic papayas, the production steadily increased in Hawaii.

Bradford et al. (2016) point out several obstacles to the adoption of RNAi technology in animal agriculture and consumer acceptance is hard to gauge. Food safety concerns, consumer perceptions, and regulatory issues play a part in whether RNAi technology is accepted in the future.

3.2.2 Consumer attitude toward biotechnology

GMOs were first approved for use in the food system in the 1990s (Colson et al., 2008). After the commercial adoption of GM foods, consumers were unaware that GM technology was being used in the food sector (Hoban, 2002). Additionally, consumers were uncertain about the safety of GM foods (Hoban, 2002). This controversial debate in the food and agriculture sector has both ends of the spectrum disseminating information to the public (Lusk et al., 2004). On one end, consumer and environmental groups warn of the dangers and risk of consuming GMO food products (Lusk et al., 2004). On the other end, agribusinesses, commodity organizations and advocacy groups have touted the benefits (Lusk et al., 2004).

Past studies have shown that some consumers are willing to pay a premium for genetically modified foods when the benefits of using biotechnology are specified (Lusk et al., 2004). Rousu et al. (2007) used an experimental auction with information and labeling treatments to estimate the willingness to pay for genetically modified foods. The information treatments varied in tone and perspective on agricultural biotechnology. The results of this study

found that consumers were influenced by the source of the entity provided information, where anti-biotechnology information from environmental non-governmental organizations positively influenced bid price differences on genetically modified foods and pro-biotechnology information from the biotechnology industry negatively influenced bid price differences. Frewer et al. (1998) found the credibility of the source of information impacted the reactions of individuals to information about food biotechnology. In addition, the source credibility was strongly influenced by prior attitudes toward biotechnology (Fewer, 1998).

In the fall of 2015, AquAdvantage salmon was approved by the U.S. Food and Drug Administration for commercial use. This product is the first meat product using genetic modification technology. Using genetic information from other species of salmon, the salmon is able to produce growth hormone year round, which causes production time to be cut in one-half (FDA, 2015a). After critical and scientific analysis, the FDA determined that the AquAdvantage salmon was nutritionally comparable to non-GE salmon as provided under the Food, Drug and Cosmetic Act and is not materially different from other Atlantic salmon (FDA, 2015a). The FDA provided manufacturers with voluntarily labeling language for food products that contained genetically engineered and non-genetically engineered ingredients (2015b). Controversy surrounding the adoption of this product focused on the effects on human health (Smith et al., 2010). Very limited research is available regarding the influence on consumer health and wellness, especially in meats products. Smith et al. (2010) note the possibility of government intervention causing the price of genetically engineered salmon to decrease, which could lead to increased consumption and may have positive effects on human health and nutrition due to increased intake of omega-3 fatty acids.

3.2.3 Food safety and animal health concerns

Food safety, on an objective basis, is based on the assessment of the risk or potential hazard by scientists and food experts while it is more subjective to consumers (Grunert, 2005). Grunert (2005) explains that consumers may have safety concerns about certain production technologies, such as food irradiation and GMOs. These perceptions are often negative about the technology used and influence products in the marketplace (Lee & Yun, 2015). Concerns about health effects and food safety from these technologies have led to increases in the demand for organic and natural food products (Harper, 2007). While some studies have shown there are no significant nutritional differences between organic and GM products (Smith-Spangler et al., 2012), government agencies have not identified this information via mandated labeling in food products.

Concerns for the welfare of animals have been increasing as well. Knight and Herzog (2009) note the spectrum of use of animals in society is complex and differs due to people's values and beliefs. On one end, people use animals for companionship while on the other end use them for research and consumption. While consumers may have an attitude about animal use in one particular application, it may not carry through to other uses (Knight & Herzog, 2009). Croney et al. (2012) point out that science alone does not dictate practices producers use, and the opinions of stakeholders in the food system should also be considered. Special interest groups, such as People for the Ethical Treatment of Animals (PETA) and the Human Society of the United States (HSUS), have disseminated information to the public about negative production practices used by farmers and ranchers as well as highlighting research that suggests having a non-animal protein diet may produce healthful benefits (PETA, 2016; HSUS, 2016). Several states have had ballot initiatives about animal agriculture production practices, e.g., the use of

gestation crates in the swine industry (Tonsor & Wolf, 2010). Previous studies have shown that consumers value certain production practice attributes and animal welfare attributes, such as individual gestation crates and stalls and antibiotic use (Olynk, Tonsor, and Wolf, 2010).

3.2.4 Risk perceptions and attitudes

Consumers have varying risk perceptions and attitudes toward food. While there are very few food products in which consumers might have a risk preference for, or risk seeking, most food products fall in the risk attitude category of risk neutral and risk averse. Compared to risk perceptions, consumers will have different feelings toward risk. Perceptions about food safety risk are what the individual believes would be the amount of health risk, if any, they would face from consuming a food product (Schroeder et. al, 2007). With the introduction of new technology, consumers have a perception of risk based on previous experiences and information available to them. Schroeder et al. (2007) notes that people with varying levels of risk attitude respond with different behaviors. Perception of risk changes due to the setting and experience consumers face. Grunert (2005) describes that while meals prepared at home are often thought to be safer as opposed to ready-made meals, the opposite is actually true, objectively. While consumers may be aware of risk associated with meal preparation, consumers feel as if their own chances of being exposed to risk are lower than average consumers, which Grunert (2005) defines as optimistic bias. Another dimension of risk perception is history with food safety, as consumers are more aware of risks they have previously encountered. Consumers with no previous experience with food safety concerns will be more risk averse to those foods due to lack of information (Schroeder et al., 2007).

3.3 Methods

3.3.1 RNAi Perceptions and Acceptance

To assess the levels of acceptance of consumers, a series of Likert-scale questions has asked of respondents. These Likert questions ranged from asking the respondents' desirability, willingness to eat, willingness to purchase and preference for the application of RNAi technology in the beef sector.

The following methods were used in an analysis of the Likert scale item with the utilization of conditional logit modeling. The expected results were consumers in general are more risk averse with new technology and will likely not accept RNAi in the food system. Albeit, if consumers receive an information treatment or an external article with a promising or positive tone, it may influence their decision on the application of RNAi.

Lusk and Coble (2005) developed a set of questions about the perception of risk in consuming genetically modified foods. This original set of questions used in the 2005 study were taken from Lusk et al. (2004). In Lusk and Coble's (2005) study, the results of these that respondents were risk averse to genetically modified foods and less accepting of the technology. With this type of mindset, questions for this study were modified from Lusk and Coble (2005) to reflect risk in consuming RNAi technology. In addition to Lusk and Coble's (2005) consumption risk, a set of questions was developed in regard to consumer acceptance of genetically modified foods. Because RNAi technology is not currently used in commercial beef products, the statement regarding previous consumption from Lusk and Coble's (2005) study was not asked of respondents.

3.3.2 Food Technology Neophobia Scale

Cox and Evans (2008) suggest a modified Food Neophobia Scale to assess the attributes of new technology with consumers. In the development of the Food Technology Neophobia Scale (FTNS), Cox and Evans (2008) hypothesized that a trait of the scale would have a positive relationship with distrust in science. In their study, they asked student respondents to rate their agreement with 13 statements about the acceptance of foods via a questionnaire. Respondents were asked to rate on a 7-point scale from strongly disagree to strongly agree. One objective of their study was to decrease the number of items in order to group statements into factors. Using a rotated varimax maximum likelihood method through factor analysis, Cox and Evans (2008) were able to group the food technology acceptance statements into factors based on the relative magnitude and signs of the eigenvalues. The FTNS was used in this study to capture respondents' attitudes toward new technologies in the beef sector. The 13 statements were modified for this study to reflect new beef technologies. Through the use of this method, the statements about perceptions and attitudes toward can be grouped into smaller factors and used in econometric models.

3.3.3. RNAi Acceptance Index

Through the use of the Likert-scale questions modified from Lusk and Coble (2005), an index was developed to denote the acceptance of RNAi technology by respondents. Three statements were included in the Likert question set, which respondents rated on a scale of 1 (strongly disagree) to 7 (strongly agree). If the combined value of the three statements equaled 15 or greater, then the index had a value of -1 representing acceptance of RNAi technology. If the combined value was 14 or below, then the index had a value of 0 representing non-

acceptance, or apprehension, of RNAi technology. Due to the programming in SAS, the conditional logit estimates the probability of the lowest value. The acceptance index was given a negative value for the model to explain the acceptance of respondents. Using the acceptance index as a dependent variable and demographics and other variables as explanatories, a conditional logit model was employed to estimate the marginal effects of respondents. Using the model developed by McFadden (1974), the conditional logit form can be expressed:

$$Prob(j \text{ is chosen as most and } k \text{ as least}) = \frac{e^{\lambda_j V_{ji}}}{\sum e^{\lambda_j V_{ki}}} \quad (3.1)$$

Where *j* is respondents who are acceptors of RNAi technology and *k* is respondents who are non-accepting, λ_j signifies the fit of the value of acceptors, and *V* denotes the utility of respondents. The conditional logit models have the assumption that consumers have homogenous preferences (Lusk, Roosen, and Fox, 2003).

3.4 Results

3.4.1 Most preferred purpose and application

Results of questions asked regarding the purpose and application of RNAi technology in the food system can be found in **Table 3.1**. The most preferred purpose of RNAi is protecting cattle from disease, followed by increasing overall animal health and keeping beef production and processing in the United States.

Respondents also were asked to rank which technology or production practice they would prefer be used for improvements in animal health in beef cattle, safety of beef products, or price of beef products. Results of the number one rankings for each technology by goal can be found in **Table 3.2**. The most frequent technology ranked number one in improving animal health and

price of beef products was feed additives while antibiotics ranked number one in improving safety of beef products. More than half of the first rankings for each goal are feed additives and antibiotic use. Vaccines were the lowest of the technology ranked as number one with less than 14 percent of respondents for each specific goal. RNAi technology received the second lowest of the number one rankings.

Table 3.1. Preferred Purpose of RNAi technology

Variable	Means (Standard Deviation)	Percentage of Observations			
		<=4	=5	=6	=7
Keep beef production and processing in the U.S.	5.16 (1.59)	35.33	20.07	17.07	27.53
Lower the price paid by beef consumers	5.05 (1.65)	37.63	19.23	16.80	26.33
Improve the nutrition content of beef	4.93 (1.61)	40.60	21.70	15.63	22.07
Reduce use of antibiotics	5.08 (1.59)	37.10	20.50	17.07	25.33
Protect cattle from disease	5.24 (1.58)	31.33	20.93	19.07	28.67
Reduce use of hormones	5.14 (1.57)	35.10	20.53	18.23	26.13
Increase overall animal health	5.17 (1.59)	33.07	22.03	17.77	27.13
Reduce death in cattle	5.03 (1.57)	37.57	22.33	16.37	23.73
Increase carcass yield	4.47 (1.61)	53.03	21.37	12.23	13.37
Reduce use of feed additives	5.00 (1.57)	38.43	22.17	16.93	22.47
Reduce farmers' time involved in labor	4.37 (1.59)	56.17	20.87	11.43	11.53

***Note*:** All questions were asked on a scale of 1 = very undesirable to 7 = very desirable.

Table 3.2. Number One Rankings of Improvements by Technology

Variable	Animal Health in Beef Cattle	Safety of Beef Products	Price of Beef Products
Feed Additives	321 (32.1%)	292 (29.2%)	345 (34.5%)
Antibiotics	272 (27.2%)	301 (30.10%)	243 (24.3%)
Vaccines	113 (11.3%)	125 (12.5%)	133 (13.3%)
Genetic Technology	148 (14.8%)	155 (15.5%)	154 (15.4%)
RNAi Technology	146 (14.6%)	127 (12.7%)	125 (12.5%)

Note: The values above are those where respondents have a ranking of 1 for the respective variable.

3.4.2 Factor Analysis

Table 3.3. Factor Analysis of New Food Technology Results		
Attribute of Beef Technology	**Factor 1[a]**	**Factor 2[b]**
New beef technologies are something I am uncertain about.	0.577	0.098
New beef products are not healthier than traditional beef products.	0.719	0.043
The benefits of new beef technologies are often grossly overstated.	0.684	0.094
There are plenty of tasty beef products around so we do not need to use new beef technologies to produce more.	0.764	0.072
New beef technologies decrease the natural quality of beef products.	0.764	0.008
New beef technologies are unlikely to have long-term negative human health effects.	-0.098	0.748
New beef technologies give people more control over their beef product choices.	-0.111	0.781
New beef products using new technologies can help people have a balanced diet.	-0.207	0.807
New technologies in beef may have long-term negative environmental effects.	0.745	-0.034
It can be risky to switch to new beef technologies too quickly.	0.714	-0.019
Society should not depend heavily on new technologies in the beef industry to solve its food problems.	0.742	-0.014
There is no sense trying out high-tech beef products because the ones I eat are already good enough.	0.698	0.103
The media usually provides a balanced and unbiased view of new beef technologies.	0.133	0.682
Notes: a Factor 1 had an eigenvalue of 4.670 and explains 35.9 percent of the variation across all questions. b Factor 2 had an eigenvalue of 2.343 and explains 17.9 percent of the variation across all questions.		

Results of the FTNS showed the statements of adopting new beef technologies could be grouped into or collapsed to two factors. Examining how each statement loaded on each factor provides a guide to labeling each factor. A full table of the results are provided in **Table 3.3**. The first factor can be described as general concerns, as it includes statements in which new beef technologies are framed negatively and reflect uncertainty. The statements included in this factor are: new beef technologies are something I am uncertain about, new beef product are not healthier than traditional beef products, the benefits of new beef technologies are often grossly overstated, there are plenty of beef products around so we do not need to use new beef technologies to produce more, new beef technologies decrease the natural quality of beef products, it can be risky to switch new beef technologies in the beef industry to solve its food problems, and there is no sense trying out high-tech beef products because the ones I eat are already good enough. The second factor can be labeled as general support as these statements

frame new beef technologies in a more positive light than the rest of the statements. The second factor includes new beef technologies are unlikely to have long-term negative human health effects, new beef technologies give people more control over their beef product choices, new beef product using new technologies can help people have a balanced diet and the media usually provides a balanced and unbiased view of new beef technologies.

3.4.3 RNAi Acceptance

The results of the Likert-scale questions pertaining to the acceptance of RNAi technology can be found in **Table 3.4**. The results of the agreement with the three statements about RNAi technology are similar.

Table 3.4. Acceptance of RNAi Technology

Variable	Definition	Mean	Percentage of Observations			
			<=4	=5	=6	=7
Eat	I am willing to eat RNAi beef products	3.73 (1.71)	67.43	17.77	8.73	6.07
Purchase	I am willing to purchase RNAi beef products.	3.75 (1.70)	67.77	17.87	8.33	6.03
Accept	In general, I support the use of RNAi technology in food production.	3.57 (1.64)	74.80	13.60	6.40	5.20

Notes:
* Numbers in parentheses are standard deviations.
All questions were asked on a scale of 1 = strongly disagree; 7 = strongly agree.

In addition to asking respondents about their acceptance of RNAi, a set of Likert-scale questions were used to assess concern over the technology. Results of these questions can be found in **Table 3.5**. It is noted that items 2 and 3 were reverse coded. Similar to the acceptance results, the results are nearly split for items 1 and 4. For items 2 and 3, the results suggest respondents are more concerned about consuming food products using RNAi technology and are uncertain about the potential side-effects.

Table 3.5. Perception of Risk in Consuming RNAi Technology		
Scale Item	**Definition**	**Mean**
Item 1	RNAi technology in beef production will not pose risk to my family and me.	3.54 (1.56)
Item 2	My family and I could be exposed to great risks from RNAi technology in food production.	4.52 (1.55)
Item 3	The side-effects from eating RNAi technology in food production are largely unknown.	5.10 (1.50)
Item 4	There is little danger that RNAi technology in food production will results in new diseases for humans.	3.63 (1.56)
Notes: *Numbers in parentheses are standard deviations. All questions were asked on a scale of 1 = strongly disagree; 7 = strongly agree; however, Items 2 and 3 were framed negatively.		

Table 3.6. Acceptance of RNAi Technology by Information Treatment						
Information Treatment	**Variable**	**Definition**	**Percentage of Observations**			
			<=4	**=5**	**=6**	**=7**
1	Eat	I am willing to eat RNAi beef products.	67.87	16.93	9.60	5.60
2			66.93	16.67	8.93	7.47
3			66.40	18.40	9.07	6.13
4			68.53	19.07	7.33	5.07
1	Purchase	I am willing to purchase RNAi beef products.	68.13	18.93	7.33	5.60
2			65.60	18.53	9.07	6.80
3			67.07	17.33	9.73	5.87
4			70.27	16.67	7.20	5.87
1	Support	In general, I support the use of RNAi technology in food production	75.07	13.87	6.67	4.40
2			75.20	12.53	6.27	6.00
3			72.53	15.20	7.47	4.80
4			76.40	12.80	5.20	5.60

Looking into the acceptance of RNAi further, the results of the acceptance Likert-scale questions were broken down by which of the four information treatments the respondent received. These information treatments were selected from searching through various forms of online media focusing on the topic of RNAi. Results of the acceptance of RNAi can be found in **Table 3.6**. Respondents who received information treatments 2 and 3, which were framed in historical and promising perspectives, respectfully, had given the statements a values of 5 or

greater more frequently. Respondents who received the information treatment 4, which was framed RNAi in a concerning manner, received more values of 5 or less.

Table 3.7. Expectation or Impression of RNAi Technology

Variable	Definition	Mean	Percentage of Observations			
			<=4	=5	=6	=7
Cattle Health	Impact on health of beef cattle	4.00 (1.61)	64.73	17.97	10.00	7.30
Production Costs	Impact on production costs	4.13 (1.54)	61.00	21.87	9.47	7.67
Price Paid	Impact on price paid by consumers	4.07 (1.59)	61.63	20.87	9.73	7.77
Taste	Impact on taste of beef products	4.09 (1.47)	66.53	18.27	8.53	6.67
Human Health	Impact on human health from beef consumption	3.90 (1.63)	67.30	17.40	8.37	6.93

Notes:
* Numbers in parentheses are standard deviations.
** All variables are on a scale from 1 = strongly negative and 7 = strongly positive.

Table 3.8. Expectation of RNAi technology by Information Treatment.

Information Treatment	Variable	Definition	Percentage of Observations			
			<=4	=5	=6	=7
1	Cattle Health	Impact on health of beef cattle	65.87	17.87	9.33	6.93
2			66.00	16.53	8.80	8.67
3			63.47	18.13	12.53	5.87
4			63.60	19.33	9.33	7.73
1	Production Costs	Impact on production costs	64.67	22.13	8.00	5.20
2			58.53	22.13	9.60	9.73
3			59.87	21.87	10.80	7.47
4			60.93	21.33	9.47	8.27
1	Price Paid	Impact on price paid by consumers	64.13	20.80	8.27	6.80
2			59.47	22.53	9.60	8.40
3			61.60	19.47	11.33	7.60
4			61.33	20.67	9.73	8.27
1	Taste	Impact on taste of beef products	68.13	17.47	8.00	6.40
2			66.67	17.87	8.93	6.53
3			66.40	19.73	8.40	5.47
4			64.93	18.00	8.80	8.27
1	Human Health	Impact on human health from beef consumption	69.07	18.28	6.53	6.13
2			67.33	15.60	9.07	8.00
3			64.27	18.80	10.40	6.53
4			68.53	16.93	7.47	7.07

Respondents also were asked about their impression and expectation of RNAi technology on different aspects of the beef food chain. In addition to the means and percentage of observations for each variable on an aggregate level, the percentage of observations was broken down by the information treatment the respondents received. The results can be found in **Table 3.7** and **Table 3.8**. Based on the results of the frequency by information treatment, it appears the results are the opposite of what was predicted for information treatment 4. With the negatively framed information, it was expected that the values would fall more on the neutral to strongly negative on the scale.

3.4.4 RNAi Acceptance Index

The RNAi acceptance index was built from the responses to the statements in Question 27 in the survey. The specific statements can be found in **Table 3.4**. Respondents with a combined value from the statements of 15 or greater were given an RNAi acceptance index value of -1, which signifies acceptance. Respondents with a combined value of 14 or lower were given an index value of 0, which denotes non-acceptance. Summary statistic for the RNAi acceptance index can be found in **Table 3.9**.

Table 3.9. Summary Statistics for RNAi Acceptance Index

Variable	N	Percentage of Respondents
-1	720	24
0	2,280	76

Results of the conditional logit models for acceptance of RNAi can be found in **Table 3.10**. In the PROC LOGISTIC command in SAS 9.4, the probability being modeled is when the index is equal to -1. For interpretation, a negative (positive) coefficient would result in respondents to be less (more) likely to accept RNAi technology. In the model, the variables

female, age, race, previous purchases of grass fed beef, food safety concerns, and external articles 1 and 4 (article from *The New York Times* and *The Scientist*, respectively) have a negative relationship with acceptance. For example, with a one-unit increase of age, the acceptance of RNAi decreases by one unit. On the other hand, education, previous purchases of natural or animal welfare-assured beef, and price concerns have a positive relationship with acceptance. For example, with a one-unit increase in education, the acceptance of RNAi technology increased by one unit. Variables that were expected to be negative with RNAi acceptance were previous purchase of natural and animal welfare-assured beef. External article 4, which put RNAi technology in a positive light, had a negative relationship with acceptance of RNAi. Through modeling the acceptance of RNAi technology, the characteristics of respondents and external factors that influenced it were identified. If RNAi technology is to be implemented in the livestock industry, then consumers with these characteristics can be targeted during the acceptance phase.

Table 3.10. Conditional Logit for RNAi Technology Acceptance				
Variable	**N**	**Estimate**	**Standard Error**	**Marginal Effects[a]**
Female	3,000	-0.618*	0.092	-0.107
Age	3,000	-0.015*	0.003	-0.003
Education	3,000	0.380*	0.092	0.066
Race: White	3,000	-0.255*	0.103	-0.044
Children	3,000	0.009	0.042	N/A
Adults	3,000	-0.120*	0.045	-0.021
Groundbeef consumption	3,000	0.109	0.056	N/A
Steak consumption	3,000	0.040	0.061	N/A
New Source: TV	3,000	-0.166	0.094	N/A
Food Source: Supermarkets	3,000	-0.148	0.113	N/A
Previous Purchase: Natural	3,000	0.211*	0.100	0.037
Previous Purchase: Animal Welfare-Assured	3,000	0.571*	0.133	0.099
Previous Purchase: Grass Fed	3,000	-0.236*	0.100	-0.041
Previous Purchase Choice	3,000	0.118	0.113	N/A
Food Safety Concerns	3,000	-0.095*	0.029	-0.017
Price Concerns	3,000	0.097*	0.033	0.017
Information Treatment: Basic	3,000	-0.117	0.124	N/A
Information Treatment: Historical	3,000	0.012	0.122	N/A
Information Treatment: Promising	3,000	0.067	0.121	N/A
External Article 1	3,000	-0.297*	0.127	-0.052
External Article 2	3,000	-0.189	0.127	N/A
External Article 3	3,000	-0.080	0.125	N/A
External Article 4	3,000	-0.212*	0.126	-0.037
External Article 5	3,000	-0.056	0.123	N/A
External Article 6	3,000	-0.186	0.124	N/A
External Article 7	3,000	-0.105	0.125	N/A

Notes:

* Indicates significance at the 0.05 level or higher.

a Only the marginal effects of significant variables were estimated.

Chapter 4 - Consumer Willingness to Pay

4.1 Format

In this chapter, willingness to pay for beef steak produced using RNAi technology is discussed and evaluation is included to gain food service channel insights. Through the use of choice experiment questions and dichotomous choice sequences, consumer willingness to pay is examined. After the introduction and literature review, the methodology and results of the choice experiment are presented follow by the methodology and results of the dichotomous choice sequence.

4.2 Introduction

A wealth of literature exists for the willingness to pay for genetically modified (GM) foods (Lusk et al., 2004; Lusk, 2003; Rousu et al., 2007; Colson et al., 2008). These studies note that consumers' willingness to pay changes with respondent attributes as well as information treatments provided. Few studies have examined the willingness to pay for RNAi technology in the food industry (Shew et al., 2016).

To assess consumer willingness to pay, respondents were given a set of choice experiment questions and a double-bounded dichotomous choice sequence to simulate real-life shopping experience within the online survey. In the choice experiments, beef steaks were presented with varying attributes under different label settings. The label settings varied to simulate possible governmental regulatory policies regarding RNAi technology. Based on previous literature (Shew et al., 2016), it is hypothesized that consumers will require a discount for beef products with RNAi use as an attribute. In addition, it is expected that beef steaks with antibiotic use will result in a discount. In the set of scenarios where both RNAi and antibiotic use

are possibilities, results are predicted to be smaller discounts wanted for steaks derived from RNAi compared to those with antibiotic use due to the perceived benefits of the technology. Results show that consumers are willing to pay more for RNAi if it were used in an application to keep beef production with in the United States and protect cattle from disease compared to alternative stated uses. Results also include consumers requiring a discount to purchase beef steaks produced using RNAi and antibiotics.

4.3 Literature Review

4.3.1 Factors influencing willingness to pay

Choice experiments have accurately predicted the success of new products in the market (Lusk, Roosen, and Fox, 2003). Choice experiments are used when real market data does not exist. As well, choice experiments offer a way to evaluate consumer willingness to pay (WTP) across multiple attributes (Lusk, Roosen, and Fox, 2003). Gao and Schroeder (2009) point out that attributes contained in WTP studies should not be limited and should be more reflective of the decisions consumers make. When the number of attributes contained in a choice experiment increased, consumers' WTP changed significantly (Gao and Schroeder, 2009). Tonsor (2011) points out that label space is restricted in the marketing of food products, and choice experiments should focus primarily on actual market attributes.

Shew et al. (2016) estimated the WTP across domestic and international consumers for RNAi technology in rice compared to *Bacillus thuringiensis* (*Bt*) rice and conventionally-produced rice. Results of the study show both products require a discount, but the discount for RNAi rice was 30 to 40 percent less than *Bt* rice. Results also showed that individuals from the U.S. and France with a bachelor's degree require a discount for RNAi rice compared to the other

base education levels. In addition, consumers were more likely to eat RNAi rice over *Bt* rice. Although very few studies cover the willingness to pay for RNAi technology, a significant amount of literature exists in the WTP for comparable technology, such as genetically modified organisms and food. Lusk (2003) shows that some consumers may be willing to pay a premium for genetically modified technology in food when the benefits are explicitly stated. Rousu et al. (2003) estimated the WTP for genetically modified food products. The results of the study showed respondents were willing to pay a premium for products that are non-GM in an experimental auction.

Tonsor and Shupp (2011) and Lusk (2003) point out that consumers may overstate their willingness to pay when taking surveys, which creates hypothetical bias in the estimates. Lusk and Schroeder (2004) note that choice experiments are less likely to encounter hypothetical bias in WTP estimates over other methods.

4.3.2 Labeling of food products

Food is labeled as a way to inform consumers of the attributes of food products, such as method of production, absence of nutritional content, attributes, among others. Golan, Kuchler, and Mitchell (2001) discussed the economic efficiencies of labeling. A label is intended to help consumers differentiate the labeled product from otherwise similar products (Golan, Kuchler, and Mitchell, 2001). Labeling of food product based on ingredient occurs in three settings – voluntary, voluntary through third-party entities, and mandatory. Both voluntary label settings depend on the decisions made by individual firms while mandatory is enforced by the federal government. While labels provide information to consumers, they also serve as an advertising function to consumers while shopping. Golan, Kuchler, and Mitchell (2001) point out the costs

and benefits of mandatory labeling are borne by consumers. Products without labels may cause consumers to think it is defective by containing a harmful component or lacking a certain attribute. Firms can also use labeling as a part of product advertising to targeted consumers. In today's shopping experience, labels may not provide consumers with full information of the products they intend to purchase. For example, there is a lack of a standardization definition for product labeled natural. Currently, the U.S. Department of Agriculture requires the following criteria to be met for a product to be labeled natural: "does not contain any artificial flavor or flavoring, coloring ingredient or chemical preservative, or any other artificial or synthetic ingredient" and "the product and its ingredients are not more than minimally processed" (USDA, 2013). Yet, the Food and Drug Administration has no formal definition of natural. While no definition has been set for natural products, the FDA allows the wording to be used on the product if, "the food does not contain added color, artificial flavors, or synthetic substances" (FDA, 2016).

Labels are seen primarily as an item of direct consumer information that may help reduce information asymmetry (Rabionwicz, 1999). In regards to labeling, mandatory labeling aims at correcting market inefficiencies whereas voluntary labeling attempts to differentiate products and call attention to desirable product attributes (Golan, Kuchler, and Mitchell, 2001). In recent years, government intervention in labeling has begun to target a new purpose, namely, influencing individual consumption choices to align them with social objectives (Golan, Kuchler, and Mitchell, 2001). Government agencies have shown interest in educating the public for the benefit of social welfare by reducing information asymmetries (Lusk et al., 2004).

4.3.3 Random Utility Model

Random utility theory was first introduction conceptually by Lancaster (1966). Random utility theory states that consumers seek to maximize their individual utility by making optimal choices. As well, the utility for a good can be separated into utilities for specific attributes in the product (Lancaster, 1966). The random utility model was developed by McFadden (1974) and can be expressed as the function:

$$U_{jt} = v_{jt} + \varepsilon_{jt} \tag{4.1}$$

where *U* is the utility obtained from selecting alternative *j* in choice scenario *t*, v is the portion of utility that can be determined by the attributes of choice option *j*, and ε is the unobservable stochastic portion. The subscript *i* has been omitted which denotes specific individuals.

Assuming v is linear in parameters, the random utility function can be rewritten as the following:

$$v_{jt} = \beta_1 x_{j1} + \cdots + \beta_n x_{jn} \tag{4.2}$$

where x_{jn} is the nth attribute value for alternative *j*, and the βs are parameters associated with the *n*th attributes.

The probability of an individual choosing each alternative can be written as:

$$\mathrm{P}_{jt} = \mathrm{P}(v_{jt} + \varepsilon_{jt} > v_{kt} + \varepsilon_{kt}; j \neq k, \forall j \in C) \tag{4.3}$$

where C is the choice set of all possible alternatives for one individual.

With the use of effects coding to separate values of zero for product attributes and the absence of attributes in the optout option, willingness to pay for attribute *k* can be calculated as:

$$WTP_k = -\left(\frac{2 * \beta_k}{\beta_c}\right) \tag{4.4}$$

where β_k is the coefficient of the attribute and β_c is the coefficient of the price variable.

Using the delta method, 95 percent confidence intervals for the WTP estimates can be calculated (Greene, 2003). The delta method can be expressed as:

$$var\left(\widehat{WTP_k}\right) = var\left(\widehat{WTP_{\beta k}}\right)^2 var\left(\widehat{\beta_k}\right) + var\left(\widehat{WTP_{\beta c}}\right)^2 var\left(\widehat{\beta_c}\right) \quad (4.5)$$

$$+2 * \widehat{WTP_{\beta k}} * \widehat{WTP_{\beta c}} * cov\left(\widehat{\beta_k}, \widehat{\beta_c}\right)$$

$$= \left[\left(\frac{-2}{\widehat{\beta_k}}\right)^2 var\left(\widehat{\beta_k}\right) + \left(\frac{2\widehat{\beta_k}}{\widehat{\beta_c}^2}\right)^2 var\left(\widehat{\beta_c}\right) + 2 * \left(\frac{-2}{\widehat{\beta_k}}\right)\left(\frac{2\widehat{\beta_k}}{\widehat{\beta_c}}\right) cov\left(\widehat{\beta_k}, \widehat{\beta_c}\right)\right]$$

where β_k and β_c are the partial derivatives of the attribute *k* estimated WTP values with respect to β_k and β_c. Using the variance estimates, the lower and upper bounds can be calculated using the following equation:

$$\widehat{WTP_k} \pm z_{\alpha/2}\sqrt{var\left(\widehat{WTP_k}\right)} \quad (4.6)$$

Where z is the critical value and α is the confidence level. A 95 percent confidence interval was used, thus $z_{\alpha/2}$ equals 1.96 under a normal distribution.

4.4 Methods

4.4.1 Choice experiment analysis

Utilizing a split-sample experience approach, a four-choice experiment design that varied in number and mixture of attributes associated with beef steaks was employed. Pozo, Tonsor, and Schroeder (2012) found that using a split-sample with the presence and absence of pork production attributes changed conclusions regarding consumer preferences when studying the use of gestation crates. In each of the scenarios presented to respondents, options A and B had varying attribute levels of beef steaks while option C was an opt-out of options A and B. Across the scenarios presented to the respondents, the level of attributes changed to help determine

willingness to pay for attributes. A full design of the choice experiments used in this study can be found in Appendix B. In addition to the varying label of attributes, respondents were presented three different levels of label approval setting: no approval, approval, and approval with mandatory labeling. A full map of choice experiment design logic can be found in **Appendix E**. Through the variation in label wording, label setting and information treatment, several potential real-world environments were created in the form of choice experiments via SAS programming. At the current time, the introduction of RNAi technology in the food system is hard to predict. By estimating the willingness to pay across the several variations, the results map out a wider set of possible future outcomes for the technology.

The attributes from the choice experiments include price, USDA grade, RNAi use, and antibiotic use, and USDA grade, depending on the design in which a respondent was randomly assigned. Panel data were constructed using individual response variables as well as the choice experiment design received. Since three of the choice experiment designs presented seven questions, or scenarios, with three options to respondents, a panel of 15,570 total observations were created for each choice experiment. This panel number was created by taking the number of people (750) times the number of scenarios per person (7) multiplied by the number of choices per scenario (3). In the case of choice experiment design four, a panel of 13,500 observations were created since respondents were given six scenarios (750 respondents, times 6 scenarios per person, times 3 choices per scenario).

To assess respondents' willingness to pay for beef products using RNAi technology, one-fourth of respondents were randomly given one of four choice experiments. The four choice experiments included the following attributes outlined in **Table 4.1**.

Table 4.1. Outline of Choice Experiment Models				
Attribute	**Design 1**	**Design 2**	**Design 3**	**Design 4**
Price	√	√	√	√
RNAi Use	√	√		√
Antibiotic Use	√		√	
USDA Grade		√	√	
Note: A check mark indicates inclusion in a given design.				

Figure 4.1. Example of a Choice Scenario from Design 1			
Beef Steak Attributes	**Option A**	**Option B**	**Option C**
Price ($/lb.) RNAi Use Antibiotic Use	$15.75 Free Free	$11.75 Used No Claim	*I choose not to purchase either of these products.*

Utilizing the PLAN and OPTEX procedures in Statistical Analysis Software (SAS) 9.4, two designs were generated. One of the designs created a sequence of variations for three attributes (price and two other beef steak attributes) for designs 1, 2 and 3, while the other design created a sequence of variations for two attributes (one price and one other beef steak attribute). **Figure 4.2** is an example of one of the seven scenarios shown to respondents in design 1 of the survey. All respondents experienced seven scenarios in which to choose from the three options, except for respondents given choice experiment design 4. This design only contained six scenarios due to the reduced number of attributes. Each question had an option between two beef steak alternatives and an option to not choose any of the products. Price levels were set in reference to the Bureau of Labor Statistics average price of $8.29 for beef steaks during November 2015 (BLS, 2016b). The higher price levels were then taken from this base price with

a $3.50 increment to $11.29 and $13.79 and $15.29. The other attribute descriptions were presented to participants as:

Antibiotic Use:

- *Used* means the product was produced utilizing antibiotics.
- *Free* means the product was produced without utilizing antibiotics.
- *No claim* means that no claims on antibiotic use are being made.

USDA Grade is the evaluation of the meat quality given by the U.S. Department of Agriculture where:

- *Choice* means the beef steak is high quality and will be very tender, juicy, and flavorful.
- *Select* means the beef steak is very uniform in quality, but may lack some of the juiciness and flavor of higher grades.

RNAi Use:

- *Used* means the product was produced utilizing RNAi technology.
- *Free* means the product was produced not utilizing RNAi technology.
- *No claim* means that no claims on RNAi use are being made.

The attribute definitions only appeared to respondents if the attributes appeared in the choice experiment design. In addition, for RNAi use and antibiotic use, only two of the three definitions would appear to respondents. Respondents randomly received the pair of definitions, and the label wording shown to them would appear throughout the choice experiment for the respective attribute. The logic of the choice experiment can be found in **Appendix E**.

With the given coding scheme, the option C of opting out had value of zero for each attribute present in every scenario across the four designs. The non-price beef steak attributes were effects coded, an approach to distinguish the non-price beef steak attributes from the opt-out coefficient in estimation (Ouma, Abdulai, and Drucker, 2007).

Previous studies have used varying attributes across choice experiment designs (Pozo, Tonsor, and Schroeder, 2012). With the variation of the attributes contained choice experiment designs, the willingness to pay for beef steaks can be compared across the attributes in this study.

Liaukonyte et al., (2013) varied the label wording of attributes contained in snack foods during choice experiments. In this study, the researchers used "free of X" and "contains X," where X referred to food production attributes and characteristics. The results showed the negative effect of a "contains X" label was greater than the positive effect of a "free of X" label. In regards to this study's choice experiment, one-third of respondents were given independently and randomly given one of the three label wording schemes through their scenarios for the RNAi use and antibiotic use attributes, regardless of the given choice experiment design: "free, used;" "free, no claim;" and "used, no claim." In some instances, respondents may have saw products with antibiotic use and RNAi having the same, or common, label wording schemes. With this approach, consumers were exposed to one of three potential label wording schemes for the respective product attributes which government regulators may enforce or suggest in the future.

Using a random utility model, willingness to pay by consumers for certain beef steak attributes was estimated. Using the marginal benefit of an attribute divided by marginal cost (price parameter), the willingness to pay is determined for each respective attribute in the choice experiment designs. The theoretical random utility model has been developed that shows the number of attributes changes in a consumer's utility function given the changes in attributes. Consumer utility can be defined as:

$$U_{ij} = \alpha * p_{ij} + \sum \beta_k + x_{ijk} + \varepsilon_{ij} \quad (4.7)$$

Where *U* is the utility of the consumers, α is the marginal utility of price for individual *i*, p_{ij} is the price of alternative *j* for individual *i*, β is the marginal utility of the *k*th attribute, x_{ijk} is the

*k*th attribute of alternative *j* for individual *i*, and ε_{ij} denotes the stochastic disturbance of alternative *j* for individual *i*. As an example, respondents given Design 1 have utility which is specified as:

$$v_j = \beta_1 Price_j + \beta_2 RNAiUse_j + \beta_3 AntibioticUse_j + \beta_4 OptOut_j \quad (4.8)$$

where $Price_j$ is the price of beef steak in scenario *j*; $RNAiUse_j$ is either 0 for a free label and 1 for used label, 0 for a used label and 1 for a no claim label, or either 0 for a free label and 1 for a no claim label; $AntibioticUse_j$ is either 0 for a free label and 1 for used label, 0 for a used label and 1 for a no claim label, or either 0 for a free label and 1 for a no claim label; and $OptOut_j$ is a constant equal to one used to describe the consumer's choice in selecting "I choose not to purchase with Option A or Option B."

Utility of respondents presented scenarios from Design 2 can be specified as:

$$v_j = \beta_1 Price_j + \beta_2 RNAiUse_j + \beta_3 USDAGrade_j + \beta_4 OptOut_j \quad (4.9)$$

Where *Price*, *RNAiUse* and *OptOut* are the same as described above and *USDAGrade* is either zero for Choice or 1 for Select in scenario *j*.

Utility of respondents presented scenarios from Design 3 can be specified as:

$$v_j = \beta_1 Price_j + \beta_2 AntibioticUse_j + \beta_3 USDAGrade_j + \beta_4 OptOut_j \quad (4.10)$$

Where the variables are the same described above.

Utility of respondents presented scenarios from Design 4 can be specified as

$$v_j = \beta_1 Price_j + \beta_2 RNAiUse_j + \beta_3 OptOut_j \quad (4.11)$$

Where the variables are the same described above.

Multinomial logit (MNL) models were employed to identify preferences broadly through the sign and magnitude in relation to the remaining attribute coefficients. Using a MNL, the point estimates for willingness to pay for specific attributes can be found. In MNL modeling,

parameters are assumed to be homogenous across respondents. From the MNL models, willingness to pay estimates can be computed from the following negative ratio between attributes and price coefficients which is expressed in equation 4.4. In the equation, β_k is the coefficient on the respective beef steak attribute, RNAi use, Antibiotic use, or USDA grade, and β_c is the coefficient on price. The coefficient on the attribute *k* is multiplied by two in the WTP ratio due to effects coding (Lusk, Roosen, and Fox, 2003).

Likelihood ratio (LR) test were employed to determine if the results from label settings, information treatments, and label wording can be pooled over estimates. The likelihood ratio uses and can be expressed as (The Pennsylvania State University, 2016):

$$\Delta G^2 = -2\log L\ from\ pooled\ model - (\sum -2\log L\ from\ current\ models). \quad (4.12)$$

With the LR test, the alternative hypothesis is the pooled model is true whereas the null hypothesis states the current models are true (The Pennsylvania State University, 2016). The degrees of freedom, k, are the number of attributes in the current models minus the number of attributes in the pooled model minus. Using a Chi-squared distribution, the results of the LR test and the degrees of freedom can be used to determine the p-value of the test:

$$p\text{-}value = X_k^2 > \Delta G^2 \quad (4.13)$$

In addition, a base statement was provided to all respondents about RNAi technology. The information treatments were displayed randomly, but proportionally, whereas each treatments was given to 750 respondents. The phrasing of the base statement was taken from TheStreet, a digital financial media news company, article focusing on the adoption of RNAi technology of medical drugs by pharmaceutical companies (Feuerstein, 2010).

The base information statement read as follows:

"RNA interference (RNAi for short) is a natural process of gene silencing in cells – think of it as a genetic switch that when turned off, tells the body to stop making a certain protein."

In addition to the base statement about RNAi, an information treatment was provided to respondents. These articles were selected from searching through popular online media and scientific sources about RNAi technology. Four information treatments were randomly, but equally distributed to respondents, so each information treatment was provided to 750 respondents. The four treatments include information were labeled as "basic and not biased," "historical," "promising and already used," and "concerned and caution" due to the tone and perspective the respective articles had. The four information treatments were taken from different types of sources, varying in tone and information about RNAi.

The basic and not biased information treatment read as follows:

"RNAi, as it's known, is an emerging science; the two US researchers who discovered it brought home a Nobel Prize in 2006. The process can be described like this: The cells of plants and animals carry their instructions in the form of DNA. To make a protein, the sequence of genetic letters in each gene gets copied into matching strands of RNA, which then float out of the nucleus to guide the protein-making machinery of the cell. RNA interference, or gene silencing, is a way to destroy specific RNA messages so that a particular protein is not made" (Philpott, 2015).

The historical information treatment read as follows:

"RNA interference (RNAi)—the process by which small interfering RNAs (siRNAs) bind to and cleave complementary mRNA sequences, inhibiting their translation into proteins—is not new to agriculture. In fact, as a naturally occurring biological process, RNAi was mediating plant metabolism, growth, and pathogen defense long before humans began cultivating crops for their own benefit. But in the last 15 years, RNAi's role in agriculture has grown as researchers have developed greater understanding of the mechanisms underlying the phenomenon and employed it to improve pathogen resistance, nutrition, and yield of crop plants. RNAi-enhanced crops have been approved for cultivation by regulatory agencies in the United States, Europe, Canada, Australia, New Zealand, and Brazil, and some of these crops—for example, papaya—have already reached our plates" (Nehra and Taylor, 2015).

The promising and already used information treatment read as follows:

"RNA interference (RNAi) is a method of designing gene function by inserting short sequences of ribonucleic acid (RNA) that match part of the target gene's sequence, thus no

proteins are produced. Since Science named it as “Breakthrough of the Year” and Fortune magazine hailed it as “Biotech’s Billion Dollar Breakthrough” in 2003, RNAi has significantly gained prominence as the method of choice for researchers sleuthing the structure and function of important genes. RNAi has provided a way to control pests and diseases, introduce novel plant traits and increase crop yield. Using RNAi, scientists have developed novel crops such as nicotine-free tobacco, non-allergenic peanuts, decaffeinated coffee, and nutrient fortified maize among many others” (ISAAA, 2008).

The concern and caution information treatment read as follows:

“As the Environmental Protection Agency develops a framework for assessing the risks posed by RNAi as pest-control strategy in plants, one consumer advocacy group has expressed concern over agricultural use of the technology and asked the agency to temporarily hold off on approving any such products. Overall, Food & Water Watch urged the EPA to "carefully weigh the risks associated with RNAi and to design a new risk assessment framework that can adequately capture the unintended consequences of the introduction of dsRNA molecules into agriculture and the environment" (Donald Danforth Plant Science Center, 2014).

Along the lines of the base statement and information treatment, respondents were presented two of eight external articles about RNAi technology. The articles varied in tone and perspective on the use of RNAi. The links include the full title of the articles and name of the source. The two articles appeared in a random, but equal distribution. The list of the eight articles are presented in Chapter 5.

To simulate a potential label setting by the FDA, respondents were given one of three settings in which RNAi technology could be labeled: no approval for labeling, approval for labeling, and approval with mandatory labeling.

To help alleviate hypothetical bias, a cheap talk script was inserted into the survey, which is found before the choice experiment segment. The language provided in this script explained that the implications of this study were real and could influence future decisions. Oftentimes in surveys estimating willingness to pay, respondents overstate the amount because of the hypothetical situation they are placed under. In this situation, there is no immediate consequence

or feedback from their response. This hypothetical bias presents skewed information in important studies. In this study, a cheap talk script was employed stating that the results of the study would be used in the formation of policy. Cheap talk scripts have been shown to reduce the hypothetical bias provided by respondents of surveys (Tonsor and Shupp, 2011).

4.5 Results

4.5.1 Choice experiments

The results of the MNL models for design 1 with RNAi use and antibiotic use as attributes can be found in **Table 4.5**. In general, respondents preferred products where RNAi is labeled as free when the label wording "free, used" and "free, no claim" are used. As well, respondents preferred products where antibiotic use is labeled as free when the label wording "free, used" and "free, no claim" are used. LR tests were employed to see if the individual models could be collapsed. We examined if the models could be collapsed in terms of label wording, label setting, information treatment, common and mixed labeling schemes, and various combinations of those qualities. The results of these hypothesis tests can be found in **Table 4.6**. In the hypothesis testing for pooled models, the LR tests showed that we failed to reject the null hypothesis that states the models can be collapsed. With the hypothesis testing in design 1, label setting and information treatment could be collapsed. The means that the MNL models were estimated for only the three label wording schemes. Models were estimated for labeling schemes with common, or matching, wording and mixed. In the common wording, the labels for RNAi use and antibiotic use were the same. In the mixed wording, the labels for the two attributes differed.

The results of the MNL models for pooled frameworks can be found in **Table 4.7**. Signs of the coefficients in the pooled models were similar to those in the individual MNL models. Since the WTP point estimates are a ratio of two coefficients, statistical significance must be examined through other means, such as the delta method. Using the delta method with a 95 percent confidence interval, the lower and upper bound of the WTP values were estimated. If the WTP interval did not contain zero, statistically significance was met for the coefficients of the respective attributes. The results of these WTP intervals for the respective attributes can be found in **Table 4.17**. Included in the table are the point estimates for the respective attributes using equation 4.4.

The results of the MNL models for design 2 with RNAi use and USDA grade as attributes can be found in **Table 4.8**. The coefficient results are similar to those in design 1. Respondents generally preferred products in which RNAi were labeled free when the wording "free, used" and "free, no claim" are used respectfully. As well, respondents preferred RNAi products labeled as no claim when the "used, no claim" wording was employed. With USDA grade, in all but one instance, respondents preferred choice steaks over ones that had a select grade attribute. With the use of LR tests, the collapsing, or pooling, of individual models were examined for label wording, label setting, information treatment, and their various combinations of those characteristics. These results can be found in **Table 4.9**. The rest results suggest all models cannot be pooled, except for pooling over information treatment and pooling over label setting. The results of the MNL models can be found in **Table 4.10**. The signs of the coefficients for the pooled attribute generally matched those in the individual models. The lower and upper bound of WTP estimates were calculated, and the results can be found in **Table 4.18**. Again the point estimates for the respective attributes are included in this table.

The results of the MNL models for design 3 with antibiotic use and USDA grade as attributes can be found in **Table 4.11**. Similar to the results from design 1, respondents generally preferred products labeled as free in terms of antibiotic use when the wording "free, used" and "free, no claim" are used. In addition, respondents preferred products when antibiotic use is labeled as no claim under the label wording of "used, no claim." As for USDA grade, in all but two instances of the 36 models, the respondents preferred choice steaks over those with a select grade attribute. Again LR tests were employed to examine whether or not models could be pooled. The results of these tests can be found in **Table 4.12**. Similar to previous two designs, all models cannot be pooled except for information treatment and label setting. The pooled MNL model results can be found in **Table 4.13**. The pooled models produced similar results to those of the individual MNL models. To test for statistical significance and find the upper and lower bound for the WTP values, the delta method was used with a 95 percent confidence interval. The results of these WTP values can be found in **Table 4.19**. Point estimates for WTP for antibiotic use and grade can also be found in the table.

The results of the MNL models for design 4 with RNAi use as the only non-price attribute can be found in **Table 4.14**. Similar to the results in designs 1 and 2, respondents preferred products in which RNAi is labeled as free under the label wording "free, used" and "free, no claim," respectfully. As well, respondents preferred products in which RNAi is labeled as no claim in the label wording of "used, no claim." LR tests again were employed to calculate whether models could be pooled together. The results of these hypothesis tests can be found in **Table 4.15**. The conclusions from these test showed that pooled over label setting and pooled over information can be collapsed. The results of the MNL models for pooled frameworks can be found in **Table 4.16**. The results were similar to those in the individual MNL models. Again, the

delta method was used to determine the lower and upper bound WTP values as well as statistical significance. The results of these WTP values can be found in **Table 4.20**. As well, the point estimates for RNAi use can be found in the table.

Generally speaking, the pooled models of label setting and information treatment failed to reject the null hypothesis stating the individual models can be collapsed down for nearly half the instances in each of the choice experiment designs. Yet, the LR tests for when both label setting and information treatment reject the null hypothesis, and we must let the models remain individualized. Due to the results of the respective hypothesis tests in the individual designs, the pooled model results for label setting and information were left out from the reported tables.

In virtually all designs, the coefficient of the Cdum variable, that captured opting out, was negative. These results denoted that respondents preferred either of the two options of beef steaks over having no beef at all.

Table 4.2, **Table 4.3**, and **Table 4.4** show the WTP estimates for the three label settings across choice experiment designs when label wording and information are collapsed in a pooled model. In the no approval setting, the opt-out magnitudes are generally larger compared to the two other label settings, which indicates respondents preferred one of the beef steak options over the option of opting out. In the mandatory approval setting, the discount for the RNAi attribute is generally larger. These results make sense as if the government mandates the technology to be labeled, consumers would prefer to have a discount for beef steaks. In the approval label setting, the discount for the antibiotic use attribute is generally larger. It was assumed that if firms have the option of labeling, they would choose not to label the use of antibiotics, thus the discount magnitudes would be smaller. It is also noted that if consumers are unsure about the use of the label and antibiotic use in production, they would require a discount to purchase the beef steak.

Table 4.2.Willingness to Pay Estimates by Choice Experiment Design - No Approval Label Setting

Attribute	*Design 1*	*Design 2*	*Design 3*	*Design 4*
RNAi Use	[-2.11, -0.75]*	[-1.94, -0.78]*	N/A	[-1.68, -1.12]*
Antibiotic Use	[-2.87, -2.42]*	N/A	[-2.28, -1.52]*	N/A
USDA Grade	N/A	[-2.11, -1.60]*	[-1.98, -1.23]*	N/A
Opt-out	-9.51	-10.55	-11.58	-10.82

Notes:
* indicates statistically significance.
Non-price attributes are reported in WTP intervals and derived from Tables 4.16, 4.17, 4.18, and 4.19.

Table 4.3.Willingness to Pay Estimates by Choice Experiment Design - Approval Label Setting

Attribute	*Design 1*	*Design 2*	*Design 3*	*Design 4*
RNAi Use	[-2.70, 1.29]	[-3.74, 2.27]	N/A	[-1.63, -0.76]*
Antibiotic Use	[-2.76, -2.42]*	N/A	[-1.99, -0.96]*	N/A
USDA Grade	N/A	[-2.65, -2.02]*	[-1.99, -1.39]*	N/A
Opt-out	-9.45	-11.46	-10.83	-9.99

Notes:
* indicates statistically significance.
Non-price attributes are reported in WTP intervals and derived from Tables 4.16, 4.17, 4.18, and 4.19.

Table 4.4.Willingness to Pay Estimates by Choice Experiment Design - Approval, Mandatory Label Setting

Attribute	*Design 1*	*Design 2*	*Design 3*	*Design 4*
RNAi Use	[-2.22, -0.74]*	[-2.46, -1.61]*	N/A	[-2.06, -1.67]*
Antibiotic Use	[-2.91, -2.39]*	N/A	[-2.24, -1.49]*	N/A
USDA Grade	N/A	[-2.57, -2.00]*	[-1.87, -1.03]*	N/A
Opt-out	-9.25	-10.14	-10.07	-10.37

Notes:
* indicates statistically significance.
Non-price attributes are reported in WTP intervals and derived from Tables 4.16, 4.17, 4.18, and 4.19.

Table 4.5. Model Fit and Coefficients for Choice Experiment Design 1									
Info. Treatment	**Label Setting**	**Label Wording**		**Log Likelihood**	**Cdum**	**Price**	**Antibiotic Use**	**RNAi Use**	**N**
		Antibiotic	**RNAi**						
1	No Approval	Free, Used	Free, Used	-45.537	-2.902	-0.298	-0.637	-0.963	56
1	No Approval	Free, No Claim	Free, Used	-65.982	-2.443	-0.276	-0.285	-0.275	70
1	No Approval	Used, No Claim	Free, Used	-29.503	-1.646	-0.151	-0.185	0.066	28
1	No Approval	Free, Used	Free, No Claim	-46.066	-0.926	-0.194	-0.554	-0.948	56
1	No Approval	Free, No Claim	Free, No Claim	-6.159	-38.525	-4.660	-0.333	-0.104	14
1	No Approval	Used, No Claim	Free, No Claim	-6.535	-24.395	-0.591	-0.315	-0.193	14
1	No Approval	Free, Used	Used, No Claim	-29.905	-3.379	-0.300	-0.785	0.153	35
1	No Approval	Free, No Claim	Used, No Claim	-33.445	-2.802	-0.299	-0.078	-0.085	35
1	No Approval	Used, No Claim	Used, No Claim	-29.207	-3.592	-0.416	0.169	-0.131	35
1	Approval	Free, Used	Free, Used	-28.996	-2.324	-0.227	-0.986	-0.069	35
1	Approval	Free, No Claim	Free, Used	-45.354	-1.173	-0.230	-0.518	-0.631	56
1	Approval	Used, No Claim	Free, Used	-38.388	-0.839	-0.176	0.434	-0.225	42
1	Approval	Free, Used	Free, No Claim	-41.501	-4.062	-0.297	-0.969	-0.182	56
1	Approval	Free, No Claim	Free, No Claim	-24.356	-1.866	-0.263	-0.353	-0.689	28
1	Approval	Used, No Claim	Free, No Claim	-35.054	-0.202	-0.087	0.192	-0.493	35
1	Approval	Free, Used	Used, No Claim	-54.051	-1.396	-0.147	-1.014	0.284	63
1	Approval	Free, No Claim	Used, No Claim	-77.108	-1.942	-0.159	-0.421	0.372	77
1	Approval	Used, No Claim	Used, No Claim	-46.215	-2.597	-0.292	-0.101	-0.018	49
1	Approval, Mandatory	Free, Used	Free, Used	-43.608	-1.870	-0.266	-0.903	-0.746	56
1	Approval, Mandatory	Free, No Claim	Free, Used	-31.815	-3.246	-0.172	-0.676	-0.506	42
1	Approval, Mandatory	Used, No Claim	Free, Used	-79.086	-1.379	-0.119	0.399	-0.347	77
1	Approval, Mandatory	Free, Used	Free, No Claim	-36.838	-1.713	-0.134	-0.960	0.299	42
1	Approval, Mandatory	Free, No Claim	Free, No Claim	-35.676	-2.353	-0.357	-0.705	-0.796	49
1	Approval, Mandatory	Used, No Claim	Free, No Claim	-26.679	-1.006	-0.171	-0.189	-0.368	28
1	Approval, Mandatory	Free, Used	Used, No Claim	-21.815	-7.073	-0.480	-1.504	0.789	42
1	Approval, Mandatory	Free, No Claim	Used, No Claim	-40.347	-2.085	-0.186	-0.594	0.287	42

Table 4.5. Model Fit and Coefficients for Choice Experiment Design 1 continued									
1	Approval, Mandatory	Used, No Claim	Used, No Claim	-31.733	-4.713	-0.507	0.043	0.542	42
2	No Approval	Free, Used	Free, Used	-24.118	-5.577	-0.457	-0.767	-0.836	35
2	No Approval	Free, No Claim	Free, Used	-20.578	-2.247	-0.403	-1.596	-0.764	35
2	No Approval	Used, No Claim	Free, Used	-61.334	-1.597	-0.200	0.392	-0.492	63
2	No Approval	Free, Used	Free, No Claim	-25.460	-7.238	-0.591	-0.342	-0.913	35
2	No Approval	Free, No Claim	Free, No Claim	-42.248	-3.209	-0.317	-0.694	-0.301	49
2	No Approval	Used, No Claim	Free, No Claim	-10.915	-8.870	-0.775	1.434*	0.199	21
2	No Approval	Free, Used	Used, No Claim	-16.635	-4.419	-0.414	-0.797	0.212	21
2	No Approval	Free, No Claim	Used, No Claim	-26.556	-3.748	-0.128	-0.450	0.553	35
2	No Approval	Used, No Claim	Used, No Claim	-60.165	-0.441	-0.107	0.208	0.543	63
2	Approval	Free, Used	Free, Used	-44.281	-2.585	-0.273	-0.510	-0.532	49
2	Approval	Free, No Claim	Free, Used	-31.846	-1.949	-0.230	-0.598	-0.323	35
2	Approval	Used, No Claim	Free, Used	-36.540	-4.948	-0.563	-0.246	-0.612	49
2	Approval	Free, Used	Free, No Claim	-21.305	-2.553	-0.195	-1.051	-0.388	28
2	Approval	Free, No Claim	Free, No Claim	-44.783	-4.404	-0.429	-0.647*	-0.624	56
2	Approval	Used, No Claim	Free, No Claim	-34.791	-2.104	-0.312	0.061	-0.473	42
2	Approval	Free, Used	Used, No Claim	-50.633	-1.196	-0.095	-0.391	0.344	49
2	Approval	Free, No Claim	Used, No Claim	-57.577	-0.205	-0.038	-0.599	0.926	63
2	Approval	Used, No Claim	Used, No Claim	-29.643	-3.580	-0.371	0.293	0.662	35
2	Approval, Mandatory	Free, Used	Free, Used	-61.880	-1.182	-0.089	-0.585	-0.712	70
2	Approval, Mandatory	Free, No Claim	Free, Used	-33.344	-3.334	-0.245	-0.320	-0.184*	35
2	Approval, Mandatory	Used, No Claim	Free, Used	-27.584	-1.453	-0.171	0.177	-0.735	28
2	Approval, Mandatory	Free, Used	Free, No Claim	-86.597	-1.458	-0.153	-0.259	-0.213	84
2	Approval, Mandatory	Free, No Claim	Free, No Claim	-51.082	-4.457	-0.303	-0.652	-0.061*	63
2	Approval, Mandatory	Used, No Claim	Free, No Claim	-34.689	0.785	-0.067	1.090	-0.422	42
2	Approval, Mandatory	Free, Used	Used, No Claim	-41.441	1.831	0.063	-0.879	0.530	49
2	Approval, Mandatory	Free, No Claim	Used, No Claim	-39.757	-1.224	-0.185	-0.125	0.256	42
2	Approval, Mandatory	Used, No Claim	Used, No Claim	-30.886	6.129	-0.300	8.102	0.399	63
3	No Approval	Free, Used	Free, Used	-45.715	-0.560	-0.124	-0.530	-0.344	49

Table 4.5. Model Fit and Coefficients for Choice Experiment Design 1 continued									
3	No Approval	Free, No Claim	Free, Used	-34.685	-3.762	-0.316	-0.759	-0.284	42
3	No Approval	Used, No Claim	Free, Used	-44.344	-1.883	-0.223	0.270	-1.135	49
3	No Approval	Free, Used	Free, No Claim	-15.890	-4.878	-0.339	-0.826	0.372	21
3	No Approval	Free, No Claim	Free, No Claim	-26.986	-3.984	-0.237	-0.818	-0.061	35
3	No Approval	Used, No Claim	Free, No Claim	-67.626	-2.000	-0.234	0.399	-0.055	70
3	No Approval	Free, Used	Used, No Claim	-40.038	-2.119	-0.253	-0.929	0.310	49
3	No Approval	Free, No Claim	Used, No Claim	-26.640	-4.672	-0.154	-0.166	0.080	35
3	No Approval	Used, No Claim	Used, No Claim	-47.101	0.618	-0.113	-0.184	0.308	70
3	Approval	Free, Used	Free, Used	-55.268	-1.988	-0.269	-0.881	-0.718	70
3	Approval	Free, No Claim	Free, Used	-24.804	-6.339	-0.511	-0.682	-0.489	35
3	Approval	Used, No Claim	Free, Used	-38.058	-4.096	-0.379	0.145	-0.771	42
3	Approval	Free, Used	Free, No Claim	-66.901	-4.170	-0.303	-0.506*	-0.140	77
3	Approval	Free, No Claim	Free, No Claim	-62.360	-0.960	-0.205	-0.683	-0.338	77
3	Approval	Used, No Claim	Free, No Claim	-37.233	-5.177	-0.484	0.795*	-0.672	49
3	Approval	Free, Used	Used, No Claim	-47.791	-0.988	-0.145	-0.402	-0.327	49
3	Approval	Free, No Claim	Used, No Claim	-78.661	-0.885	-0.135	-0.549	0.436	84
3	Approval	Used, No Claim	Used, No Claim	-56.202	-2.955	-0.309	0.287	0.616*	63
3	Approval, Mandatory	Free, Used	Free, Used	-25.512	-7.155	-0.795	-1.052	-0.427	42
3	Approval, Mandatory	Free, No Claim	Free, Used	-26.919	-2.016	-0.212	-0.503	0.093	28
3	Approval, Mandatory	Used, No Claim	Free, Used	-51.634	-0.617	-0.155	0.460	-0.428	56
3	Approval, Mandatory	Free, Used	Free, No Claim	-52.622	-0.656	-0.089	-0.714	-0.309	56
3	Approval, Mandatory	Free, No Claim	Free, No Claim	-35.693	-0.737	-0.098	-0.297	-0.403	35
3	Approval, Mandatory	Used, No Claim	Free, No Claim	-64.768	0.705	-0.039	0.670	0.032	70
3	Approval, Mandatory	Free, Used	Used, No Claim	-49.778	-2.671	-0.241	-0.774	0.199	56
3	Approval, Mandatory	Free, No Claim	Used, No Claim	-32.993	-0.614	-0.145	-0.074	-0.560	35
3	Approval, Mandatory	Used, No Claim	Used, No Claim	-46.167	-0.763	-0.143	0.650	0.145	49
4	No Approval	Free, Used	Free, Used	-33.380	-2.039	-0.303	-0.584	-0.166	42
4	No Approval	Free, No Claim	Free, Used	-93.655	-1.682	-0.236	-0.481	-0.371	105
4	No Approval	Used, No Claim	Free, Used	-19.511	-2.182	-0.255	0.391	-0.798	21

Table 4.5. Model Fit and Coefficients for Choice Experiment Design 1 continued									
4	No Approval	Free, Used	Free, No Claim	-33.427	-2.853	-0.332	-0.900	-0.351	42
4	No Approval	Free, No Claim	Free, No Claim	-55.549	-2.495	-0.167	-0.797	-0.580	70
4	No Approval	Used, No Claim	Free, No Claim	-24.508	-7.156	-0.611	0.609	0.439	35
4	No Approval	Free, Used	Used, No Claim	-61.333	-1.606	-0.167	-0.544	0.274	63
4	No Approval	Free, No Claim	Used, No Claim	-10.092	-4.214	-0.180	-0.810	0.339	14
4	No Approval	Used, No Claim	Used, No Claim	-44.562	1.012	-0.053	0.763	0.439	56
4	Approval	Free, Used	Free, Used	-42.330	-4.327	-0.424	-0.378	-0.247	49
4	Approval	Free, No Claim	Free, Used	-67.756	-3.216	-0.267	-0.231	-0.338	70
4	Approval	Used, No Claim	Free, Used	-56.826	-4.246	-0.383	0.324	-0.153	63
4	Approval	Free, Used	Free, No Claim	-27.571	-3.317	-0.345	-0.901	-0.512	35
4	Approval	Free, No Claim	Free, No Claim	-35.223	-1.907	-0.194	-0.329	-0.123	35
4	Approval	Used, No Claim	Free, No Claim	-85.350	-2.694	-0.293	0.410*	-0.200	91
4	Approval	Free, Used	Used, No Claim	-53.861	-0.852	-0.186	-0.310	0.136	63
4	Approval	Free, No Claim	Used, No Claim	-36.822	-0.732	-0.115	-0.628	0.895	42
4	Approval	Used, No Claim	Used, No Claim	-8.282	-35.421	-4.482	0.105	0.214	28
4	Approval, Mandatory	Free, Used	Free, Used	-28.395	0.495	-0.059	-0.998	-0.390	35
4	Approval, Mandatory	Free, No Claim	Free, Used	-28.299	0.813	0.100	-0.239	-0.386	28
4	Approval, Mandatory	Used, No Claim	Free, Used	-54.748	-4.419	-0.305	0.414*	-0.296	63
4	Approval, Mandatory	Free, Used	Free, No Claim	-38.980	-2.983	-0.210	-1.049	0.277	49
4	Approval, Mandatory	Free, No Claim	Free, No Claim	-84.421	-3.755	-0.303	-0.383*	-0.106	91
4	Approval, Mandatory	Used, No Claim	Free, No Claim	-56.227	-1.678	-0.285	0.183	-0.276	70
4	Approval, Mandatory	Free, Used	Used, No Claim	-36.168	-2.948	-0.312	-0.708	0.090	42
4	Approval, Mandatory	Free, No Claim	Used, No Claim	-56.053	-1.311	-0.196	-0.629	0.026	63
4	Approval, Mandatory	Used, No Claim	Used, No Claim	-46.289	-2.869	-0.297	0.300	0.142	49
									5,250
Note: * denotes statistical significance.									

Table 4.6. Hypothesis Testing for Choice Experiment Design 1									
Info. Treatment	**Label Setting**	**Label Wording**		**Hypothesis**	**LR Test**	**DF**	**P-Value**	**Conclusion**	**N**
		RNAi	**Antibiotic**						
Pooled Over Label Wording									
1	No Approval	Pooled	Pooled	Pooled over Label Wording	69.231	32	0.000	Reject	343
1	Approval	Pooled	Pooled	Pooled over Label Wording	86.220	32	0.000	Reject	441
1	Approval, Mandatory	Pooled	Pooled	Pooled over Label Wording	139.771	32	0.000	Reject	420
2	No Approval	Pooled	Pooled	Pooled over Label Wording	144.285	32	0.000	Reject	357
2	Approval	Pooled	Pooled	Pooled over Label Wording	94.590	32	0.000	Reject	406
2	Approval, Mandatory	Pooled	Pooled	Pooled over Label Wording	168.577	32	0.000	Reject	476
3	No Approval	Pooled	Pooled	Pooled over Label Wording	155.303	32	0.000	Reject	420
3	Approval	Pooled	Pooled	Pooled over Label Wording	139.404	32	0.000	Reject	546
3	Approval, Mandatory	Pooled	Pooled	Pooled over Label Wording	94.093	32	0.000	Reject	427
4	No Approval	Pooled	Pooled	Pooled over Label Wording	136.525	32	0.000	Reject	448
4	Approval	Pooled	Pooled	Pooled over Label Wording	104.960	32	0.000	Reject	476
4	Approval, Mandatory	Pooled	Pooled	Pooled over Label Wording	130.793	32	0.000	Reject	490
									5,250
Pooled over Label Setting									
1	Pooled	Free, Used	Free, Used	Pooled Over Label Setting	8.363	8	0.399	Fail	147
1	Pooled	Free, Used	Free, No Claim	Pooled Over Label Setting	33.491	8	0.000	Reject	168
1	Pooled	Free, Used	Used, No Claim	Pooled Over Label Setting	13.474	8	0.097	Fail	147
1	Pooled	Free, No Claim	Free, Used	Pooled Over Label Setting	28.140	8	0.000	Reject	154
1	Pooled	Free, No Claim	Free, No Claim	Pooled Over Label Setting	8.591	8	0.378	Fail	91
1	Pooled	Free, No Claim	Used, No Claim	Pooled Over Label Setting	23.177	8	0.003	Reject	77
1	Pooled	Used, No Claim	Free, Used	Pooled Over Label Setting	16.021	8	0.042	Reject	140
1	Pooled	Used, No Claim	Free, No Claim	Pooled Over Label Setting	6.253	8	0.619	Fail	154

Table 4.6. Hypothesis Testing for Choice Experiment Design 1 continued									
1	Pooled	Used, No Claim	Used, No Claim	Pooled Over Label Setting	5.068	8	0.750	Fail	126
2	Pooled	Free, Used	Free, Used	Pooled Over Label Setting	11.689	8	0.166	Fail	154
2	Pooled	Free, Used	Free, No Claim	Pooled Over Label Setting	20.783	8	0.008	Reject	105
2	Pooled	Free, Used	Used, No Claim	Pooled Over Label Setting	13.216	8	0.105	Fail	140
2	Pooled	Free, No Claim	Free, Used	Pooled Over Label Setting	16.809	8	0.032	Reject	147
2	Pooled	Free, No Claim	Free, No Claim	Pooled Over Label Setting	13.123	8	0.108	Fail	168
2	Pooled	Free, No Claim	Used, No Claim	Pooled Over Label Setting	24.613	8	0.002	Reject	105
2	Pooled	Used, No Claim	Free, Used	Pooled Over Label Setting	15.791	8	0.045	Reject	119
2	Pooled	Used, No Claim	Free, No Claim	Pooled Over Label Setting	31.616	8	0.000	Reject	140
2	Pooled	Used, No Claim	Used, No Claim	Pooled Over Label Setting	27.786	8	0.001	Reject	161
3	Pooled	Free, Used	Free, Used	Pooled Over Label Setting	14.005	8	0.082	Fail	161
3	Pooled	Free, Used	Free, No Claim	Pooled Over Label Setting	7.399	8	0.494	Fail	105
3	Pooled	Free, Used	Used, No Claim	Pooled Over Label Setting	12.982	8	0.112	Fail	147
3	Pooled	Free, No Claim	Free, Used	Pooled Over Label Setting	14.728	8	0.065	Fail	154
3	Pooled	Free, No Claim	Free, No Claim	Pooled Over Label Setting	29.500	8	0.000	Reject	147
3	Pooled	Free, No Claim	Used, No Claim	Pooled Over Label Setting	20.881	8	0.007	Reject	189
3	Pooled	Used, No Claim	Free, Used	Pooled Over Label Setting	8.935	8	0.348	Fail	154
3	Pooled	Used, No Claim	Free, No Claim	Pooled Over Label Setting	43.792	8	0.000	Reject	154
3	Pooled	Used, No Claim	Used, No Claim	Pooled Over Label Setting	27.989	8	0.000	Reject	182
4	Pooled	Free, Used	Free, Used	Pooled Over Label Setting	12.970	8	0.113	Fail	126
4	Pooled	Free, Used	Free, No Claim	Pooled Over Label Setting	25.092	8	0.001	Reject	203
4	Pooled	Free, Used	Used, No Claim	Pooled Over Label Setting	12.409	8	0.134	Fail	147
4	Pooled	Free, No Claim	Free, Used	Pooled Over Label Setting	11.594	8	0.170	Fail	126
4	Pooled	Free, No Claim	Free, No Claim	Pooled Over Label Setting	15.687	8	0.047	Reject	196
4	Pooled	Free, No Claim	Used, No Claim	Pooled Over Label Setting	24.779	8	0.002	Reject	196
4	Pooled	Used, No Claim	Free, Used	Pooled Over Label Setting	10.356	8	0.241	Fail	168
4	Pooled	Used, No Claim	Free, No Claim	Pooled Over Label Setting	19.628	8	0.012	Reject	119
4	Pooled	Used, No Claim	Used, No Claim	Pooled Over Label Setting	28.800	8	0.000	Reject	133
									5,250

Table 4.6. Hypothesis Testing for Choice Experiment Design 1 continued									
Pooled Over Information Treatment									
Pooled	No Approval	Free, Used	Free, Used	Pooled Over Information Treatment	24.963	12	0.015	Reject	182
Pooled	No Approval	Free, Used	Free, No Claim	Pooled Over Information Treatment	21.771	12	0.040	Reject	252
Pooled	No Approval	Free, Used	Used, No Claim	Pooled Over Information Treatment	11.261	12	0.507	Fail	161
Pooled	No Approval	Free, No Claim	Free, Used	Pooled Over Information Treatment	31.723	12	0.002	Reject	154
Pooled	No Approval	Free, No Claim	Free, No Claim	Pooled Over Information Treatment	34.691	12	0.001	Reject	168
Pooled	No Approval	Free, No Claim	Used, No Claim	Pooled Over Information Treatment	35.283	12	0.000	Reject	140
Pooled	No Approval	Used, No Claim	Free, Used	Pooled Over Information Treatment	6.150	12	0.908	Fail	168
Pooled	No Approval	Used, No Claim	Free, No Claim	Pooled Over Information Treatment	35.440	12	0.000	Reject	119
Pooled	No Approval	Used, No Claim	Used, No Claim	Pooled Over Information Treatment	26.804	12	0.008	Reject	224
Pooled	Approval	Free, Used	Free, Used	Pooled Over Information Treatment	12.079	12	0.439	Fail	203
Pooled	Approval	Free, Used	Free, No Claim	Pooled Over Information Treatment	28.028	12	0.005	Reject	196
Pooled	Approval	Free, Used	Used, No Claim	Pooled Over Information Treatment	24.643	12	0.017	Reject	196
Pooled	Approval	Free, No Claim	Free, Used	Pooled Over Information Treatment	12.361	12	0.417	Fail	196
Pooled	Approval	Free, No Claim	Free, No Claim	Pooled Over Information Treatment	16.146	12	0.185	Fail	196
Pooled	Approval	Free, No Claim	Used, No Claim	Pooled Over Information Treatment	21.445	12	0.044	Reject	217
Pooled	Approval	Used, No Claim	Free, Used	Pooled Over Information Treatment	24.789	12	0.016	Reject	224
Pooled	Approval	Used, No Claim	Free, No Claim	Pooled Over Information Treatment	13.391	12	0.341	Fail	266

Table 4.6. Hypothesis Testing for Choice Experiment Design 1 continued									
Pooled	Approval	Used, No Claim	Used, No Claim	Pooled Over Information Treatment	31.447	12	0.002	Reject	175
Pooled	Approval, Mandatory	Free, Used	Free, Used	Pooled Over Information Treatment	36.235	12	0.000	Reject	203
Pooled	Approval, Mandatory	Free, Used	Free, No Claim	Pooled Over Information Treatment	20.432	12	0.059	Fail	133
Pooled	Approval, Mandatory	Free, Used	Used, No Claim	Pooled Over Information Treatment	29.012	12	0.004	Reject	224
Pooled	Approval, Mandatory	Free, No Claim	Free, Used	Pooled Over Information Treatment	18.574	12	0.099	Fail	231
Pooled	Approval, Mandatory	Free, No Claim	Free, No Claim	Pooled Over Information Treatment	39.489	12	0.000	Reject	238
Pooled	Approval, Mandatory	Free, No Claim	Used, No Claim	Pooled Over Information Treatment	19.153	12	0.085	Fail	210
Pooled	Approval, Mandatory	Used, No Claim	Free, Used	Pooled Over Information Treatment	38.732	12	0.000	Reject	189
Pooled	Approval, Mandatory	Used, No Claim	Free, No Claim	Pooled Over Information Treatment	14.114	12	0.293	Fail	182
Pooled	Approval, Mandatory	Used, No Claim	Used, No Claim	Pooled Over Information Treatment	36.184	12	0.000	Reject	203
									5,250
Pooled Over Label Wording and Label Setting									
1	Pooled	Pooled	Pooled	Pooled Over Label Wording and Label Setting	304.500	32	0.000	Reject	1,204
2	Pooled	Pooled	Pooled	Pooled Over Label Wording and Label Setting	421.390	32	0.000	Reject	1,239
3	Pooled	Pooled	Pooled	Pooled Over Label Wording and Label Setting	400.649	32	0.000	Reject	1,393
4	Pooled	Pooled	Pooled	Pooled Over Label Wording and Label Setting	383.875	32	0.000	Reject	1,414
									5,250
Pooled Over Label Wording and Information Treatment									
Pooled	No Approval	Pooled	Pooled	Pooled Over Label Wording and Information Treatment	518.355	140	0.000	Reject	1,568
Pooled	Approval	Pooled	Pooled	Pooled Over Label Wording and Information Treatment	442.295	140	0.000	Reject	1,869

Table 4.6. Hypothesis Testing for Choice Experiment Design 1 continued									
Pooled	Approval, Mandatory	Pooled	Pooled	Pooled Over Label Wording and Information Treatment	556.119	140	0.000	Reject	1,813
									5,250
Pooled Over Label Setting and Information Treatment									
Pooled	Pooled	Free, Used	Free, Used	Pooled Over Label Setting and Information Treatment	76.891	44	0.002	Reject	588
Pooled	Pooled	Free, Used	Free, No Claim	Pooled Over Label Setting and Information Treatment	101.104	44	0.000	Reject	581
Pooled	Pooled	Free, Used	Used, No Claim	Pooled Over Label Setting and Information Treatment	82.740	44	0.000	Reject	581
Pooled	Pooled	Free, No Claim	Free, Used	Pooled Over Label Setting and Information Treatment	84.568	44	0.000	Reject	581
Pooled	Pooled	Free, No Claim	Free, No Claim	Pooled Over Label Setting and Information Treatment	115.859	44	0.000	Reject	602
Pooled	Pooled	Free, No Claim	Used, No Claim	Pooled Over Label Setting and Information Treatment	113.495	44	0.000	Reject	567
Pooled	Pooled	Used, No Claim	Free, Used	Pooled Over Label Setting and Information Treatment	78.511	44	0.001	Reject	581
Pooled	Pooled	Used, No Claim	Free, No Claim	Pooled Over Label Setting and Information Treatment	116.464	44	0.000	Reject	567
Pooled	Pooled	Used, No Claim	Used, No Claim	Pooled Over Label Setting and Information Treatment	109.088	44	0.000	Reject	602
									5,250
Pooled Over Common Label									
-	-	Mixed	Mixed	Pooled Over Mixed Label	943.859	284	0.000	Reject	3,458
-	-	Common	Common	Pooled Over Common Label	556.819	140	0.000	Reject	1,792
									5,250
Pooled Over All									
Pooled	Pooled	Pooled	Pooled	Pooled Over All	1526.203	428	0.000	Reject	5250

Table 4.7. Pooled Models for Design 1									
Info. Treatment	**Label Setting**	**Label Wording**		**LL**	**Cdum**	**Price**	**Antibiotic Use**	**RNAi Use**	**N**
		RNAi	**Antibiotic**						
Pooled Over Label Wording									
1	No Approval	Pooled	Pooled	-326.956	-2.440	-0.263	-0.331*	-0.312*	343
1	Approval	Pooled	Pooled	-434.133	-1.722	-0.189	-0.436	-0.074	441
1	Approval, Mandatory	Pooled	Pooled	-417.481	-2.131	-0.205	-0.387*	-0.138	420
2	No Approval	Pooled	Pooled	-360.150	-2.447	-0.231	-0.209	-0.092	357
2	Approval	Pooled	Pooled	-398.695	-2.056	-0.217	-0.381	0.000	406
2	Approval, Mandatory	Pooled	Pooled	-491.549	-1.249	-0.148	-0.195*	-0.170*	476
3	No Approval	Pooled	Pooled	-426.678	-1.701	-0.183	-0.268*	-0.118	420
3	Approval	Pooled	Pooled	-536.980	-2.368	-0.244	-0.282*	-0.146	546
3	Approval, Mandatory	Pooled	Pooled	-433.133	-1.174	-0.158	-0.129	-0.135	427
4	No Approval	Pooled	Pooled	-444.279	-1.772	-0.199	-0.330*	-0.129	448
4	Approval	Pooled	Pooled	-466.500	-2.424	-0.261	-0.115	-0.079	476
4	Approval, Mandatory	Pooled	Pooled	-494.976	-2.164	-0.214	-0.248*	-0.093	490
									5,250
Pooled Over Label Wording and Label Setting									
1	Pooled	Pooled	Pooled	-1183.209	-2.052	-0.214	-0.388*	-0.160*	1,204
2	Pooled	Pooled	Pooled	-1257.362	-1.849	-0.194	-0.257*	-0.093	1,239
3	Pooled	Pooled	Pooled	-1402.715	-1.792	-0.198	-0.232*	-0.133*	1,393
4	Pooled	Pooled	Pooled	-1411.554	-2.123	-0.224	-0.229*	-0.101	1,414
									5,250
Pooled Over Label Wording and Information Treatment									
Pooled	No Approval	Pooled	Pooled	-1564.568	-2.037	-0.214	-0.283*	-0.153*	1,568
Pooled	Approval	Pooled	Pooled	-1844.868	-2.164	-0.229	-0.296*	-0.081	1,869
Pooled	Approval, Mandatory	Pooled	Pooled	-1848.581	-1.676	-0.181	-0.240*	-0.134*	1,813
									5,250

Table 4.7. Pooled Models for Design 1 continued									
Pooled Over Label Setting and Information Treatment									
Pooled	Pooled	Free, Used	Free, Used	-517.465	-2.170	-0.248	-0.652	-0.516	588
Pooled	Pooled	Free, Used	Free, No Claim	-555.590	-2.142	-0.222	-0.456	-0.332	581
Pooled	Pooled	Free, Used	Used, No Claim	-578.926	-2.190	-0.228	0.268	-0.421	581
Pooled	Pooled	Free, No Claim	Free, Used	-535.441	-2.484	-0.220	-0.644	-0.204	581
Pooled	Pooled	Free, No Claim	Free, No Claim	-562.467	-2.515	-0.245	-0.530	-0.308	602
Pooled	Pooled	Free, No Claim	Used, No Claim	-541.122	-1.935	-0.238	0.401	-0.198	567
Pooled	Pooled	Used, No Claim	Free, Used	-542.704	-1.760	-0.189	-0.664	0.215	581
Pooled	Pooled	Used, No Claim	Free, No Claim	-574.282	-1.375	-0.137	-0.401	0.329	567
Pooled	Pooled	Used, No Claim	Used, No Claim	-530.995	-1.481	-0.229	0.275	0.317	602
									5,250
Pooled Over Common Label									
-	-	Mixed	Mixed	-3511.554	-1.965	-0.200	-0.246*	-0.098*	3,458
-	-	Common	Common	-1738.418	-1.960	-0.225	-0.330*	-0.171	1,792
									5,250
Pooled Over All									
Pooled	Pooled	Pooled	Pooled	-5262.735	-1.952	-0.208	-0.273*	-0.121*	5,250
Note: * denotes statistical significance.									

Table 4.8. Model Fit and Coefficients for Choice Experiment Design 2								
Info. Treatment	**Label Setting**	**Antibiotic Label Wording**	**LL**	**Cdum**	**Price**	**Grade**	**RNAi Use**	**N**
1	No Approval	Free, Used	-154.224	-1.209	-0.146	-0.134	-0.591	154
1	No Approval	Free, No Claim	-209.109	-2.630	-0.263	-0.005	-0.222	210
1	No Approval	Used, No Claim	-77.367	-2.400	-0.285	-0.400*	0.646*	91
1	Approval	Free, Used	-187.331	-1.957	-0.184	-0.235*	-0.144	182
1	Approval	Free, No Claim	-132.053	-2.797	-0.242	-0.137	-0.393*	133
1	Approval	Used, No Claim	-131.255	-2.898	-0.149	-0.166	0.373	140
1	Approval, Mandatory	Free, Used	-169.025	-1.234	-0.119	-0.169	-0.597	168
1	Approval, Mandatory	Free, No Claim	-169.079	-2.494	-0.245	-0.036	-0.250	168
1	Approval, Mandatory	Used, No Claim	-138.555	-2.898	-0.280	-0.328*	0.359*	147
2	No Approval	Free, Used	-121.799	-2.702	-0.304	-0.285	-0.501*	133
2	No Approval	Free, No Claim	-195.978	-3.421	-0.273	-0.226	-0.228	203
2	No Approval	Used, No Claim	-196.244	-1.313	-0.115	-0.016	0.016	182
2	Approval	Free, Used	-113.990	-2.990	-0.175	0.105	-0.275	119
2	Approval	Free, No Claim	-97.214	-2.221	-0.186	-0.292	-0.407	98
2	Approval	Used, No Claim	-111.876	-2.097	-0.202	-0.266	0.346	112
2	Approval, Mandatory	Free, Used	-134.063	-0.757	-0.105	-0.305	-0.766	140
2	Approval, Mandatory	Free, No Claim	-141.556	-1.705	-0.152	-0.266	-0.422	140
2	Approval, Mandatory	Used, No Claim	-149.220	-1.235	-0.144	-0.252	0.308	147
3	No Approval	Free, Used	-191.618	-2.490	-0.195	-0.273*	-0.627*	203
3	No Approval	Free, No Claim	-120.472	-3.047	-0.290	-0.309*	-0.272	126
3	No Approval	Used, No Claim	-188.062	-2.301	-0.225	-0.158	0.325*	189
3	Approval	Free, Used	-150.063	-1.932	-0.178	-0.268	-0.256	147
3	Approval	Free, No Claim	-170.972	-1.739	-0.200	-0.320*	-0.395*	175
3	Approval	Used, No Claim	-177.773	-2.564	-0.233	-0.318*	0.375*	182
3	Approval, Mandatory	Free, Used	-119.003	-2.615	-0.235	-0.528*	-0.637*	133
3	Approval, Mandatory	Free, No Claim	-129.035	-1.697	-0.176	-0.230	-0.221	126
3	Approval, Mandatory	Used, No Claim	-115.017	-2.321	-0.207	-0.074	0.196	112
4	No Approval	Free, Used	-74.807	-2.532	-0.273	-0.080	-0.324	77
4	No Approval	Free, No Claim	-193.225	-2.380	-0.219	-0.310*	-0.367*	196
4	No Approval	Used, No Claim	-149.167	-2.709	-0.260	-0.352*	0.596*	161
4	Approval	Free, Used	-130.448	-1.766	-0.126	-0.412	-0.360	133
4	Approval	Free, No Claim	-70.553	-2.862	-0.241	-0.048	-0.257	70
4	Approval	Used, No Claim	-114.944	-1.100	-0.184	-0.034	0.418	126
4	Approval, Mandatory	Free, Used	-154.074	-1.735	-0.194	-0.303*	-0.657	161
4	Approval, Mandatory	Free, No Claim	-92.319	-5.094	-0.426	-0.021	-0.277	105
4	Approval, Mandatory	Used, No Claim	-144.739	-1.952	-0.242	-0.128	0.607*	161
								5,250

Note: * denotes statistical significance.

Table 4.9. Hypothesis Testing for Choice Experiment Design 2								
Info. Treatment	**Label Setting**	**RNAi Label Wording**	**Hypothesis**	**LR Test**	**DF**	**P-value**	**Conclusion**	**N**
Pooled over Label Wording								
1	No Approval	Pooled	Pooled over Label Wording	39.198	8	0.000	Reject	455
1	Approval	Pooled	Pooled over Label Wording	41.274	8	0.000	Reject	455
1	Approval, Mandatory	Pooled	Pooled over Label Wording	37.984	8	0.000	Reject	483
2	No Approval	Pooled	Pooled over Label Wording	33.630	8	0.000	Reject	518
2	Approval	Pooled	Pooled over Label Wording	36.617	8	0.000	Reject	329
2	Approval, Mandatory	Pooled	Pooled over Label Wording	36.669	8	0.000	Reject	427
3	No Approval	Pooled	Pooled over Label Wording	49.711	8	0.000	Reject	518
3	Approval	Pooled	Pooled over Label Wording	25.327	8	0.001	Reject	504
3	Approval, Mandatory	Pooled	Pooled over Label Wording	26.132	8	0.001	Reject	371
4	No Approval	Pooled	Pooled over Label Wording	35.552	8	0.000	Reject	434
4	Approval	Pooled	Pooled over Label Wording	54.790	8	0.000	Reject	329
4	Approval, Mandatory	Pooled	Pooled over Label Wording	72.055	8	0.000	Reject	427
								5,250
Pooled over Label Setting								
1	Pooled	Free, Used	Pooled Over Label Setting	12.463	8	0.132	Fail	504
1	Pooled	Free, No Claim	Pooled Over Label Setting	5.651	8	0.686	Fail	511
1	Pooled	Used, No Claim	Pooled Over Label Setting	54.694	8	0.000	Reject	378
2	Pooled	Free, Used	Pooled Over Label Setting	54.687	8	0.000	Reject	392
2	Pooled	Free, No Claim	Pooled Over Label Setting	7.430	8	0.491	Fail	441
2	Pooled	Used, No Claim	Pooled Over Label Setting	11.443	8	0.178	Fail	441
3	Pooled	Free, Used	Pooled Over Label Setting	12.407	8	0.134	Fail	483
3	Pooled	Free, No Claim	Pooled Over Label Setting	4.762	8	0.783	Fail	427
3	Pooled	Used, No Claim	Pooled Over Label Setting	3.678	8	0.885	Fail	483
4	Pooled	Free, Used	Pooled Over Label Setting	18.052	8	0.021	Reject	371
4	Pooled	Free, No Claim	Pooled Over Label Setting	13.109	8	0.108	Fail	371

Table 4.9. Hypothesis Testing for Choice Experiment Design 2 continued								
4	Pooled	Used, No Claim	Pooled Over Label Setting	14.367	8	0.073	Fail	448
								5,250
Pooled Over Information Treatment								
Pooled	No Approval	Free, Used	Pooled Over Information Treatment	31.625	12	0.002	Reject	567
Pooled	No Approval	Free, No Claim	Pooled Over Information Treatment	18.500	12	0.101	Fail	735
Pooled	No Approval	Used, No Claim	Pooled Over Information Treatment	33.221	12	0.001	Reject	623
Pooled	Approval	Free, Used	Pooled Over Information Treatment	33.007	12	0.001	Reject	581
Pooled	Approval	Free, No Claim	Pooled Over Information Treatment	13.017	12	0.368	Fail	476
Pooled	Approval	Used, No Claim	Pooled Over Information Treatment	64.983	12	0.000	Reject	560
Pooled	Approval, Mandatory	Free, Used	Pooled Over Information Treatment	13.294	12	0.348	Fail	602
Pooled	Approval, Mandatory	Free, No Claim	Pooled Over Information Treatment	22.832	12	0.029	Reject	539
Pooled	Approval, Mandatory	Used, No Claim	Pooled Over Information Treatment	19.596	12	0.075	Fail	567
								5,250
Pooled Over Label Wording and Label Setting								
1	Pooled	Pooled	Pooled Over Label Wording and Label Setting	146.174	32	0.000	Reject	1,393
2	Pooled	Pooled	Pooled Over Label Wording and Label Setting	126.313	32	0.000	Reject	1,274
3	Pooled	Pooled	Pooled Over Label Wording and Label Setting	106.621	32	0.000	Reject	1,393
4	Pooled	Pooled	Pooled Over Label Wording and Label Setting	168.804	32	0.000	Reject	1,190
								5,250
Pooled Over Label Wording and Information Treatment								
Pooled	No Approval	Pooled	Pooled Over Label Wording and Information Treatment	176.664	46	0.000	Reject	1,925

Table 4.9. Hypothesis Testing for Choice Experiment Design 2 continued								
Pooled	Approval	Pooled	Pooled Over Label Wording and Information Treatment	184.668	46	0.000	Reject	1,617
Pooled	Approval, Mandatory	Pooled	Pooled Over Label Wording and Information Treatment	191.299	46	0.000	Reject	1,708
								5,250
Pooled Over Label Setting and Information Treatment								
Pooled	Pooled	Free, Used	Pooled Over Label Setting and Information Treatment	111.203	46	0.000	Reject	1,750
Pooled	Pooled	Free, No Claim	Pooled Over Label Setting and Information Treatment	58.565	46	0.101	Fail	1,750
Pooled	Pooled	Used, No Claim	Pooled Over Label Setting and Information Treatment	125.793	46	0.000	Reject	1,750
								5,250
Pooled Over All								
Pooled	Pooled	Pooled	Pooled Over All	570.172	140	0.000	Reject	5,250

Table 4.10. Pooled Models for Design 2								
Info. Treatment	**Label Setting**	**Antibiotic Label Wording**	**LL**	**Cdum**	**Price**	**Grade**	**RNAi Use**	**N**
Pooled over Label Wording								
1	No Approval	Pooled	-460.299	-1.985	-0.213	-0.114	-0.194*	455
1	Approval	Pooled	-471.276	-2.285	-0.175	-0.179*	-0.021	455
1	Approval, Mandatory	Pooled	-495.651	-2.073	-0.200	-0.164*	-0.198*	483
2	No Approval	Pooled	-530.836	-2.324	-0.209	-0.160*	-0.174*	518
2	Approval	Pooled	-341.389	-2.280	-0.176	-0.127	-0.111	329
2	Approval, Mandatory	Pooled	-443.175	-1.150	-0.123	-0.267*	-0.263*	427
3	No Approval	Pooled	-525.009	-2.373	-0.211	-0.241*	-0.189*	518
3	Approval	Pooled	-511.471	-2.010	-0.196	-0.298*	-0.066	504
3	Approval, Mandatory	Pooled	-376.120	-2.118	-0.195	-0.283*	-0.216*	371
4	No Approval	Pooled	-434.975	-2.369	-0.227	-0.281*	-0.007	434
4	Approval	Pooled	-343.340	-1.576	-0.158	-0.204*	-0.087	329
4	Approval, Mandatory	Pooled	-427.159	-2.347	-0.239	-0.167	-0.085	427
								5,250
Pooled Over Label Wording and Label Setting								
1	Pooled	Pooled	-1441.085	-2.075	-0.194	-0.152*	-0.133*	1393
2	Pooled	Pooled	-1325.098	-1.908	-0.171	-0.184*	-0.184*	1274
3	Pooled	Pooled	-1415.326	-2.168	-0.201	-0.272*	-0.152*	1393
4	Pooled	Pooled	-1208.678	-2.132	-0.211	-0.218*	-0.057	1190
								5,250
Pooled Over Label Wording and Information Treatment								
Pooled	No Approval	Pooled	-1960.404	-2.254	-0.214	-0.198*	-0.146*	1925
Pooled	Approval	Pooled	-1680.806	-2.030	-0.177	-0.207*	-0.065	1617
Pooled	Approval, Mandatory	Pooled	-1751.335	-1.910	-0.188	-0.215*	-0.192*	1708
								5,250
Pooled Over Label Setting and Information Treatment								
Pooled	Pooled	Free, Used	-1756.047	-1.863	-0.174	-0.239*	-0.467*	1750
Pooled	Pooled	Free, No Claim	-1750.846	-2.578	-0.237	-0.184*	-0.303*	1750
Pooled	Pooled	Used, No Claim	-1757.116	-2.030	-0.200	-0.197*	0.350*	1750
								5,250
Pooled Over All								
Pooled	Pooled	Pooled	-5401.316	-2.066	-0.193	-0.206*	-0.134*	5,250
Note: * denotes statistical significance.								

Table 4.11. Model Fit and Coefficients for Choice Experiment Design 3								
Info. Treatment	**Label Setting**	**Antibiotic Label Wording**	**LL**	**Cdum**	**Price**	**Grade**	**Antibiotic Use**	**N**
1	No Approval	Free, Used	-170.936	-2.994	-0.210	-0.003	-0.400*	175
1	No Approval	Free, No Claim	-143.756	-2.915	-0.259	-0.150	-0.466*	147
1	No Approval	Used, No Claim	-149.351	-2.278	-0.216	-0.263*	0.535*	154
1	Approval	Free, Used	-114.460	-2.948	-0.288	-0.278*	-0.200	119
1	Approval	Free, No Claim	-113.985	-2.738	-0.238	-0.170	-0.651	119
1	Approval	Used, No Claim	-107.001	-3.740	-0.340	-0.365*	0.412*	119
1	Approval, Mandatory	Free, Used	-155.350	-3.043	-0.293	-0.219	-0.743*	168
1	Approval, Mandatory	Free, No Claim	-188.818	-4.350	-0.370	-0.163	-0.606*	210
1	Approval, Mandatory	Used, No Claim	-135.876	-1.081	-0.169	0.156	0.181	140
2	No Approval	Free, Used	-173.657	-1.416	-0.185	-0.059	-0.814	182
2	No Approval	Free, No Claim	-128.247	-3.801	-0.366	-0.171	-0.494*	140
2	No Approval	Used, No Claim	-101.772	-1.309	-0.084	-0.263	0.384	98
2	Approval	Free, Used	-204.284	-1.257	-0.158	-0.001	-0.563	203
2	Approval	Free, No Claim	-124.453	-4.811	-0.333	-0.343*	-0.294	147
2	Approval	Used, No Claim	-100.676	-2.524	-0.289	-0.359*	0.314	112
2	Approval, Mandatory	Free, Used	-138.444	-2.352	-0.201	-0.242*	-0.460*	140
2	Approval, Mandatory	Free, No Claim	-173.109	-2.346	-0.244	-0.373	-0.459*	182
2	Approval, Mandatory	Used, No Claim	-143.515	-2.390	-0.264	-0.156	0.442*	154
3	No Approval	Free, Used	-155.121	-2.669	-0.246	-0.281*	-0.506*	161
3	No Approval	Free, No Claim	-137.151	-3.044	-0.240	0.024	-0.489*	140
3	No Approval	Used, No Claim	-145.562	-1.858	-0.186	-0.237*	0.477*	147
3	Approval	Free, Used	-123.331	-2.913	-0.304	-0.385*	-0.244	133
3	Approval	Free, No Claim	-122.967	-3.051	-0.237	-0.089	-0.453*	126
3	Approval	Used, No Claim	-140.626	-2.608	-0.264	-0.067	0.441*	147
3	Approval, Mandatory	Free, Used	-122.521	-1.846	-0.137	-0.088	-0.374	119
3	Approval, Mandatory	Free, No Claim	-115.417	-1.677	-0.130	-0.133	-0.392	112
3	Approval, Mandatory	Used, No Claim	-175.534	-1.440	-0.212	-0.177	0.472*	196
4	No Approval	Free, Used	-113.657	-3.349	-0.327	-0.383*	-0.961*	133
4	No Approval	Free, No Claim	-94.885	-5.416	-0.309	-0.140	-0.620*	126
4	No Approval	Used, No Claim	-141.320	-2.446	-0.225	-0.185	0.612*	147
4	Approval	Free, Used	-119.565	-2.313	-0.229	0.132	-0.456*	119
4	Approval	Free, No Claim	-194.172	-3.128	-0.236	-0.259*	-0.385	203
4	Approval	Used, No Claim	-197.499	-0.896	-0.110	-0.188	0.225	189
4	Approval, Mandatory	Free, Used	-89.060	-3.585	-0.309	-0.053	-0.876*	98
4	Approval, Mandatory	Free, No Claim	-95.618	-3.513	-0.282	-0.017	-0.262	98
4	Approval, Mandatory	Used, No Claim	-136.087	-1.517	-0.210	-0.153	0.380*	147
								5,250
Note: * denotes statistical significance.								

Table 4.12. Hypothesis Testing for Choice Experiment Design 3								
Info. Treatment	**Label Setting**	**Antibiotic Label Wording**	**Hypothesis**	**LR Test**	**DF**	**P-value**	**Conclusion**	**N**
Pooled over Label Wording								
1	No Approval	Pooled	Pooled over Label Wording	49.757	8	0.000	Reject	476
1	Approval	Pooled	Pooled over Label Wording	27.988	8	0.000	Reject	357
1	Approval, Mandatory	Pooled	Pooled over Label Wording	59.843	8	0.000	Reject	518
2	No Approval	Pooled	Pooled over Label Wording	52.214	8	0.000	Reject	420
2	Approval	Pooled	Pooled over Label Wording	74.717	8	0.000	Reject	462
2	Approval, Mandatory	Pooled	Pooled over Label Wording	43.235	8	0.000	Reject	476
3	No Approval	Pooled	Pooled over Label Wording	44.587	8	0.000	Reject	448
3	Approval	Pooled	Pooled over Label Wording	40.963	8	0.000	Reject	406
3	Approval, Mandatory	Pooled	Pooled over Label Wording	69.626	8	0.000	Reject	427
4	No Approval	Pooled	Pooled over Label Wording	110.787	8	0.000	Reject	406
4	Approval	Pooled	Pooled over Label Wording	43.512	8	0.000	Reject	511
4	Approval, Mandatory	Pooled	Pooled over Label Wording	55.906	8	0.000	Reject	343
								5,250
Pooled over Label Setting								
1	Pooled	Free, Used	Pooled Over Label Setting	27.115	8	0.001	Reject	462
1	Pooled	Free, No Claim	Pooled Over Label Setting	5.127	8	0.744	Fail	476
1	Pooled	Used, No Claim	Pooled Over Label Setting	23.689	8	0.003	Reject	413
2	Pooled	Free, Used	Pooled Over Label Setting	13.426	8	0.098	Fail	525
2	Pooled	Free, No Claim	Pooled Over Label Setting	35.305	8	0.000	Reject	469
2	Pooled	Used, No Claim	Pooled Over Label Setting	23.975	8	0.002	Reject	364
3	Pooled	Free, Used	Pooled Over Label Setting	18.274	8	0.019	Reject	413
3	Pooled	Free, No Claim	Pooled Over Label Setting	3.372	8	0.909	Fail	378
3	Pooled	Used, No Claim	Pooled Over Label Setting	13.335	8	0.101	Fail	490
4	Pooled	Free, Used	Pooled Over Label Setting	16.791	8	0.032	Reject	350
4	Pooled	Free, No Claim	Pooled Over Label Setting	26.885	8	0.001	Reject	427

Table 4.12. Hypothesis Testing for Choice Experiment Design 3 continued								
4	Pooled	Used, No Claim	Pooled Over Label Setting	17.210	8	0.028	Reject	483
								5,250
Pooled Over Information Treatment								
Pooled	No Approval	Free, Used	Pooled Over Information Treatment	43.683	12	0.000	Reject	651
Pooled	No Approval	Free, No Claim	Pooled Over Information Treatment	50.943	12	0.000	Reject	553
Pooled	No Approval	Used, No Claim	Pooled Over Information Treatment	10.603	12	0.563	Fail	546
Pooled	Approval	Free, Used	Pooled Over Information Treatment	21.515	12	0.043	Reject	574
Pooled	Approval	Free, No Claim	Pooled Over Information Treatment	15.606	12	0.210	Fail	595
Pooled	Approval	Used, No Claim	Pooled Over Information Treatment	21.589	12	0.042	Reject	567
Pooled	Approval, Mandatory	Free, Used	Pooled Over Information Treatment	13.241	12	0.352	Fail	525
Pooled	Approval, Mandatory	Free, No Claim	Pooled Over Information Treatment	26.280	12	0.010	Reject	602
Pooled	Approval, Mandatory	Used, No Claim	Pooled Over Information Treatment	10.196	12	0.599	Fail	637
								5,250
Pooled Over Label Wording and Label Setting								
1	Pooled	Pooled	Pooled Over Label Wording and Label Setting	155.265	32	0.000	Reject	1,351
2	Pooled	Pooled	Pooled Over Label Wording and Label Setting	175.359	32	0.000	Reject	1,358
3	Pooled	Pooled	Pooled Over Label Wording and Label Setting	166.858	32	0.000	Reject	1,281
4	Pooled	Pooled	Pooled Over Label Wording and Label Setting	226.823	32	0.000	Reject	1,260
								5,250
Pooled Over Label Wording and Information Treatment								
Pooled	No Approval	Pooled	Pooled Over Label Wording and Information Treatment	276.334	46	0.000	Reject	1,750

Table 4.12. Hypothesis Testing for Choice Experiment Design 3 continued								
Pooled	Approval	Pooled	Pooled Over Label Wording and Information Treatment	199.180	46	0.000	Reject	1,736
Pooled	Approval, Mandatory	Pooled	Pooled Over Label Wording and Information Treatment	248.864	46	0.000	Reject	1,764
								5,250
Pooled Over Label Setting and Information Treatment								
Pooled	Pooled	Free, Used	Pooled Over Label Setting and Information Treatment	101.060	46	0.000	Reject	1,750
Pooled	Pooled	Free, No Claim	Pooled Over Label Setting and Information Treatment	106.656	46	0.000	Reject	1,750
Pooled	Pooled	Used, No Claim	Pooled Over Label Setting and Information Treatment	84.798	46	0.000	Reject	1,750
								5,250
Pooled Over All								
Pooled	Pooled	Pooled	Pooled Over All	745.392	140	0.000	Reject	5,250

Table 4.13. Pooled Models for Design 3								
Info. Treatment	**Label Setting**	**Antibiotic Label Wording**	**LL**	**Cdum**	**Price**	**Grade**	**Antibiotic Use**	**N**
Pooled over Label Wording								
1	No Approval	Pooled	-454.304	-2.867	-0.249	-0.141	-0.452*	476
1	Approval	Pooled	-449.123	-3.456	-0.299	-0.160	-0.567*	357
1	Approval, Mandatory	Pooled	-404.072	-2.244	-0.231	-0.159*	0.374*	518
2	No Approval	Pooled	-523.098	-1.583	-0.177	-0.089	-0.608*	420
2	Approval	Pooled	-443.462	-3.336	-0.295	-0.294*	-0.397*	462
2	Approval, Mandatory	Pooled	-357.950	-1.967	-0.207	-0.239*	0.386*	476
3	No Approval	Pooled	-410.110	-2.402	-0.223	-0.247*	-0.380*	448
3	Approval	Pooled	-377.221	-2.613	-0.204	-0.060	-0.443*	406
3	Approval, Mandatory	Pooled	-468.389	-1.889	-0.217	-0.159	0.458*	427
4	No Approval	Pooled	-330.677	-2.970	-0.278	-0.108	-0.732*	406
4	Approval	Pooled	-398.118	-3.607	-0.255	-0.169*	-0.416*	511
4	Approval, Mandatory	Pooled	-483.511	-1.484	-0.169	-0.175*	0.380*	343
								5,250
Pooled Over Label Wording and Label Setting								
1	Pooled	Pooled	-1357.166	-2.688	-0.243	-0.159*	-0.226*	1,351
2	Pooled	Pooled	-1375.837	-2.152	-0.211	-0.200*	-0.252*	1,358
3	Pooled	Pooled	-1321.659	-2.087	-0.198	-0.159*	-0.095	1,281
4	Pooled	Pooled	-1295.275	-2.306	-0.203	-0.158*	-0.173*	1,260
								5,250
Pooled Over Label Wording and Information Treatment								
Pooled	No Approval	Pooled	-1793.581	-2.364	-0.204	-0.164*	-0.194*	1,750
Pooled	Approval	Pooled	-1762.609	-2.405	-0.222	-0.188*	-0.164*	1,736
Pooled	Approval, Mandatory	Pooled	-1793.783	-2.162	-0.215	-0.156*	-0.200*	1,764
								5,250
Pooled Over Label Setting and Information Treatment								
Pooled	Pooled	Free, Used	-1730.916	-2.364	-0.225	-0.144*	-0.529*	1,750
Pooled	Pooled	Free, No Claim	-1685.908	-3.224	-0.263	-0.173*	-0.452*	1,750
Pooled	Pooled	Used, No Claim	-1717.217	-1.873	-0.205	-0.180*	0.400*	1,750
								5,250
Pooled Over All								
Pooled	Pooled	Pooled	-5360.480	-2.303	-0.213	-0.169*	-0.186*	5,250
								5,250
Note: * denotes statistical significance.								

Table 4.14. Model Fit and Coefficients for Choice Experiment Design 4.							
Info. Treatment	**Label Setting**	**RNAi Label Wording**	**LL**	**Cdum**	**Price**	**RNAi Use**	**N**
1	No Approval	Free, Used	-122.111	-5.943	-0.486	-0.601*	138
1	No Approval	Free, No Claim	-106.768	-3.109	-0.317	-0.343	108
1	No Approval	Used, No Claim	-100.429	-3.034	-0.340	0.274	108
1	Approval	Free, Used	-125.403	-2.974	-0.291	-0.475*	126
1	Approval	Free, No Claim	-105.276	-2.487	-0.227	-0.416	102
1	Approval	Used, No Claim	-118.661	-2.039	-0.224	0.386	120
1	Approval, Mandatory	Free, Used	-155.060	-2.562	-0.217	-0.645*	156
1	Approval, Mandatory	Free, No Claim	-155.158	-4.335	-0.405	-0.318*	162
1	Approval, Mandatory	Used, No Claim	-97.800	-2.664	-0.249	0.215	96
2	No Approval	Free, Used	-164.152	-3.044	-0.304	-0.550*	168
2	No Approval	Free, No Claim	-120.793	-4.701	-0.460	-0.378*	132
2	No Approval	Used, No Claim	-74.882	-4.476	-0.451	0.321	84
2	Approval	Free, Used	-101.831	-4.305	-0.414	-0.403*	108
2	Approval	Free, No Claim	-146.224	-4.277	-0.410	-0.744*	162
2	Approval	Used, No Claim	-179.144	-3.488	-0.369	0.253	192
2	Approval, Mandatory	Free, Used	-104.821	-5.120	-0.424	-0.594*	114
2	Approval, Mandatory	Free, No Claim	-130.779	-2.184	-0.230	-0.626	132
2	Approval, Mandatory	Used, No Claim	-92.240	-2.268	-0.218	0.263	90
3	No Approval	Free, Used	-78.126	-2.251	-0.240	-0.515	78
3	No Approval	Free, No Claim	-92.691	-3.479	-0.220	-0.390	96
3	No Approval	Used, No Claim	-181.296	-3.424	-0.291	0.324*	186
3	Approval	Free, Used	-91.407	-3.009	-0.301	-0.712*	96
3	Approval	Free, No Claim	-108.759	-3.424	-0.317	-0.261	108
3	Approval	Used, No Claim	-124.515	-2.070	-0.243	0.207	126
3	Approval, Mandatory	Free, Used	-108.052	-5.007	-0.511	-0.545*	126
3	Approval, Mandatory	Free, No Claim	-100.565	-4.342	-0.426	-0.412*	108
3	Approval, Mandatory	Used, No Claim	-94.369	-1.935	-0.192	0.141	90
4	No Approval	Free, Used	-144.934	-1.974	-0.205	-0.592	144
4	No Approval	Free, No Claim	-136.214	-4.817	-0.395	-0.461*	144
4	No Approval	Used, No Claim	-110.610	-4.550	-0.443	0.145	120
4	Approval	Free, Used	-109.132	-2.999	-0.320	-0.541*	114
4	Approval	Free, No Claim	-111.702	-2.739	-0.259	-0.213	108
4	Approval	Used, No Claim	-161.503	-2.484	-0.252	0.318*	162
4	Approval, Mandatory	Free, Used	-109.224	-4.147	-0.476	-0.540*	132
4	Approval, Mandatory	Free, No Claim	-134.968	-3.064	-0.287	-0.628*	138
4	Approval, Mandatory	Used, No Claim	-117.604	-3.396	-0.337	0.461*	126
							4,500
Note: * denotes statistical significance.							

Table 4.15. Hypothesis Testing for Choice Experiment Design 4								
Info Treatment	**Label Setting**	**RNAi Label Wording**	**Hypothesis**	**LR Test**	**DF**	**P-value**	**Conclusion**	**N**
Pooled over Label Wording								
1	No Approval	Pooled	Pooled over Label Wording	37.822	6	0.000	Reject	354
1	Approval	Pooled	Pooled over Label Wording	24.173	6	0.000	Reject	348
1	Approval, Mandatory	Pooled	Pooled over Label Wording	27.480	6	0.000	Reject	414
2	No Approval	Pooled	Pooled over Label Wording	21.650	6	0.001	Reject	384
2	Approval	Pooled	Pooled over Label Wording	36.309	6	0.000	Reject	462
2	Approval, Mandatory	Pooled	Pooled over Label Wording	28.668	6	0.000	Reject	336
3	No Approval	Pooled	Pooled over Label Wording	40.415	6	0.000	Reject	360
3	Approval	Pooled	Pooled over Label Wording	21.629	6	0.001	Reject	330
3	Approval, Mandatory	Pooled	Pooled over Label Wording	16.566	6	0.011	Reject	324
4	No Approval	Pooled	Pooled over Label Wording	33.793	6	0.000	Reject	408
4	Approval	Pooled	Pooled over Label Wording	21.146	6	0.002	Reject	384
4	Approval, Mandatory	Pooled	Pooled over Label Wording	52.505	6	0.000	Reject	396
								4,500
Pooled over Label Setting								
1	Pooled	Free, Used	Pooled Over Label Setting	16.731	6	0.010	Reject	420
1	Pooled	Free, No Claim	Pooled Over Label Setting	5.968	6	0.427	Fail	372
1	Pooled	Used, No Claim	Pooled Over Label Setting	5.840	6	0.441	Fail	324
2	Pooled	Free, Used	Pooled Over Label Setting	10.119	6	0.120	Fail	390
2	Pooled	Free, No Claim	Pooled Over Label Setting	11.064	6	0.086	Fail	426
2	Pooled	Used, No Claim	Pooled Over Label Setting	6.090	6	0.413	Fail	366
3	Pooled	Free, Used	Pooled Over Label Setting	8.531	6	0.202	Fail	300
3	Pooled	Free, No Claim	Pooled Over Label Setting	23.674	6	0.001	Reject	312
3	Pooled	Used, No Claim	Pooled Over Label Setting	14.041	6	0.029	Reject	402
4	Pooled	Free, Used	Pooled Over Label Setting	16.617	6	0.011	Reject	390
4	Pooled	Free, No Claim	Pooled Over Label Setting	10.781	6	0.095	Fail	390

Table 4.15. Hypothesis Testing for Choice Experiment Design 4 continued								
4	Pooled	Used, No Claim	Pooled Over Label Setting	5.399	6	0.494	Fail	408
								4,500
Pooled Over Information Treatment								
Pooled	No Approval	Free, Used	Pooled Over Information Treatment	21.398	9	0.011	Reject	528
Pooled	No Approval	Free, No Claim	Pooled Over Information Treatment	34.857	9	0.000	Reject	480
Pooled	No Approval	Used, No Claim	Pooled Over Information Treatment	18.109	9	0.034	Reject	498
Pooled	Approval	Free, Used	Pooled Over Information Treatment	5.337	9	0.804	Fail	444
Pooled	Approval	Free, No Claim	Pooled Over Information Treatment	11.675	9	0.232	Fail	480
Pooled	Approval	Used, No Claim	Pooled Over Information Treatment	5.852	9	0.755	Fail	600
Pooled	Approval, Mandatory	Free, Used	Pooled Over Information Treatment	50.532	9	0.000	Reject	528
Pooled	Approval, Mandatory	Free, No Claim	Pooled Over Information Treatment	13.261	9	0.151	Fail	540
Pooled	Approval, Mandatory	Used, No Claim	Pooled Over Information Treatment	5.591	9	0.780	Fail	402
								4,500
Pooled Over Label Wording and Label Setting								
1	Pooled	Pooled	Pooled Over Label Wording and Label Setting	97.772	24	0.000	Reject	1,116
2	Pooled	Pooled	Pooled Over Label Wording and Label Setting	97.502	24	0.000	Reject	1,182
3	Pooled	Pooled	Pooled Over Label Wording and Label Setting	106.015	24	0.000	Reject	1,014
4	Pooled	Pooled	Pooled Over Label Wording and Label Setting	120.187	24	0.000	Reject	1,188
								4,500
Pooled Over Label Wording and Information Treatment								
Pooled	No Approval	Pooled	Pooled Over Label Wording and Information Treatment	160.142	33	0.000	Reject	1,506

Table 4.15. Hypothesis Testing for Choice Experiment Design 4 continued								
Pooled	Approval	Pooled	Pooled Over Label Wording and Information Treatment	112.878	33	0.000	Reject	1,524
Pooled	Approval, Mandatory	Pooled	Pooled Over Label Wording and Information Treatment	144.052	33	0.000	Reject	1,146
								4,500
Pooled Over Label Setting and Information Treatment								
Pooled	Pooled	Free, Used	Pooled Over Label Setting and Information Treatment	81.418	33	0.000	Reject	1,500
Pooled	Pooled	Free, No Claim	Pooled Over Label Setting and Information Treatment	66.407	33	0.000	Reject	1,500
Pooled	Pooled	Used, No Claim	Pooled Over Label Setting and Information Treatment	39.769	33	0.194	Fail	1,500
								4,500
Pooled Over All								
Pooled	Pooled	Pooled	Pooled Over All	431.358	105	0.000	Reject	4,500

Table 4.16. Pooled Models for Design 4							
Info. Treatment	**Label Setting**	**RNAi Label Wording**	**LL**	**Cdum**	**Price**	**RNAi Use**	**N**
Pooled over Label Wording							
1	No Approval	Pooled	-410.939	-3.625	-0.314	-0.561*	354
1	Approval	Pooled	-370.186	-3.417	-0.325	-0.351*	348
1	Approval, Mandatory	Pooled	-319.810	-2.512	-0.266	0.295*	414
2	No Approval	Pooled	-375.864	-3.896	-0.362	-0.510*	384
2	Approval	Pooled	-403.327	-3.682	-0.362	-0.588*	462
2	Approval, Mandatory	Pooled	-349.311	-3.343	-0.343	0.267*	336
3	No Approval	Pooled	-281.851	-3.525	-0.360	-0.588*	360
3	Approval	Pooled	-313.852	-3.528	-0.308	-0.348*	330
3	Approval, Mandatory	Pooled	-407.201	-2.612	-0.250	0.249*	324
4	No Approval	Pooled	-371.599	-2.813	-0.310	-0.557*	408
4	Approval	Pooled	-388.273	-3.548	-0.314	-0.437*	384
4	Approval, Mandatory	Pooled	-392.416	-3.336	-0.331	0.309*	396
							4,500
Pooled Over Label Wording and Label Setting							
1	Pooled	Pooled	-1135.551	-3.121	-0.294	-0.245*	1,116
2	Pooled	Pooled	-1163.617	-3.570	-0.348	-0.295*	1,182
3	Pooled	Pooled	-1032.788	-3.125	-0.296	-0.171*	1,014
4	Pooled	Pooled	-1195.983	-3.161	-0.310	-0.210*	1,188
							4,500
Pooled Over Label Wording and Information Treatment							
Pooled	No Approval	Pooled	-1513.076	-3.513	-0.325	-0.227*	1,506
Pooled	Approval	Pooled	-1539.994	-2.967	-0.297	-0.177*	1,524
Pooled	Approval, Mandatory	Pooled	-1472.667	-3.281	-0.316	-0.295*	1,470
							4,500
Pooled Over Label Setting and Information Treatment							
Pooled	Pooled	Free, Used	-1454.962	-3.408	-0.330	-0.544*	1,500
Pooled	Pooled	Free, No Claim	-1483.098	-3.534	-0.328	-0.435*	1,500
Pooled	Pooled	Used, No Claim	-1472.937	-2.947	-0.297	0.278*	1,500
							4,500
Pooled Over All							
Pooled	Pooled	Pooled	-4532.880	-3.245	-0.312	-0.232*	4500

Table 4.17. Willingness to Pay for Design 1									
Info. Treatment	**Label Setting**	**Label Wording**		**RNAi**			**Antibiotic**		
		RNAi	**Antibiotic**	**Point Estimate**	**Lower Bound**	**Upper Bound**	**Point Estimate**	**Lower Bound**	**Upper Bound**
1	No Approval	Free, Used	Free, Used	-6.47	-17.79	4.84	-4.28	-9.89	1.33
1	No Approval	Free, Used	Free, No Claim	-2.00	-8.08	4.09	-2.07	-6.32	2.18
1	No Approval	Free, Used	Used, No Claim	0.87	-166.60	168.34	-2.45	-26.75	21.84
1	No Approval	Free, No Claim	Free, Used	-9.77	-62.90	43.37	-5.71	-25.06	13.64
1	No Approval	Free, No Claim	Free, No Claim	-0.04	-412.39	412.30	-0.14	-234.43	234.14
1	No Approval	Free, No Claim	Used, No Claim	-0.65	-77.40	76.09	-1.06	-17.96	15.83
1	No Approval	Used, No Claim	Free, Used	1.02	-31.20	33.25	-5.24	-15.30	4.82
1	No Approval	Used, No Claim	Free, No Claim	-0.57	-106.00	104.86	-0.52	-89.09	88.05
1	No Approval	Used, No Claim	Used, No Claim	-0.63	-56.91	55.65	0.81	-22.25	23.88
1	Approval	Free, Used	Free, Used	-0.61	-167.78	166.56	-8.69	-55.04	37.66
1	Approval	Free, Used	Free, No Claim	-5.49	-20.43	9.46	-4.51	-15.19	6.18
1	Approval	Free, Used	Used, No Claim	-2.55	-20.17	15.06	4.93	-15.22	25.09
1	Approval	Free, No Claim	Free, Used	-1.23	-16.52	14.07	-6.54	-16.49	3.41
1	Approval	Free, No Claim	Free, No Claim	-5.23	-24.44	13.98	-2.68	-13.54	8.18
1	Approval	Free, No Claim	Used, No Claim	-11.29	-391.95	369.37	4.40	-68.35	77.15
1	Approval	Used, No Claim	Free, Used	3.85	-11.78	19.49	-13.76	-150.41	122.88
1	Approval	Used, No Claim	Free, No Claim	4.67	-5.32	14.67	-5.29	-16.98	6.39
1	Approval	Used, No Claim	Used, No Claim	-0.12	-1772.25	1772.01	-0.69	-39.89	38.50
1	Approval, Mandatory	Free, Used	Free, Used	-5.60	-18.05	6.85	-6.78	-23.61	10.05
1	Approval, Mandatory	Free, Used	Free, No Claim	-5.90	-36.61	24.82	-7.88	-59.93	44.17
1	Approval, Mandatory	Free, Used	Used, No Claim	-5.83	-30.17	18.51	6.70	-23.93	37.32
1	Approval, Mandatory	Free, No Claim	Free, Used	4.47	-24.04	32.97	-14.36	-247.44	218.71
1	Approval, Mandatory	Free, No Claim	Free, No Claim	-4.46	-11.85	2.93	-3.95	-9.97	2.06
1	Approval, Mandatory	Free, No Claim	Used, No Claim	-4.30	-32.72	24.12	-2.21	-28.48	24.06
1	Approval, Mandatory	Used, No Claim	Free, Used	3.29	-0.67	7.24	-6.26	-12.97	0.44

Table 4.17. Willingness to Pay for Design 1 continued									
1	Approval, Mandatory	Used, No Claim	Free, No Claim	3.08	-8.53	14.69	-6.38	-29.91	17.15
1	Approval, Mandatory	Used, No Claim	Used, No Claim	2.14	-1.58	5.85	0.17	-300.77	301.11
2	No Approval	Free, Used	Free, Used	-3.66	-8.90	1.59	-3.36	-7.36	0.65
2	No Approval	Free, Used	Free, No Claim	-3.79	-14.68	7.10	-7.92	-39.44	23.60
2	No Approval	Free, Used	Used, No Claim	-4.91	-14.93	5.11	3.91	-3.33	11.15
2	No Approval	Free, No Claim	Free, Used	-3.09	-6.73	0.55	-1.16	-5.92	3.60
2	No Approval	Free, No Claim	Free, No Claim	-1.90	-9.57	5.78	-4.38	-9.96	1.19
2	No Approval	Free, No Claim	Used, No Claim	0.51	-88.09	89.12	3.70	0.69	6.71
2	No Approval	Used, No Claim	Free, Used	1.02	-31.34	33.39	-3.85	-11.76	4.06
2	No Approval	Used, No Claim	Free, No Claim	8.64	-86.90	104.18	-7.02	-71.59	57.55
2	No Approval	Used, No Claim	Used, No Claim	10.15	-104.59	124.89	3.89	-21.28	29.05
2	Approval	Free, Used	Free, Used	-3.90	-10.62	2.81	-3.74	-9.42	1.95
2	Approval	Free, Used	Free, No Claim	-2.81	-15.18	9.56	-5.20	-22.01	11.62
2	Approval	Free, Used	Used, No Claim	-2.17	-5.33	0.98	-0.87	-9.94	8.20
2	Approval	Free, No Claim	Free, Used	-3.99	-26.07	18.10	-10.79	-125.28	103.70
2	Approval	Free, No Claim	Free, No Claim	-2.91	-5.97	0.15	-3.01	-5.45	-0.58
2	Approval	Free, No Claim	Used, No Claim	-3.03	-9.97	3.90	0.39	-160.61	161.39
2	Approval	Used, No Claim	Free, Used	7.26	-78.59	93.10	-8.24	-117.20	100.72
2	Approval	Used, No Claim	Free, No Claim	48.75	-22568.74	22666.24	-31.51	-9480.66	9417.63
2	Approval	Used, No Claim	Used, No Claim	3.57	-1.24	8.39	1.58	-6.41	9.57
2	Approval, Mandatory	Free, Used	Free, Used	-16.06	-434.05	401.93	-13.21	-296.25	269.82
2	Approval, Mandatory	Free, Used	Free, No Claim	-1.51	-21.00	17.99	-2.62	-9.84	4.61
2	Approval, Mandatory	Free, Used	Used, No Claim	-8.61	-89.98	72.76	2.07	-22.67	26.81
2	Approval, Mandatory	Free, No Claim	Free, Used	-2.77	-11.66	6.11	-3.38	-10.89	4.13
2	Approval, Mandatory	Free, No Claim	Free, No Claim	-0.41	-101.30	100.48	-4.31	-8.16	-0.46
2	Approval, Mandatory	Free, No Claim	Used, No Claim	-12.55	-770.82	745.73	32.44	-5008.14	5073.02
2	Approval, Mandatory	Used, No Claim	Free, Used	-16.79	-1692.65	1659.06	27.88	-4581.14	4636.90
2	Approval, Mandatory	Used, No Claim	Free, No Claim	2.77	-11.12	16.65	-1.36	-35.26	32.55
2	Approval, Mandatory	Used, No Claim	Used, No Claim	2.67	-4.35	9.68	54.08	-26893.14	27001.29

Table 4.17. Willingness to Pay for Design 1 continued									
3	No Approval	Free, Used	Free, Used	-5.55	-48.66	37.57	-8.54	-100.93	83.85
3	No Approval	Free, Used	Free, No Claim	-1.80	-11.13	7.53	-4.81	-11.88	2.27
3	No Approval	Free, Used	Used, No Claim	-10.20	-57.57	37.18	2.42	-5.31	10.15
3	No Approval	Free, No Claim	Free, Used	2.20	-8.89	13.29	-4.87	-15.90	6.16
3	No Approval	Free, No Claim	Free, No Claim	-0.51	-171.66	170.63	-6.91	-29.63	15.82
3	No Approval	Free, No Claim	Used, No Claim	-0.47	-118.65	117.71	3.42	-0.96	7.79
3	No Approval	Used, No Claim	Free, Used	2.45	-6.27	11.18	-7.36	-29.40	14.69
3	No Approval	Used, No Claim	Free, No Claim	1.05	-71.92	74.02	-2.16	-22.45	18.13
3	No Approval	Used, No Claim	Used, No Claim	5.44	-48.11	58.99	-3.25	-36.30	29.80
3	Approval	Free, Used	Free, Used	-5.34	-14.20	3.53	-6.56	-18.69	5.58
3	Approval	Free, Used	Free, No Claim	-1.91	-7.40	3.57	-2.67	-5.51	0.17
3	Approval	Free, Used	Used, No Claim	-4.07	-8.77	0.63	0.76	-18.58	20.11
3	Approval	Free, No Claim	Free, Used	-0.92	-17.12	15.28	-3.34	-5.75	-0.93
3	Approval	Free, No Claim	Free, No Claim	-3.30	-11.79	5.19	-6.66	-25.28	11.96
3	Approval	Free, No Claim	Used, No Claim	-2.78	-5.72	0.16	3.29	1.39	5.18
3	Approval	Used, No Claim	Free, Used	-4.52	-26.80	17.76	-5.56	-34.26	23.14
3	Approval	Used, No Claim	Free, No Claim	6.44	-19.04	31.92	-8.12	-47.13	30.89
3	Approval	Used, No Claim	Used, No Claim	3.99	0.34	7.65	1.86	-2.87	6.59
3	Approval, Mandatory	Free, Used	Free, Used	-1.07	-8.34	6.19	-2.65	-5.66	0.37
3	Approval, Mandatory	Free, Used	Free, No Claim	0.87	-99.15	100.90	-4.74	-23.06	13.58
3	Approval, Mandatory	Free, Used	Used, No Claim	-5.54	-29.09	18.01	5.95	-20.07	31.98
3	Approval, Mandatory	Free, No Claim	Free, Used	-6.92	-104.67	90.83	-16.02	-517.05	485.01
3	Approval, Mandatory	Free, No Claim	Free, No Claim	-8.26	-170.60	154.08	-6.08	-97.33	85.18
3	Approval, Mandatory	Free, No Claim	Used, No Claim	1.64	-340.74	344.02	34.24	-8467.49	8535.97
3	Approval, Mandatory	Used, No Claim	Free, Used	1.65	-10.39	13.68	-6.42	-18.81	5.98
3	Approval, Mandatory	Used, No Claim	Free, No Claim	-7.73	-85.54	70.08	-1.02	-114.07	112.04
3	Approval, Mandatory	Used, No Claim	Used, No Claim	2.02	-23.53	27.58	9.09	-55.90	74.08
4	No Approval	Free, Used	Free, Used	-1.10	-31.86	29.67	-3.85	-11.72	4.01
4	No Approval	Free, Used	Free, No Claim	-3.14	-7.22	0.94	-4.08	-8.18	0.02

Table 4.17. Willingness to Pay for Design 1 continued									
4	No Approval	Free, Used	Used, No Claim	-6.25	-37.92	25.42	3.06	-9.80	15.92
4	No Approval	Free, No Claim	Free, Used	-2.12	-10.50	6.27	-5.43	-15.88	5.02
4	No Approval	Free, No Claim	Free, No Claim	-6.94	-32.45	18.58	-9.52	-56.04	36.99
4	No Approval	Free, No Claim	Used, No Claim	1.44	-5.48	8.35	1.99	-0.08	4.07
4	No Approval	Used, No Claim	Free, Used	3.29	-6.49	13.07	-6.53	-27.41	14.35
4	No Approval	Used, No Claim	Free, No Claim	3.77	-32.64	40.17	-9.00	-147.67	129.67
4	No Approval	Used, No Claim	Used, No Claim	16.62	-1565.60	1598.84	28.90	-4750.61	4808.42
4	Approval	Free, Used	Free, Used	-1.17	-11.80	9.46	-1.78	-5.19	1.63
4	Approval	Free, Used	Free, No Claim	-2.53	-6.77	1.71	-1.73	-6.60	3.13
4	Approval	Free, Used	Used, No Claim	-0.80	-20.54	18.94	1.69	-1.27	4.65
4	Approval	Free, No Claim	Free, Used	-2.97	-10.15	4.20	-5.23	-15.73	5.28
4	Approval	Free, No Claim	Free, No Claim	-1.27	-45.89	43.35	-3.38	-15.09	8.32
4	Approval	Free, No Claim	Used, No Claim	-1.37	-9.10	6.37	2.80	0.58	5.03
4	Approval	Used, No Claim	Free, Used	1.46	-25.55	28.47	-3.33	-13.13	6.47
4	Approval	Used, No Claim	Free, No Claim	15.60	-392.21	423.41	-10.94	-212.52	190.63
4	Approval	Used, No Claim	Used, No Claim	0.10	-243.47	243.66	0.05	-338.97	339.06
4	Approval, Mandatory	Free, Used	Free, Used	-13.32	-1779.96	1753.32	-34.11	-11592.85	11524.64
4	Approval, Mandatory	Free, Used	Free, No Claim	7.73	-142.44	157.90	4.78	-62.89	72.45
4	Approval, Mandatory	Free, Used	Used, No Claim	-1.94	-7.05	3.17	2.71	0.03	5.40
4	Approval, Mandatory	Free, No Claim	Free, Used	2.64	-6.80	12.08	-10.01	-51.27	31.25
4	Approval, Mandatory	Free, No Claim	Free, No Claim	-0.70	-24.20	22.80	-2.52	-4.50	-0.54
4	Approval, Mandatory	Free, No Claim	Used, No Claim	-1.94	-9.58	5.70	1.28	-11.00	13.57
4	Approval, Mandatory	Used, No Claim	Free, Used	0.58	-81.51	82.67	-4.54	-11.70	2.62
4	Approval, Mandatory	Used, No Claim	Free, No Claim	0.27	-640.06	640.60	-6.41	-25.44	12.62
4	Approval, Mandatory	Used, No Claim	Used, No Claim	0.96	-24.85	26.77	2.02	-3.28	7.32
Pooled over Label Wording									
1	No Approval	Pooled	Pooled	-2.38	-3.43	-1.32	-2.52	-3.28	-1.76
1	Approval	Pooled	Pooled	-0.79	-10.73	9.16	-4.63	-6.01	-3.25
1	Approval, Mandatory	Pooled	Pooled	-1.35	-4.33	1.63	-3.77	-4.71	-2.83

Table 4.17. Willingness to Pay for Design 1 continued									
2	No Approval	Pooled	Pooled	-0.79	-8.46	6.87	-1.81	-3.04	-0.57
2	Approval	Pooled	Pooled	0.00	-704021.98	704021.98	-3.51	-4.38	-2.65
2	Approval, Mandatory	Pooled	Pooled	-2.30	-4.33	-0.26	-2.64	-4.14	-1.14
3	No Approval	Pooled	Pooled	-1.29	-5.34	2.77	-2.93	-4.00	-1.85
3	Approval	Pooled	Pooled	-1.20	-3.37	0.97	-2.32	-2.88	-1.76
3	Approval, Mandatory	Pooled	Pooled	-1.71	-4.97	1.55	-1.63	-4.49	1.23
4	No Approval	Pooled	Pooled	-1.30	-4.62	2.02	-3.32	-4.23	-2.41
4	Approval	Pooled	Pooled	-0.61	-9.06	7.85	-0.88	-3.82	2.05
4	Approval, Mandatory	Pooled	Pooled	-0.87	-6.32	4.58	-2.32	-3.09	-1.55
Pooled over Label Setting									
1	Pooled	Free, Used	Free, Used	-4.91	-8.50	-1.33	-6.20	-11.20	-1.20
1	Pooled	Free, Used	Free, No Claim	-4.04	-6.94	-1.14	-3.98	-6.56	-1.40
1	Pooled	Free, Used	Used, No Claim	-3.42	-9.18	2.34	4.10	-1.90	10.09
1	Pooled	Free, No Claim	Free, Used	-2.61	-6.50	1.27	-8.05	-19.21	3.12
1	Pooled	Free, No Claim	Free, No Claim	-3.66	-6.72	-0.60	-2.83	-5.27	-0.38
1	Pooled	Free, No Claim	Used, No Claim	-4.18	-14.46	6.11	-0.36	-301.34	300.63
1	Pooled	Used, No Claim	Free, Used	2.51	0.09	4.92	-7.41	-13.15	-1.68
1	Pooled	Used, No Claim	Free, No Claim	2.65	-0.43	5.73	-4.01	-6.94	-1.07
1	Pooled	Used, No Claim	Used, No Claim	0.59	-18.13	19.31	0.07	-928.73	928.87
2	Pooled	Free, Used	Free, Used	-6.23	-12.35	-0.11	-5.55	-10.42	-0.69
2	Pooled	Free, Used	Free, No Claim	-2.59	-6.64	1.46	-4.98	-9.85	-0.11
2	Pooled	Free, Used	Used, No Claim	-4.05	-6.28	-1.81	1.16	-4.31	6.63
2	Pooled	Free, No Claim	Free, Used	-2.94	-5.45	-0.42	-3.64	-5.86	-1.42
2	Pooled	Free, No Claim	Free, No Claim	-1.72	-4.03	0.59	-3.86	-5.08	-2.64
2	Pooled	Free, No Claim	Used, No Claim	-2.91	-6.49	0.67	5.02	0.41	9.64
2	Pooled	Used, No Claim	Free, Used	7.98	-45.17	61.14	-12.48	-139.64	114.69
2	Pooled	Used, No Claim	Free, No Claim	12.72	-83.92	109.36	-8.16	-48.64	32.32
2	Pooled	Used, No Claim	Used, No Claim	4.80	1.05	8.55	4.20	0.92	7.48

Table 4.17. Willingness to Pay for Design 1 continued									
3	Pooled	Free, Used	Free, Used	-3.40	-5.49	-1.31	-5.03	-7.86	-2.21
3	Pooled	Free, Used	Free, No Claim	-1.30	-7.30	4.70	-4.02	-6.05	-2.00
3	Pooled	Free, Used	Used, No Claim	-6.37	-11.89	-0.85	2.39	-0.06	4.83
3	Pooled	Free, No Claim	Free, Used	-1.13	-10.68	8.41	-5.29	-8.75	-1.84
3	Pooled	Free, No Claim	Free, No Claim	-3.31	-8.34	1.71	-6.85	-18.29	4.59
3	Pooled	Free, No Claim	Used, No Claim	-1.20	-10.00	7.59	5.59	1.95	9.22
3	Pooled	Used, No Claim	Free, Used	0.52	-56.54	57.59	-6.61	-13.27	0.05
3	Pooled	Used, No Claim	Free, No Claim	2.03	-7.35	11.41	-4.88	-13.15	3.40
3	Pooled	Used, No Claim	Used, No Claim	3.57	0.41	6.72	2.80	-0.40	6.00
4	Pooled	Free, Used	Free, Used	-1.83	-5.99	2.33	-3.98	-6.49	-1.47
4	Pooled	Free, Used	Free, No Claim	-3.74	-6.60	-0.87	-3.64	-6.16	-1.12
4	Pooled	Free, Used	Used, No Claim	-1.85	-4.15	0.44	2.30	1.13	3.46
4	Pooled	Free, No Claim	Free, Used	-0.80	-21.38	19.77	-6.98	-13.57	-0.39
4	Pooled	Free, No Claim	Free, No Claim	-2.35	-4.43	-0.27	-4.25	-6.10	-2.40
4	Pooled	Free, No Claim	Used, No Claim	-0.87	-8.79	7.05	2.22	1.08	3.36
4	Pooled	Used, No Claim	Free, Used	1.77	-3.45	6.99	-4.94	-8.85	-1.03
4	Pooled	Used, No Claim	Free, No Claim	5.14	-5.67	15.95	-8.44	-34.19	17.31
4	Pooled	Used, No Claim	Used, No Claim	2.94	-1.79	7.68	4.71	-1.15	10.57
Pooled Over Information Treatment									
Pooled	No Approval	Free, Used	Free, Used	-4.42	-6.87	-1.97	-4.81	-7.35	-2.27
Pooled	No Approval	Free, Used	Free, No Claim	-2.61	-4.07	-1.15	-4.06	-5.42	-2.71
Pooled	No Approval	Free, Used	Used, No Claim	-5.99	-11.73	-0.26	2.48	-0.40	5.36
Pooled	No Approval	Free, No Claim	Free, Used	-3.19	-4.99	-1.39	-3.97	-5.72	-2.22
Pooled	No Approval	Free, No Claim	Free, No Claim	-3.04	-5.27	-0.80	-5.89	-9.81	-1.96
Pooled	No Approval	Free, No Claim	Used, No Claim	0.12	-411.40	411.65	2.41	1.37	3.45
Pooled	No Approval	Used, No Claim	Free, Used	2.09	-0.75	4.93	-5.93	-9.67	-2.18
Pooled	No Approval	Used, No Claim	Free, No Claim	2.61	-2.06	7.29	-3.33	-7.44	0.79
Pooled	No Approval	Used, No Claim	Used, No Claim	5.19	-1.98	12.35	3.29	-1.74	8.32
Pooled	Approval	Free, Used	Free, Used	-2.86	-4.30	-1.42	-4.43	-6.01	-2.85

Table 4.17. Willingness to Pay for Design 1 continued									
Pooled	Approval	Free, Used	Free, No Claim	-2.92	-4.45	-1.38	-3.13	-4.37	-1.90
Pooled	Approval	Free, Used	Used, No Claim	-2.17	-3.50	-0.83	1.01	-2.26	4.28
Pooled	Approval	Free, No Claim	Free, Used	-1.63	-4.31	1.05	-5.24	-7.20	-3.29
Pooled	Approval	Free, No Claim	Free, No Claim	-3.04	-4.84	-1.25	-4.04	-5.83	-2.26
Pooled	Approval	Free, No Claim	Used, No Claim	-2.59	-3.94	-1.25	2.80	1.79	3.81
Pooled	Approval	Used, No Claim	Free, Used	1.85	-5.63	9.33	-7.86	-21.05	5.33
Pooled	Approval	Used, No Claim	Free, No Claim	10.29	-14.23	34.80	-8.99	-27.83	9.84
Pooled	Approval	Used, No Claim	Used, No Claim	2.50	0.91	4.08	0.95	-5.61	7.52
Pooled	Approval, Mandatory	Free, Used	Free, Used	-5.80	-10.62	-0.98	-7.02	-13.60	-0.43
Pooled	Approval, Mandatory	Free, Used	Free, No Claim	-4.21	-12.32	3.90	-6.66	-22.47	9.14
Pooled	Approval, Mandatory	Free, Used	Used, No Claim	-4.32	-7.21	-1.43	4.32	1.60	7.04
Pooled	Approval, Mandatory	Free, No Claim	Free, Used	-0.69	-40.57	39.18	-8.87	-22.59	4.85
Pooled	Approval, Mandatory	Free, No Claim	Free, No Claim	-1.74	-4.05	0.58	-3.55	-4.66	-2.44
Pooled	Approval, Mandatory	Free, No Claim	Used, No Claim	-2.89	-8.69	2.91	6.55	-4.91	18.01
Pooled	Approval, Mandatory	Used, No Claim	Free, Used	2.83	0.51	5.15	-7.45	-13.63	-1.26
Pooled	Approval, Mandatory	Used, No Claim	Free, No Claim	0.44	-90.95	91.84	-4.50	-8.47	-0.52
Pooled	Approval, Mandatory	Used, No Claim	Used, No Claim	1.87	-0.48	4.22	3.37	2.02	4.71
Pooled Over Label Wording and Label Setting									
1	Pooled	Pooled	Pooled	-1.50	-2.33	-0.67	-3.63	-3.93	-3.32
2	Pooled	Pooled	Pooled	-0.96	-3.13	1.21	-2.66	-3.00	-2.32
3	Pooled	Pooled	Pooled	-1.34	-2.33	-0.35	-2.34	-2.66	-2.01
4	Pooled	Pooled	Pooled	-0.90	-2.59	0.79	-2.04	-2.33	-1.75
Pooled Over Label Wording and Information Treatment									
Pooled	No Approval	Pooled	Pooled	-1.43	-2.11	-0.75	-2.64	-2.87	-2.42
Pooled	Approval	Pooled	Pooled	-0.71	-2.70	1.29	-2.59	-2.76	-2.42
Pooled	Approval, Mandatory	Pooled	Pooled	-1.48	-2.22	-0.74	-2.65	-2.91	-2.39
Pooled Over Label Setting and Information Treatment									
Pooled	Pooled	Free, Used	Free, Used	-12.94	-55.76	29.87	-8.56	-27.95	10.83
Pooled	Pooled	Free, Used	Free, No Claim	-3.99	-12.34	4.35	-4.13	-10.80	2.54

Table 4.17. Willingness to Pay for Design 1 continued									
Pooled	Pooled	Free, Used	Used, No Claim	1.74	-168.04	171.51	-4.91	-48.97	39.16
Pooled	Pooled	Free, No Claim	Free, Used	-19.54	-229.25	190.17	-11.43	-84.33	61.47
Pooled	Pooled	Free, No Claim	Free, No Claim	-0.09	-472.60	472.42	-0.29	-854.06	853.49
Pooled	Pooled	Free, No Claim	Used, No Claim	-1.31	-79.51	76.90	-2.13	-22.32	18.06
Pooled	Pooled	Used, No Claim	Free, Used	2.05	-31.30	35.40	-10.48	-47.46	26.49
Pooled	Pooled	Used, No Claim	Free, No Claim	-1.13	-106.84	104.58	-1.04	-89.85	87.77
Pooled	Pooled	Used, No Claim	Used, No Claim	-1.26	-57.79	55.27	1.63	-21.87	25.12
Pooled Over Common Label									
-	-	Mixed	Mixed	-4.76	-6.50	-3.01	-5.04	-6.58	-3.50
-	-	Common	Common	-1.57	-11.60	8.46	-9.25	-14.10	-4.40
Pooled Over All									
Pooled	Pooled	Pooled	Pooled	-1.16	-1.48	-0.85	-2.63	-2.70	-2.56

Table 4.18. Willingness to Pay for Design 2								
Info. Treatment	**Label Setting**	**RNAi Label Wording**	**RNAi**			**Grade**		
			Point Estimate	**LB**	**UB**	**Point Estimate**	**LB**	**UB**
1	No Approval	Free, Used	-8.09	-25.29	9.12	-1.83	-9.13	5.48
1	No Approval	Free, No Claim	-1.69	-4.35	0.96	-0.03	-3919.95	3919.88
1	No Approval	Used, No Claim	4.54	0.80	8.27	-2.81	-5.55	-0.06
1	Approval	Free, Used	-1.56	-7.81	4.69	-2.56	-5.04	-0.08
1	Approval	Free, No Claim	-3.25	-5.80	-0.70	-1.14	-7.70	5.43
1	Approval	Used, No Claim	5.01	-1.30	11.32	-2.23	-7.49	3.04
1	Approval, Mandatory	Free, Used	-10.04	-44.42	24.35	-2.84	-9.04	3.35
1	Approval, Mandatory	Free, No Claim	-2.04	-4.82	0.74	-0.29	-79.62	79.04
1	Approval, Mandatory	Used, No Claim	2.56	0.77	4.35	-2.34	-3.96	-0.71
2	No Approval	Free, Used	-3.29	-5.40	-1.19	-1.88	-4.03	0.28
2	No Approval	Free, No Claim	-1.67	-4.16	0.81	-1.66	-3.36	0.04
2	No Approval	Used, No Claim	0.28	-408.17	408.72	-0.27	-380.22	379.68
2	Approval	Free, Used	-3.15	-7.57	1.28	1.20	-10.38	12.78
2	Approval	Free, No Claim	-4.37	-10.72	1.98	-3.14	-7.47	1.19
2	Approval	Used, No Claim	3.42	-0.20	7.04	-2.64	-6.11	0.83
2	Approval, Mandatory	Free, Used	-14.64	-135.93	106.65	-5.82	-26.24	14.59
2	Approval, Mandatory	Free, No Claim	-5.55	-14.18	3.08	-3.50	-8.12	1.13
2	Approval, Mandatory	Used, No Claim	4.26	-1.84	10.37	-3.49	-8.53	1.56
3	No Approval	Free, Used	-6.42	-11.82	-1.02	-2.79	-4.79	-0.80
3	No Approval	Free, No Claim	-1.88	-5.16	1.40	-2.13	-4.02	-0.25
3	No Approval	Used, No Claim	2.89	1.09	4.70	-1.41	-5.43	2.62
3	Approval	Free, Used	-2.88	-6.74	0.98	-3.00	-6.09	0.09
3	Approval	Free, No Claim	-3.95	-7.07	-0.83	-3.20	-5.53	-0.87
3	Approval	Used, No Claim	3.22	1.52	4.92	-2.73	-4.31	-1.14
3	Approval, Mandatory	Free, Used	-5.42	-10.27	-0.56	-4.49	-7.74	-1.23
3	Approval, Mandatory	Free, No Claim	-2.51	-7.68	2.66	-2.61	-6.58	1.35

Table 4.18. Willingness to Pay for Design 2 continued								
3	Approval, Mandatory	Used, No Claim	1.90	-3.48	7.28	-0.72	-28.30	26.86
4	No Approval	Free, Used	-2.38	-6.93	2.17	-0.59	-37.48	36.31
4	No Approval	Free, No Claim	-3.36	-5.44	-1.27	-2.83	-4.46	-1.20
4	No Approval	Used, No Claim	4.59	2.51	6.66	-2.71	-4.29	-1.13
4	Approval	Free, Used	-5.69	-18.83	7.45	-6.52	-22.52	9.49
4	Approval	Free, No Claim	-2.13	-8.26	4.00	-0.39	-100.67	99.89
4	Approval	Used, No Claim	4.55	-1.08	10.18	-0.37	-164.27	163.54
4	Approval, Mandatory	Free, Used	-6.77	-14.38	0.84	-3.12	-5.83	-0.41
4	Approval, Mandatory	Free, No Claim	-1.30	-5.35	2.75	-0.10	-344.61	344.41
4	Approval, Mandatory	Used, No Claim	5.02	2.08	7.96	-1.06	-9.56	7.45
Pooled over Label Wording								
1	No Approval	Pooled	-1.82	-3.39	-0.24	-1.07	-4.12	1.98
1	Approval	Pooled	-0.24	-99.54	99.06	-2.04	-3.34	-0.74
1	Approval, Mandatory	Pooled	-1.98	-3.38	-0.59	-1.64	-3.05	-0.22
2	No Approval	Pooled	-1.66	-3.21	-0.12	-1.53	-2.85	-0.21
2	Approval	Pooled	-1.26	-6.34	3.83	-1.45	-4.55	1.65
2	Approval, Mandatory	Pooled	-4.28	-7.22	-1.34	-4.35	-7.10	-1.59
3	No Approval	Pooled	-1.79	-3.15	-0.44	-2.28	-3.01	-1.55
3	Approval	Pooled	-0.68	-10.84	9.49	-3.03	-3.80	-2.27
3	Approval, Mandatory	Pooled	-2.21	-3.85	-0.57	-2.90	-3.94	-1.87
4	No Approval	Pooled	-0.06	-1044.45	1044.32	-2.48	-3.21	-1.75
4	Approval	Pooled	-1.09	-9.92	7.73	-2.58	-4.42	-0.73
4	Approval, Mandatory	Pooled	-0.71	-8.49	7.07	-1.39	-2.95	0.16
Pooled over Label Setting								
1	Pooled	Free, Used	-5.72	-8.36	-3.09	-2.44	-3.89	-0.99
1	Pooled	Free, No Claim	-2.22	-3.01	-1.43	-0.41	-12.81	11.98
1	Pooled	Used, No Claim	3.90	2.91	4.89	-2.45	-3.41	-1.50
2	Pooled	Free, Used	-5.40	-7.67	-3.14	-1.58	-3.89	0.73
2	Pooled	Free, No Claim	-3.06	-3.98	-2.14	-2.35	-3.15	-1.54

Table 4.18. Willingness to Pay for Design 2 continued								
2	Pooled	Used, No Claim	2.57	0.72	4.42	-2.09	-4.17	0.00
3	Pooled	Free, Used	-5.15	-6.66	-3.64	-3.43	-4.28	-2.58
3	Pooled	Free, No Claim	-2.78	-3.81	-1.75	-2.64	-3.45	-1.84
3	Pooled	Used, No Claim	2.79	2.07	3.51	-1.77	-2.82	-0.72
4	Pooled	Free, Used	-5.20	-7.46	-2.93	-3.25	-4.52	-1.98
4	Pooled	Free, No Claim	-2.27	-3.18	-1.37	-1.26	-2.77	0.24
4	Pooled	Used, No Claim	4.70	3.69	5.72	-1.64	-3.05	-0.23
Pooled Over Information Treatment								
Pooled	No Approval	Free, Used	-5.21	-6.39	-4.03	-1.99	-2.83	-1.15
Pooled	No Approval	Free, No Claim	-2.11	-2.67	-1.55	-1.56	-2.17	-0.94
Pooled	No Approval	Used, No Claim	3.20	2.54	3.85	-1.88	-2.81	-0.94
Pooled	Approval	Free, Used	-2.99	-4.04	-1.94	-2.47	-3.42	-1.53
Pooled	Approval	Free, No Claim	-3.49	-4.39	-2.60	-2.03	-2.95	-1.12
Pooled	Approval	Used, No Claim	3.95	3.08	4.82	-2.20	-3.15	-1.26
Pooled	Approval, Mandatory	Free, Used	-8.24	-12.32	-4.15	-3.93	-5.11	-2.74
Pooled	Approval, Mandatory	Free, No Claim	-2.46	-3.21	-1.72	-1.16	-2.87	0.54
Pooled	Approval, Mandatory	Used, No Claim	3.42	2.75	4.08	-1.86	-2.81	-0.91
Pooled Over Label Wording and Label Setting								
1	Pooled	Pooled	-1.37	-2.30	-0.44	-1.57	-2.12	-1.01
2	Pooled	Pooled	-2.16	-2.76	-1.56	-2.15	-2.62	-1.68
3	Pooled	Pooled	-1.51	-2.25	-0.77	-2.71	-2.97	-2.44
4	Pooled	Pooled	-0.54	-6.42	5.34	-2.07	-2.44	-1.70
Pooled Over Label Wording and Information Treatment								
Pooled	No Approval	Pooled	-1.36	-1.94	-0.78	-1.86	-2.11	-1.60
Pooled	Approval	Pooled	-0.74	-3.74	2.27	-2.34	-2.65	-2.02
Pooled	Approval, Mandatory	Pooled	-2.04	-2.46	-1.61	-2.29	-2.57	-2.00

Table 4.18. Willingness to Pay for Design 2 continued								
Pooled Over Label Setting and Information Treatment								
Pooled	Pooled	Free, Used	-5.36	-5.89	-4.84	-2.74	-3.02	-2.45
Pooled	Pooled	Free, No Claim	-2.56	-2.78	-2.34	-1.55	-1.85	-1.25
Pooled	Pooled	Used, No Claim	3.51	3.27	3.75	-1.97	-2.28	-1.66
Pooled Over All								
Pooled	Pooled	Pooled	-1.39	-1.63	-1.14	-2.13	-2.22	-2.04

Table 4.19. Willingness to Pay for Design 3								
Info. Treatment	**Label Setting**	**Antibiotic Label Wording**	**Antibiotic Use**			**Grade**		
			PE	**LB**	**UB**	**PE**	**LB**	**UB**
1	No Approval	Free, Used	-3.81	-6.34	-1.28	-0.02	-13659.87	13659.82
1	No Approval	Free, No Claim	-3.60	-5.79	-1.40	-1.16	-6.25	3.94
1	No Approval	Used, No Claim	4.96	1.75	8.16	-2.43	-4.87	0.01
1	Approval	Free, Used	-1.39	-7.13	4.35	-1.93	-4.23	0.38
1	Approval	Free, No Claim	-5.48	-10.59	-0.37	-1.43	-6.52	3.67
1	Approval	Used, No Claim	2.42	0.75	4.10	-2.15	-3.69	-0.60
1	Approval, Mandatory	Free, Used	-5.07	-7.53	-2.61	-1.49	-3.85	0.86
1	Approval, Mandatory	Free, No Claim	-3.27	-4.29	-2.26	-0.88	-3.88	2.12
1	Approval, Mandatory	Used, No Claim	2.14	-4.07	8.35	1.85	-5.22	8.92
2	No Approval	Free, Used	-8.78	-20.81	3.25	-0.64	-29.88	28.60
2	No Approval	Free, No Claim	-2.70	-4.23	-1.17	-0.94	-5.33	3.46
2	No Approval	Used, No Claim	9.17	-73.88	92.22	-6.28	-47.05	34.50
2	Approval	Free, Used	-7.13	-16.03	1.77	-0.02	-62413.03	62413.00
2	Approval	Free, No Claim	-1.77	-4.20	0.66	-2.06	-3.31	-0.82
2	Approval	Used, No Claim	2.17	-0.82	5.17	-2.48	-4.66	-0.31
2	Approval, Mandatory	Free, Used	-4.58	-8.75	-0.41	-2.41	-5.26	0.45
2	Approval, Mandatory	Free, No Claim	-3.76	-5.89	-1.63	-3.06	-4.62	-1.51
2	Approval, Mandatory	Used, No Claim	3.34	1.57	5.12	-1.18	-6.73	4.37
3	No Approval	Free, Used	-4.12	-6.57	-1.67	-2.29	-4.12	-0.46
3	No Approval	Free, No Claim	-4.08	-6.88	-1.28	0.20	-190.04	190.44
3	No Approval	Used, No Claim	5.12	0.50	9.74	-2.54	-5.82	0.73
3	Approval	Free, Used	-1.60	-5.50	2.30	-2.53	-4.07	-0.99
3	Approval	Free, No Claim	-3.83	-6.83	-0.83	-0.75	-16.55	15.05
3	Approval	Used, No Claim	3.34	1.60	5.08	-0.51	-29.58	28.56
3	Approval, Mandatory	Free, Used	-5.46	-16.78	5.86	-1.28	-18.91	16.35

Table 4.19. Willingness to Pay for Design 3 continued								
3	Approval, Mandatory	Free, No Claim	-6.04	-21.85	9.76	-2.06	-11.69	7.58
3	Approval, Mandatory	Used, No Claim	4.46	1.65	7.26	-1.67	-5.71	2.37
4	No Approval	Free, Used	-5.87	-9.52	-2.23	-2.34	-3.81	-0.87
4	No Approval	Free, No Claim	-4.01	-7.16	-0.86	-0.91	-7.49	5.68
4	No Approval	Used, No Claim	5.43	1.89	8.96	-1.64	-5.74	2.46
4	Approval	Free, Used	-3.99	-7.41	-0.56	1.16	-7.11	9.42
4	Approval	Free, No Claim	-3.26	-5.01	-1.51	-2.19	-3.73	-0.65
4	Approval	Used, No Claim	4.09	-3.39	11.57	-3.41	-9.86	3.03
4	Approval, Mandatory	Free, Used	-5.67	-10.63	-0.70	-0.34	-60.89	60.21
4	Approval, Mandatory	Free, No Claim	-1.86	-5.98	2.27	-0.12	-536.21	535.96
4	Approval, Mandatory	Used, No Claim	3.62	0.53	6.71	-1.45	-8.12	5.22
Pooled over Label Wording								
1	No Approval	Pooled	-3.63	-4.20	-3.06	-1.13	-2.85	0.58
1	Approval	Pooled	-3.79	-4.43	-3.15	-1.07	-2.97	0.83
1	Approval, Mandatory	Pooled	3.24	2.48	4.00	-1.37	-2.73	-0.02
2	No Approval	Pooled	-6.88	-9.97	-3.80	-1.01	-6.16	4.14
2	Approval	Pooled	-2.70	-3.20	-2.19	-2.00	-2.49	-1.50
2	Approval, Mandatory	Pooled	3.74	2.79	4.68	-2.31	-3.18	-1.45
3	No Approval	Pooled	-3.41	-4.17	-2.64	-2.21	-2.98	-1.45
3	Approval	Pooled	-4.35	-5.58	-3.11	-0.59	-12.36	11.19
3	Approval, Mandatory	Pooled	4.21	3.31	5.11	-1.46	-3.16	0.23
4	No Approval	Pooled	-5.26	-6.08	-4.43	-0.77	-4.19	2.64
4	Approval	Pooled	-3.26	-3.75	-2.76	-1.32	-2.49	-0.15
4	Approval, Mandatory	Pooled	4.50	2.31	6.69	-2.08	-4.04	-0.11
Pooled over Label Setting								
1	Pooled	Free, Used	-1.13	-5.40	3.14	-1.23	-3.46	1.00
1	Pooled	Free, No Claim	-1.15	-3.85	1.56	-1.95	-2.55	-1.36
1	Pooled	Used, No Claim	-2.99	-3.60	-2.39	-0.90	-4.18	2.39
2	Pooled	Free, Used	-3.39	-4.47	-2.30	-1.45	-3.28	0.38

Table 4.19. Willingness to Pay for Design 3 continued								
2	Pooled	Free, No Claim	-2.39	-3.53	-1.24	-1.73	-2.86	-0.60
2	Pooled	Used, No Claim	-1.59	-3.77	0.59	-2.41	-3.41	-1.40
3	Pooled	Free, Used	-1.57	-4.13	1.00	-1.63	-3.24	-0.03
3	Pooled	Free, No Claim	-0.52	-15.66	14.61	-1.42	-2.83	-0.01
3	Pooled	Used, No Claim	-0.76	-16.34	14.82	-1.82	-4.31	0.67
4	Pooled	Free, Used	-1.83	-4.50	0.85	-2.11	-3.27	-0.95
4	Pooled	Free, No Claim	-1.84	-4.37	0.68	-1.64	-3.57	0.29
4	Pooled	Used, No Claim	-1.36	-3.35	0.63	-0.78	-5.89	4.34
Pooled Over Information Treatment								
Pooled	No Approval	Free, Used	-5.43	-6.41	-4.46	-1.37	-2.50	-0.25
Pooled	No Approval	Free, No Claim	-3.65	-4.20	-3.10	-0.76	-3.40	1.89
Pooled	No Approval	Used, No Claim	5.52	4.12	6.92	-2.57	-3.45	-1.68
Pooled	Approval	Free, Used	-3.42	-4.10	-2.74	-0.98	-3.44	1.48
Pooled	Approval	Free, No Claim	-3.31	-3.84	-2.77	-1.74	-2.35	-1.13
Pooled	Approval	Used, No Claim	2.92	2.30	3.54	-1.97	-2.76	-1.18
Pooled	Approval, Mandatory	Free, Used	-5.11	-6.21	-4.02	-1.44	-2.68	-0.20
Pooled	Approval, Mandatory	Free, No Claim	-3.37	-3.89	-2.85	-1.45	-2.25	-0.64
Pooled	Approval, Mandatory	Used, No Claim	3.49	2.83	4.16	-0.85	-4.92	3.22
Pooled Over Label Wording and Label Setting								
1	Pooled	Pooled	-1.86	-2.25	-1.47	-1.31	-1.81	-0.80
2	Pooled	Pooled	-2.39	-2.75	-2.02	-1.90	-2.26	-1.53
3	Pooled	Pooled	-0.96	-2.87	0.94	-1.60	-2.17	-1.04
4	Pooled	Pooled	-1.70	-2.34	-1.07	-1.56	-2.11	-1.01
Pooled Over Label Wording and Information Treatment								
Pooled	No Approval	Pooled	-1.90	-2.28	-1.52	-1.60	-1.98	-1.23
Pooled	Approval	Pooled	-1.48	-1.99	-0.96	-1.69	-1.99	-1.39
Pooled	Approval, Mandatory	Pooled	-1.87	-2.24	-1.49	-1.45	-1.87	-1.03

Table 4.19. Willingness to Pay for Design 3 continued								
Pooled Over Label Setting and Information Treatment								
Pooled	Pooled	Free, Used	-4.71	-5.00	-4.42	-1.29	-1.76	-0.81
Pooled	Pooled	Free, No Claim	-3.45	-3.62	-3.27	-1.32	-1.64	-1.00
Pooled	Pooled	Used, No Claim	3.91	3.66	4.16	-1.76	-2.14	-1.39
Pooled Over All								
Pooled	Pooled	Pooled	-1.75	-1.88	-1.61	-1.58	-1.70	-1.47

Table 4.20. Willingness to Pay for Design 4					
Info. Treatment	**Label Setting**	**RNAi Label Wording**	**RNAi**		
			Point Estimate	**LB**	**UB**
1	No Approval	Free, Used	-2.47	-3.39	-1.55
1	No Approval	Free, No Claim	-2.16	-4.49	0.16
1	No Approval	Used, No Claim	1.61	-1.51	4.74
1	Approval	Free, Used	-3.26	-5.34	-1.18
1	Approval	Free, No Claim	-3.67	-7.86	0.53
1	Approval	Used, No Claim	3.44	-0.39	7.27
1	Approval, Mandatory	Free, Used	-5.95	-11.88	-0.02
1	Approval, Mandatory	Free, No Claim	-1.57	-3.03	-0.11
1	Approval, Mandatory	Used, No Claim	1.73	-3.49	6.95
2	No Approval	Free, Used	-3.62	-5.19	-2.04
2	No Approval	Free, No Claim	-1.64	-3.03	-0.25
2	No Approval	Used, No Claim	1.42	-1.40	4.25
2	Approval	Free, Used	-1.94	-3.57	-0.32
2	Approval	Free, No Claim	-3.63	-4.70	-2.56
2	Approval	Used, No Claim	1.37	-0.54	3.28
2	Approval, Mandatory	Free, Used	-2.80	-4.08	-1.51
2	Approval, Mandatory	Free, No Claim	-5.44	-10.90	0.01
2	Approval, Mandatory	Used, No Claim	2.41	-2.63	7.46
3	No Approval	Free, Used	-4.29	-10.33	1.75
3	No Approval	Free, No Claim	-3.54	-8.50	1.42
3	No Approval	Used, No Claim	2.22	0.69	3.76
3	Approval	Free, Used	-4.73	-8.60	-0.86
3	Approval	Free, No Claim	-1.65	-4.76	1.47
3	Approval	Used, No Claim	1.71	-2.84	6.26
3	Approval, Mandatory	Free, Used	-2.13	-3.12	-1.15
3	Approval, Mandatory	Free, No Claim	-1.93	-3.51	-0.35
3	Approval, Mandatory	Used, No Claim	1.48	-10.36	13.31
4	No Approval	Free, Used	-5.76	-12.41	0.89
4	No Approval	Free, No Claim	-2.33	-3.48	-1.19
4	No Approval	Used, No Claim	0.65	-7.75	9.06
4	Approval	Free, Used	-3.38	-5.47	-1.29
4	Approval	Free, No Claim	-1.64	-6.20	2.91
4	Approval	Used, No Claim	2.52	0.38	4.65
4	Approval, Mandatory	Free, Used	-2.27	-3.38	-1.15
4	Approval, Mandatory	Free, No Claim	-4.37	-6.93	-1.80
4	Approval, Mandatory	Used, No Claim	2.74	1.08	4.39
Pooled over Label Wording					
1	No Approval	Pooled	-3.57	-4.27	-2.86
1	Approval	Pooled	-2.16	-2.80	-1.52
1	Approval, Mandatory	Pooled	2.22	1.43	3.01
2	No Approval	Pooled	-2.82	-3.27	-2.36
2	Approval	Pooled	-3.25	-3.65	-2.85
2	Approval, Mandatory	Pooled	1.55	0.61	2.50
3	No Approval	Pooled	-3.27	-3.72	-2.81

Table 4.20. Willingness to Pay for Design 4 continued					
3	Approval	Pooled	-2.26	-3.00	-1.52
3	Approval, Mandatory	Pooled	1.99	0.62	3.36
4	No Approval	Pooled	-3.59	-4.20	-2.99
4	Approval	Pooled	-2.79	-3.34	-2.24
4	Approval, Mandatory	Pooled	1.87	1.18	2.55
Pooled over Label Setting					
1	Pooled	Free, Used	-1.33	-2.28	-0.38
1	Pooled	Free, No Claim	-1.37	-3.50	0.75
1	Pooled	Used, No Claim	-2.20	-3.13	-1.27
2	Pooled	Free, Used	-1.60	-2.30	-0.91
2	Pooled	Free, No Claim	-1.29	-2.24	-0.34
2	Pooled	Used, No Claim	-2.48	-3.29	-1.67
3	Pooled	Free, Used	-0.36	-39.64	38.92
3	Pooled	Free, No Claim	-1.51	-3.12	0.10
3	Pooled	Used, No Claim	-1.53	-2.19	-0.86
4	Pooled	Free, Used	-1.97	-2.74	-1.21
4	Pooled	Free, No Claim	-0.58	-8.89	7.72
4	Pooled	Used, No Claim	-1.35	-2.40	-0.29
Pooled Over Information Treatment					
Pooled	No Approval	Free, Used	-3.58	-4.08	-3.09
Pooled	No Approval	Free, No Claim	-2.27	-2.70	-1.84
Pooled	No Approval	Used, No Claim	1.50	0.85	2.15
Pooled	Approval	Free, Used	-3.18	-3.66	-2.69
Pooled	Approval	Free, No Claim	-2.79	-3.26	-2.32
Pooled	Approval	Used, No Claim	2.05	1.48	2.62
Pooled	Approval, Mandatory	Free, Used	-3.12	-3.47	-2.77
Pooled	Approval, Mandatory	Free, No Claim	-2.94	-3.32	-2.56
Pooled	Approval, Mandatory	Used, No Claim	2.22	1.30	3.15
Pooled Over Label Wording and Label Setting					
1	Pooled	Pooled	-1.66	-2.01	-1.32
2	Pooled	Pooled	-1.70	-1.93	-1.46
3	Pooled	Pooled	-1.16	-1.85	-0.46
4	Pooled	Pooled	-1.36	-1.77	-0.95
Pooled Over Label Wording and Information Treatment					
Pooled	No Approval	Pooled	-1.40	-1.68	-1.12
Pooled	Approval	Pooled	-1.20	-1.63	-0.76
Pooled	Approval, Mandatory	Pooled	-1.86	-2.06	-1.67
Pooled Over Label Setting and Information Treatment					
Pooled	Pooled	Free, Used	-3.29	-3.44	-3.15
Pooled	Pooled	Free, No Claim	-2.66	-2.80	-2.52
Pooled	Pooled	Used, No Claim	1.88	1.65	2.10
Pooled Over All					
Pooled	Pooled	Pooled	-1.48	-1.58	-1.39

4.6 Methods

4.6.1 Dichotomous choice sequences

Respondents were put in one of two scenarios of purchasing beef steaks from a restaurant using different beef sources. One-half of respondents were asked the premium they would pay for the beef steak from the restaurant in question versus a beef steak from an alternative restaurant. In the first scenario, the steaks were supplied from producers who may utilize RNAi technology. Within the scenario, respondents were shown one of 11 reasons why the restaurant supplied steaks with RNAi technology. In the second scenario, the other one-half were asked about the premium they would pay for beef steaks that were supplied from sources that did not use RNAi technology. The same method used in the other scenario was followed except respondents were shown one of the same 11 reasons why the restaurants supplied steaks that did not use RNAi. With the approach of the two scenarios, the results could be compared for the two different sources as well as the 11 reasons. Respondents were given one of five prices in which they answered yes or no. The premium levels were $0.50, $1.50, $2.50, $3.50, $4.50. Respondents were given one of the five prices randomly. If respondents answered with yes, the same question would be asked yet the new price shown would be twice as large as the original price. If respondents answered with no, the same question would be asked yet the new price shown would be the original divided in half. The table of possible premium levels in the dichotomous choice models can be found in **Table 4.21**. In this model, half of respondents were asked their willingness to pay while the remainder were asked their willingness to avoid compared to alternative steaks.

Cameron (1988) and Cameron and Quiggin (1994) offer a model for interval censored models, or double-bounded dichotomous models. The dichotomous choice models can be expressed as:

$$WTP_{ijk}^{*} = X_i\beta_{jk} + \varepsilon_{ijk} \quad (4.14)$$

Where *j* represents the respective beef steak, *k* represents one of the 11 attributes, X_i is a vector of explanatory variables pertaining to respondent *i*, β_{jk} is the conformable vector of coefficients, and ε_{ijk} is an i.i.d. normal error term.

Table 4.21. Table of Premiums Possible in Double-Bounded Dichotomous Choice Sequences

Original Price:	$0.50	$1.50	$2.50	$3.50	$4.50
Second Price (Yes to Question 1):	$1.00	$3.00	$5.00	$7.00	$9.00
Second Price (No to Question 1):	$0.25	$0.75	$1.25	$1.75	$2.25

4.7 Results

4.7.1 Dichotomous choice sequences

The results of the dichotomous choice model with suppliers who used RNAi technology can be found in **Table 4.22**. Consumers were willing to pay $2.82 for beef steaks from restaurants for the purpose of keeping beef production and processing within the United States as opposed to increasing carcass yield which only had a $0.42. A majority of the reasons that ranked in the top five for WTP pertained to benefits of cattle rather than production, consumer and producer benefits. The willingness to pay for increasing carcass yield was shown to be statistically insignificant. A likelihood ratio (LR) test was employed to determine whether or not the results of the 11 WTP estimates in the interval censored regressions could be pooled together. The results of the LR test provides evidence to reject the null hypothesis that states the WTP can be pooled, thus the individual WTP values should be used.

The results of the dichotomous choice model with suppliers who did not use RNAi technology can be found in **Table 4.23**. On the other hand, in the willingness to pay for non-RNAi beef steaks dichotomous choice model, all attributes were statistically significant. The attribute respondents were most willing to pay more to avoid RNAi beef steaks was reducing farmers' time involved in labor at $3.28. The lower bound for this model was in the attribute of increasing carcass yield at $2.12. An LR test was used to determine if the results of the 11 WTP estimates could be pooled. The LR test results shows that we fail we to reject the null hypothesis which states the the WTP estimates can be pooled. The pooled model premium value for this sequence showed a $2.82 premium by respondents.

With the results of the two sequences, the reasons can be compared between each other. In the sequences, respondents showed larger willingness to pay for beef steaks when it was to keep beef production and processing in the United States. On the other end, respondents showed the smaller willingness to pay to reduce farmers' time involved in labor.

The results of the interval censored regression model showed to have social desirability bias. The results of the second dichotomous choice model, the beef steaks from non-RNAi sources, is the opposite of what was expected in the dichotomous choice models. As most results showed consumers prefer a discount on products which were derived from RNAi technology, consistent with the choice experiment results, the magnitudes of the WTP in the non-RNAi beef steaks was expected to be smaller than those of the RNAi steaks. An explanation of this could be respondents did not see "suppliers who did not use RNAi technology." It cannot be specifically determined a particular reason of why the results were positive in the willingness to pay for non-RNAi steaks scenario and in the WTP for RNAi scenario.

Table 4.22. Willingness to Pay for RNAi Steaks by Attribute			
Reason	**WTP per meal (USD)**	**N**	**Ranking of WTP**
Keeping beef production and processing in the U.S.	2.49	137	1
Lowering the price paid by beef consumers	1.61	136	6
Improving the nutrition content of beef	2.02	137	5
Reducing use of antibiotics	1.59	137	7
Protecting cattle from disease	2.29	136	4
Reducing use of hormones	2.47	136	2
Increasing overall animal health	2.44	136	3
Reducing death in cattle	1.37	136	8
Increasing carcass yield	0.43	136	11
Reducing use of feed additives	1.34	136	9
Reducing farmers' time involved in labor	1.21	136	10
Pooled among all attributes	1.78	1,500	

Table 4.23. Willingness to Pay for non-RNAi Beef Steaks by Attribute			
Reason	**WTP per meal (USD)**	**N**	**Ranking of WTP**
Keeping beef production and processing in the U.S.	3.21	136	2
Lowering the price paid by beef consumers	3.04	137	4
Improving the nutrition content of beef	2.82	136	6
Reducing use of antibiotics	3.10	137	3
Protecting cattle from disease	2.80	136	7
Reducing use of hormones	2.46	136	10
Increasing overall animal health	2.82	136	5
Reducing death in cattle	2.72	137	8
Increasing carcass yield	2.48	136	9
Reducing use of feed additives	3.22	137	1
Reducing farmers' time involved in labor	2.40	136	11
Pooled among all attributes	2.82	1,500	

Chapter 5 - Duration of Consumers' Information Consumption and Impact of Information Source on Consumers' Acceptance of RNAi

5.1 Introduction

With the large amount of information provided to consumers on a daily basis, it may be difficult for accurate messaging to reach target audiences through any kind of channel. Some consumers may inadvertently miss information delivered to them through various communication channels, such as food product labels, news stories or online articles, while some consumers are apathetic or passive when this kind of information is provided. Economic theory states that consumers seek to maximize utility with their purchasing decisions (Verbeke, 2005); however, consumers may behave irrationally (Kahneman & Tversky, 1973). When credible information about food safety is absent, consumers become uncertain and incur costs for seeking information (Hobbs, 2004). Information search behavior is prompted by a lack of information, but also a desire to find information (Verbeke, 2005). In this part of the study component, the duration spent reading various forms of information as well as the impact of information treatments and articles on consumer acceptance of RNAi were analyzed. The predicted results of this study component were respondents more apprehensive of RNAi technology were more likely to spend more time reading external articles and information treatments. In comparison, respondents more like to accept RNAi were more likely to spend less time reading information treatments and external articles. In addition, consumers with certain demographic features, (e.g., gender, age, household with children, etc.,) will spend more time reading articles compared to others. With the use of Tobit models, duration of time is the dependent variable while information treatments, external links and RNAi acceptance and risk factors are explanatory variables. Results include that age is statistically significant in a full Tobit model of choice

experiment designs 1, 2 and 4. In choice experiment design 3, gender and income are statistically significant in the full Tobit model.

5.2 Literature Review

5.2.1 Food information and consumer information processing

In neo-classical microeconomics, assumptions are made to maximize consumer utility by making optimal choices (Verbeke, 2005). The first major assumption is in regards to the access and availability of information (Verbeke, 2005). The second falls on the consumers' ability and willingness to process information. While several credible food safety and quality indicators are provided by trustworthy sources, consumers encounter uncertainty and incur costs by searching information (Hobbs, 2004). In the realm of psychology and behavioral economics, the decisions made by consumers are more complex than perceived when there is not perfect information (Verbeke, 2005). Kahnemann and Tversky (1973) suggest that when faced with uncertainty in a decision-making situation, consumers do not behave in a manner to maximize expected utility. Further studies focus on limitations in regards to inputs, cognitive capabilities and willpower to engage in active reasoning (Camerer & Loewenstein, 2004). McCluskey and Swinnen (2004) suggest a hypothesis that consumers are imperfectly informed in cases of food safety issues. Dissemination of information through labeling of food serves to mitigate the problems resulting from information asymmetry (Lusk et al., 2004). Lusk et al. (2004) described the use of labeling as an effective tool to translate important information to consumers in symmetric settings. During market failures where asymmetric information is the main cause, solutions incorporating better information and transparency are reasonable (McCluskey & Swinnen, 2004).

5.2.2 Uncertainty, knowledge and needs of consumers

While consumers may face frequent instances of uncertainty in food purchasing decisions, firms and governmental agencies might feel inclined to provide information to consumers. The cost of providing this information would fall eventually on consumers. The information needs and information processing of an individual are closely tied with an individual's knowledge base. Bettman and Park (1980) observed that consumers seek out information by comparing product attributes more when they have low to moderate levels of prior knowledge and experience rather than having the motivation or processing the information in the current decision moment. Lusk et al. (2004) found that previous knowledge of genetically modified food influenced changes in bids in an experimental auction, whereas the higher the subject knowledge, the smaller the bid changes. Information provided to respondents during a test was shown not to be as influential as prior knowledge (Gwin et al., 2012). Previous literature throughout the years has contradictory findings (Lusk et al., 2004; Radecki & Jaccard, 1995), but the consensus from these studies show that knowledge is important in the processing of information (Verbeke, 2005). Functional foods have been a large concern in the past decade with consumers as the perception of health benefits being merely a marketing ploy in the food industry (Verbeke, 2005). With the creation of a positive image of these foods without credible information, consumers questioned the potential risk and issues focusing around food safety and health (Verbeke, 2005).

Government agencies have expressed interest in educating the public sector about biotechnology as a means to improve social welfare and reduce asymmetric information (Lusk et al., 2004). The costs of funding these outreach efforts to provide more information to the public would be passed on to consumers.

5.2.3 Information search behavior

While consumers may be provided information about food safety, they may not have a full comprehension of the respective subject (Verbeke, 2005). Consumers may seek out information if they perceive there is need for it (Verbeke, 2005). The need for information could be caused by uncertainty or risk about well-being could prompt the information search process (Aaker et al., 1992). In today's food and agriculture environment, consumers who encounter uncertainty about risk and food safety decisions make those choices based on heuristics or peripheral routes of information processing (Frewer et al., 1997, 2005). Another aspect of this is consumer apathy toward information searches. While information may be available to consumers, consumers neither read nor process the information provided to them (Verbeke, 2005).

Previous literature explained that individual personality influences the processing of information. Personality is defined as a particular pattern of organization that makes one person unique compared to others (Engel, Blackwell, & Miniard, 1995). Verbeke (2005) describes personalities with lower emotional stability as ones with more need for information during a crisis event; however, these persons are not easily identifiable through behavioral or socio-demographic factors.

Consumers use information from a variety of sources, (e.g., government, universities, physicians and dieticians, etc.,) to formulate their views of food safety (Tonsor and Wolf, 2009). The risk behavior of consumers is a function of their trust of entities providing risk information.

5.2.4 Impact of information on willingness to pay

Information effects have been a concern for research when observing human behavior in economics research (Czajkowski, Hanley, and LaRiviere, 2016). Several studies have examined the effects of information on willingness to pay estimates (Czajkowski, Hanley, and LaRiviere, 2016; Fox, Hayes, and Shogren, 2002; Colson et al., 2008; Lusk et al., 2004). Czajkowski, Hanley, and LaRiviere (2016) estimated the impact using the method in a random utility model. In this particular study, it was found that information does influence consumers' willingness to pay. When respondents were provided additional information and retain information by learning, the WTP for the good decreased (Czajkowski, Hanley, and LaRiviere, 2016). Fox, Hayes, and Shogren (2002) looked at the influence of positively and negatively toned information treatments on WTP for irradiated food. Three groups of respondents were provided information treatments. One group received positive information, one received negative information, and the third received both positive and negative. Respondents provided a positive (negative) information treatment provided larger (smaller) WTP values. When provided both negative and positive information treatments, negative treatments had a greater effect on respondents and their willingness to pay values decreased (Fox, Hayes, and Shogren, 2002). Lusk et al. (2004) added to the literature by providing one of three information treatments from the perspective of benefiting the environment, health, and the world. Lusk et al. (2004) found that providing information treatments to people for an experimental auction for cookies with non-GMO and GMO ingredients, the willingness to pay varied across individuals from different countries. Few studies have examined the duration spent on information treatments in the realm of agricultural economics. This study aims to add to the literature by providing insight about the impact of the time respondents spend reading information treatments.

5.3 Methods

To assess the use of information in this study, different external articles and information treatments were presented to respondents. The eight articles were selected after searching through popular online media and scientific articles about RNAi technology. The information treatments were paragraphs derived from four external articles. Two external articles and one information treatment was randomly provided to respondents before the choice experiment scenarios in the designs where RNAi use was an attribute of the beef steak products. In the one choice experiment design where RNAi use was not an attribute, design 3, the external articles and information treatment was presented to respondents after completing the choice experiment scenarios. The title of the articles and sources were provided in hyperlinks. Respondents had the opportunities to click the hyperlinks and read the articles before returning back to the survey. The outline of the eight articles can be found in **Table 5.1**. Using respondents' time between entering the choice experiment information and the first choice experiment question in choice experiments designs 1, 2 and 4, a variable for duration was created. In choice experiment design 3, respondents were presented a similar format of information treatments and external articles yet after the set of choice experiment questions were answered due to RNAi use not being an attribute of the beef steaks. The time after the last choice experiment and the first RNAi-related Likert-scale question was used for the duration variable.

The acceptance level of RNAi by consumers was compared to the duration of time spent with RNAi-related information. Using the answers provided in the Likert-scale questions, a model was employed to determine if a relationship existed between acceptance of RNAi and duration of time.

Table 5.1. Outline of External Articles			
Article	**Title**	**Source**	**URL**
1	Genetic Weapon Against Insect Raises Hope and Fear in Farming	*The New York Times*	http://www.nytimes.com/2014/01/28/business/energy-environment/genetic-weapon-against-insects-raises-hope-and-fear-in-farming.html?_r=0
2	The Next Great GMO Debate	MIT Technology Review	http://www.technologyreview.com/featuredstory/540136/the-next-great-gmo-debate/
3	Transgenic Pigs Resistant to Foot-and-Mouth Disease	Columbia University Virology Course Blog	http://www.virology.ws/2015/07/23/transgenic-pigs-resistant-to-foot-and-mouth-disease/
4	Improving Crops with RNAi	The Scientist	http://www.the-scientist.com/?articles.view/articleNo/43020/title/Improving-Crops-with-RNAi/
5	New Monsanto Spray Kills Bugs by Messing With Their Genes	Mother Jones	http://www.motherjones.com/tom-philpott/2015/08/coming-farm-field-near-you-gene-silencing-pesticides-RNA-RNAi
6	Developing Disease-Resistant Poultry May Be Solution for Multiple Virus Issues	University of Georgia's *UGA Today*	http://news.uga.edu/releases/article/developing-disease-resistant-poultry-0615/
7	RNAi for Crop Improvement	International Service for the Acquisition of Agri-Biotech Applications	https://isaaa.org/resources/publications/pocketk/34/default.asp
8	Advocacy Groups Urges Caution Over Agricultural RNAi	Danforth Plant Science Center	https://www.danforthcenter.org/news-media/news-releases/news-item/(genomeweb)-advocacy-group-urges-caution-over-agricultural-rnai

To analyze the impact of RNAi information on respondents, Tobit models were employed. With the duration of time spent on external articles as the endogenous variable, several models were conducted using socio-demographic factors as well as external links and

information presented. Only seven of the eight articles and three of the four information treatments were used in the models. The last external article and information treatment were left out to avoid multicollinearity problems. Greene (2003) presents a general Tobit model equation, which can be expressed as:

$$y_i = x_i' \beta + \varepsilon_i \quad (5.1)$$

$$y_i = 0 \text{ if } y_i^* \leq 0,$$

$$y_i = y_i^* \text{ if } y_i^* \geq 0,$$

Where *yi* represents the optimal level of the *i*th consumer. The model had a lower bound of zero, but no upper bound due to time being a continuous variable for each respondent.

To determine the impact of information on the acceptance of RNAi technology, a Tobit regression model was conducted. The values of the Likert-scale questions were highly correlated to each other. To use the responses of the Likert-scale questions regarding RNAi acceptance, the values were collapsed to fewer variables through factor analysis. Models were employed to explain the variation in the duration of reading articles through the use of acceptance factor(s) as independent variable(s). The same procedure was followed for risk perception of RNAi technology. A Tobit model was employed to explain the variation of duration by risk factors.

5.4 Results

5.4.1 Duration of time by consumer

Summary statistics for duration can be found in **Table 5.2**. On average, respondents spent 81.94 seconds in designs 1, 2 and 4 and 54.95 seconds in design 3. Econometric models were constructed using duration as the dependent variable. With the dependent variable being continuous, Tobit models were utilized in regression efforts. Three models were designed for

each of the two duration times. These models included socio-demographics, information treatments, and RNAi external links as the exogenous variables, respectively. The results of the specified Tobit model can be found in **Table 5.3** and **Table 5.5**.

Table 5.2. Summary Statistics for Duration				
Variable	**N**	**Mean**	**Minimum**	**Maximum**
Duration for Designs 1, 2 and 4	2,250	81.94	3.64	8,332.34
Duration for Design 3	750	54.95	3.31	5,882.86
Note: Means, maximums, and minimums units are seconds.				

Correlation and multicollinearity tests were conducted to determine if independent variables had correlation with each other. A majority of the variables had no strong relationship with another except for education and income. Due to this, the education variable was taken out of the Tobit models. Full Tobit models were employed using the factors listed above. In conjunction with the full Tobit models, joint tests were conducted to determine if the coefficient on the independent variables jointly equal zero. **Table 5.4** and **Table 5.6** provide results of these joint tests. Because there is no statistical significance found in the tests for designs 1, 2 and 3, we fail to reject the null hypothesis which states that the sum of the coefficients on the independent variables equals zero. It could be stated that socioeconomic and demographic factors of respondents, the information treatment and the external links presented to respondents are not correlated with the amount of time spent reading information about RNAi technology. However, in design 3, this is not the case. The joint test provides statistical evidence that the sum of the coefficients on socio-demographic variables does equal zero meaning they are unique and independent.

Table 5.3. Full Tobit Regression Results on Duration of Time on External Links for Choice Experiments Designs 1, 2 and 4			
Variable	**N**	**Estimate**	**Standard Error**
Intercept	2,250	108.734*	40.289
Age	2,250	0.948*	0.407
Female	2,250	-4.974	10.928
Income	2,250	-4.336	3.234
Adults	2,250	-5.193	5.428
Children	2,250	-3.960	5.116
News Source: TV	2,250	-14.253	11.228
Race: White	2,250	-16.278	12.839
Food Source: Supermarket	2,250	-26.993	14.200
Groundbeef Consumption	2,250	5.653	6.356
Info. Treatment: Basic and No Bias	2,250	-2.669	14.972
Info. Treatment: Historical	2,250	-5.395	14.945
Info. Treatment: Promising	2,250	-7.775	14.878
External Article 1	2,250	-14.833	16.179
External Article 2	2,250	1.006	16.346
External Article 3	2,250	-15.429	15.876
External Article 4	2,250	1.268	16.398
External Article 5	2,250	-7.158	15.961
External Article 6	2,250	-14.859	15.983
External Article 7	2,250	12.199	16.367
Sigma	2,250	250.158*	3.729
Note:* indicates statistical significance at the 0.05 level or higher			

Table 5.4. Joint Tests on Variables Used in Full Tobit Regression Results on Duration of Time on External Links for Choice Experiments Designs 1, 2 and 4			
Label	**Type**	**Statistic**	**P-value**
Age = 0, Female = 0, Income = 0, Adults = 0, Children = 0, Race: White=0, TV=0, Supermarket=0, Groundbeef Consumption = 0	Wald	15.94	0.0681
Info. Treatment 1 = 0, Info. Treatment 2 = 0, Info. Treatment 3 = 0	Wald	0.31	0.9588
CE Link 1 = 0, CE Link 2 = 0, CE Link 3 = 0, CE Link 4 = 0, CE Link 5 = 0, CE Link 6 = 0, CE Link 7 = 0	Wald	5.47	0.6032
Note:* indicates statistical significance at the 0.05 level or higher			

Table 5.5. Full Tobit Regression Results on Duration of Time on External Links for Choice Experiments Design 3			
Variable	**N**	**Estimate**	**Standard Error**
Intercept	750	-65.917	62.867
Age	750	0.693	0.607
Female	750	-27.285	16.506
Income	750	-8.438	5.083
Adults	750	40.358*	8.760
Children	750	1.483	7.845
News Source: TV	750	-10.190	16.990
Race: White	750	-30.731	19.412
Food Source: Supermarket	750	4.971	20.357
Groundbeef Consumption	750	12.756	10.047
Information Treatment: Basic and No Bias	750	-3.008	22.908
Information Treatment: Historical	750	27.469	22.806
Information Treatment: Promising	750	23.793	23.042
External Article 1	750	8.972	25.022
External Article 2	750	-4.753	24.970
External Article 3	750	-6.206	25.220
External Article 4	750	-9.022	23.601
External Article 5	750	7.629	24.293
External Article 6	750	31.016	24.674
External Article 7	750	32.970	24.670
Sigma	750	216.902*	5.600
Note: indicates statistical significance at the 0.05 level or higher			

Table 5.6. Joint Tests on Variables Used in Full Tobit Regression Results on Duration of Time on External Links for Choice Experiments Design 3			
Label	**Type**	**Statistic**	**P-value**
Age = 0, Female = 0, Income = 0, Adults = 0, Children = 0, Race: White=0, TV=0, Supermarket=0, Groundbeef Consumption = 0	Wald	31.12*	0.003
Info. Treatment 1 = 0, Info. Treatment 2 = 0, Info. Treatment 3 = 0	Wald	2.92	0.4037
CE Link 1 = 0, CE Link 2 = 0, CE Link 3 = 0, CE Link 4 = 0, CE Link 5 = 0, CE Link 6 = 0, CE Link 7 = 0	Wald	5.54	0.5941
Note: indicates statistical significance at the 0.05 level or higher			

5.4.2 Impact of information

Using the results of the Likert-scale questions, the impact of the information treatments provided to respondents was analyzed. To observe if there is an influence between information treatment presented and the responses to Likert-scale RNAi questions, Tobit models were used to estimate the relationship.

In Question 27 of the survey, respondents were asked about their agreement with eating RNAi beef products, purchasing RNAi beef products, and supporting the use of RNAi technology in food production. Through factor analysis, the acceptance variables were collapsed to one factor. The results of these Tobit models can be found in **Table 5.7** and **Table 5.8**. The independent variable for each model was not statistically significant; however, the sign of the coefficient matched the predicted results. If respondents already had prior knowledge of RNAi technology or had developed their perception of the technology, then they may have not wanted to spend time to find more information. This was not explored due to the fact that RNAi technology is a new development, and the number of respondents who may have had previous knowledge of the technology would be relatively small. As well, the survey was developed to assess perceptions and acceptance of RNAi technology and not capture prior knowledge or pre-survey perceptions.

Table 5.7. Regression Results on Duration of Time on Acceptance Factor – Designs 1, 2 and 4

Variable	N	Estimate	Standard Error
Intercept	2,250	81.896*	5.297
Acceptance Factor	2,250	-6.548	-5.300
Sigma	2,250	251.273*	3.745

Note: * indicates statistical significance at the 0.05 level or higher

Table 5.8. Regression Results on Duration of Time on Acceptance Factor - Design 3			
Variable	**N**	**Estimate**	**Standard Error**
Intercept	750	55.052*	8.132
Acceptance Factor	750	-4.980	8.123
Sigma	750	222.669*	38.73
Note:* indicates statistical significance at the 0.05 level or higher			

In Question 30 of the survey, respondents were asked about their agreement with the perception of concern RNAi technology had to them, their families and human health. Using factor analysis, these variables were collapsed down to two factors. The statements of "My family and I could be exposed to great risks from RNAi technology in beef production" and "The side-effects from eating RNAi technology in beef production are largely unknown" loaded on the first factor. The first factor can be labeled as personal concern. The statements of "RNAi technology in beef production will not pose risks to my family and me" and "There is little danger that RNAi technology in beef production will result in new disease for humans" loaded on the second factor. This factor can be identified as general concern. The results of the Tobit models can be found in **Table 5.9** and **Table 5.10**. Both factors were significant in choice experiment designs 1, 2 and 4. If respondents' risk perception of RNAi was higher, they spent more time reading external articles and the information treatment. For choice experiment design 3, respondents were not given information treatments and external articles until all scenarios were finished due to beef steaks only having antibiotic use and USDA grade attributes. Respondents in the three remaining designs had more exposure to RNAi technology in the scenarios, which may explain the larger magnitudes and significance.

Table 5.9. Regression Results on Duration of Time on Risk Factors - Designs 1, 2 and 4			
Variable	**N**	**Estimate**	**Standard Error**
Intercept	2,250	81.911*	5.289
Personal Concern Factor	2,250	12.200*	5.247
General Concern Factor	2,250	10.855*	5.296
Sigma	2,250	250.833*	3.739
Note:* indicates statistical significance at the 0.05 level or higher			

Table 5.10. Regression Results on Duration of Time on Risk Factors - Design 3			
Variable	**N**	**Estimate**	**Standard Error**
Intercept	750	54.815*	8.136
Personal Concern Factor	750	8.069	8.356
General Concern Factor	750	2.513	8.123
Sigma	750	222.567*	5.747
Note:* indicates statistical significance at the 0.05 level or higher			

Chapter 6 - Conclusions and Implications

6.1 Summary of Results

The beef sector in the United States will continue to be shaped by the preferences of consumers and the practices of producers. Implementing new practices is dependent on the acceptance and willingness to pay by consumers for products derived from these production practices as well as the costs incurred by farmers and ranchers.

The research in this thesis measures consumer acceptance and WTP for beef steaks utilizing RNAi technology compared to conventional-raised beef. A national consumer survey was completed online by 3,000 respondents, representing a sample of the U.S. population. Data from the choice experiment scenarios and dichotomous choice sequences provide a better understanding of WTP for RNAi use in beef steaks while Likert-scale questions yielded insight into general RNAi technology acceptance.

In Chapter 3, consumer acceptance was observed through the use of Likert-scale questions. The results of these analyses showed a mixed acceptance of RNAi. Respondents were asked to rate their agreement about their willingness to eat RNAi beef products, willingness to purchase RNAi beef products, and overall support of RNAi technology in food production. Results showed that the means of the three statements were generally around the middle indicating a split in acceptance. If RNAi were to be used for a specific purpose, respondents would prefer that the technology be used to protect cattle from disease. In addition, respondents were asked to rate their concern of RNAi through four statements about risks associated with the technology. The results yield a mean toward the middle for the two statements putting RNAi in a positive framework. Yet, the statements in a negative light yielded higher concerns from respondents. For consumers to accept RNAi technology, the risks associated with the technology

as well as benefits it brings, especially animal agriculture, should be noted. A majority of respondents noted food safety as the main concern in regards to beef and production method. With that noted, food safety information should be supplied to consumers. Additionally, in Chapter 3, adoption of new beef technologies was examined using the Food Technology Neophobia Scale (FTNS). The FTNS yielded results that split the adopting of beef technology into two groupings. One of these factors can be used to describe human effects while the other factor describes the product and food system effects. Due to these results, the two factors were included in various empirical models in this study.

In Chapter 4, consumer WTP was estimated through the use of choice experiment scenarios and double-bounded dichotomous choice sequences. Based on the choice experiment results, there appears to be a potential market for beef steaks using RNAi technology. In the specific choice experiment designs, varying attributes of beef steaks were examined. These included price, RNAi use, antibiotic use, and USDA grade. Along the lines of the choice experiment, label setting and label wording also were analyzed. In a general sense, cases where the wording for "free and used," and "free and no claim," showed respondents would want a discount for products labeled with RNAi use. On the other hand, label wording with "used, no claim" showed respondents wanted to pay a premium for products with no claim about RNAi use. In some cases of RNAi use and antibiotic use in beef steaks, the magnitudes of the point estimates for RNAi are smaller than those for antibiotic, which suggests respondents would want to avoid products labeled with antibiotic use more than RNAi. Using the point estimates of the choice experiment designs with the delta method, the lower and upper bound for willingness to pay for beef steaks was calculated. In most cases, consumers would be willing to pay a discount for products with RNAi use. As for the other attributes, the results for antibiotic use were similar

to RNAi use. Under the label wording of "free, used" and "free, no claim," respondents wanted a discount for products labeled with antibiotic use. For a large majority of the designs with USDA grade, respondents preferred choice steaks over select. In all the cases in the choice experiment questions, respondents preferred the two beef steaks over opting out of either steak option. The way that RNAi use will be labeled in the future in unknown, if it is to be implemented in the food sector. By varying the label wording among the different schemes as well as label approval, this research provides potential scenarios of what may happen in the marketplace. When RNAi use and other attributes, such as antibiotic use, are labeled in beef products, the WTP by consumers changes.

Through the dichotomous choice sequences, the premium for production benefits could be examined. The premium was the largest in magnitude for restaurants who supplied beef steaks using RNAi technology for the reason of keeping beef production in the United States. The second and third largest willingness to pay magnitudes were for the reasons of protecting cattle from disease and improving overall animal health. In the scenario where beef was from non-RNAi sources, the magnitude of the premium was higher for restaurants who did not supply beef steaks due to reducing the use of hormones. In addition, keeping beef production in the United States and reducing the use of antibiotics were second and third, respectively. It was predicted that the WTP estimates in this non-RNAi source scenario would be smaller than those of the beef steaks from suppliers who did utilize RNAi technology. The results of these models suggest that stating the benefits of supporting animal health will result in consumers willing to pay premiums.

In Chapter 5, the impact and use of information was observed. Respondents were given one of four information treatments from different sources as well as two of eight links to external articles that varied in tone and viewpoint about RNAi technology. Respondents had the ability to

click on the links provided and utilize the articles to gather more information before providing responses to choice experiment scenarios. A base information treatment was given to all respondents to briefly describe how the technology works along with the information treatment. Given the differences in information treatment and articles provided to respondents, the influence of that information on respondents' answers to Likert-scale questions was analyzed. The results of these Tobit models found that socio-demographic factors, presentation of external articles, and information treatment presented did not affect the duration of time spent on the external articles. Along the lines of the external links provided to respondents, models were employed to observe if the articles presented influenced the acceptance of RNAi technology. The results of the models showed statistical insignificance for the explanatory variables. Additionally, Tobit models were used to see if duration could be explained by respondents concern over RNAi technology. The values of the four concern Likert-scale statements were collapsed down to two risk factors. The results showed statistically significance on the explanatory variables for the model with the duration of choice experiment design 1, 2 and 4 as the dependent variable. The two risk factors had a positive coefficient, meaning the higher the rating they provided on the concern Likert-scale statements, the longer time they spent reading the information treatment and external articles provided to them. With the relatively short time respondents spent on the information provided to them, it should be noted that the way information is presented and the amount should be considered when implementing the technology in the food industry.

The results of this study adds to the literature through the topics of RNAi, labeling schemes, and duration of information consumption. Acceptance of RNAi is mixed among consumers. The major concern of respondents is the side effects of consuming beef products

derived from RNAi technology. Consumers should be given full information about the benefits and costs of the technology as to have more complete information during purchasing decisions. In regards to willingness to pay, consumers require a discount for beef steaks derived from RNAi technology. When other controversial attributes are in question in these products, such as antibiotic use, a potential market share exists for products with a RNAi label. Depending on the wording scheme used and the other attributes labeled, respondents' willingness to pay will change. In future, the way RNAi technology is labeled in food products matters. In order to have a market share, the way in which the technology is labeled should be approached cautiously. Using "free of RNAi use" may create food stigmas in the mind of consumers. Lastly, with information consumption, the more concerned consumers are about RNAi technology, the longer amount of time they will spend seeking information about RNAi technology.

6.2 Limitations

6.2.1 Online Consumer Survey

One limitation was caused by lack of communication with the survey developers. One intended data variable desired for collection in the survey administration was the use of the two articles. It was intended for a variable to capture if respondents clicked on the external articles presented to them. The other was the duration on those articles if respondents decided to click on the links provided and assess the information provide in the articles. These variables could have been used in the analysis of consumer use and impact of information whereas the use of one articles or sources of information may have been utilized more than others. Through the separation of the articles being presented to respondent versus actually clicking on them may have warranted different results in the analysis. Instead, the total duration spent between the

beginning and end of the choice experiment in designs 1, 2 and 4 as well as post-choice experiment design 3 and before Likert-scale questions were used as a proxy for the duration of time spent on external articles.

6.2.2 Label Wording

It was the intention of this research to use a common labeling scheme for choice experiment design 1. In this particular design, the beef steaks contained RNAi use and antibiotic use attributes. Respondents should have seen a common labeling scheme of "free or used," "used, no claim," or "free or no claim" for both two beef steak attributes. In the administering of the survey, the attributes were given a label wording scheme randomly and independently rather than a random and common scheme. For example, respondents may have seen "free or used" for antibiotic use while RNAi use could have been labeled as "used or no claim." While the intended procedure was not followed, there were limited instances when respondents were given a common label wording for both attributes. Albeit, due to the two different label wording schemes, testing for common labeling and mixed labeling could be employed. In the mixed label case, hypothetically, it would be more likely that one of the attributes contained in the choice experiment steaks, antibiotic use and RNAi use, would have a different labeling scheme compared to the other.

6.2.3 Dichotomous Choice and Choice Experiment Results

Another limitation was the hypothetical bias present in the dichotomous choice sequences and choice experiment models. In the dichotomous choice sequence, the respondents were asked whether or not they would purchase beef steaks from a restaurant with suppliers who did not

utilize RNAi technology compared to a restaurant that did. The results of these models were expected to have all smaller magnitudes of the coefficients rather than larger magnitudes. Although the specific reason why the results of the non-RNAi source suppliers were larger, there is speculation of why the current results are inconsistent. In the willingness to pay for non-RNAi steaks scenario, the phrasing of the question may have caused some confusion with respondents as to the intention of why restaurants sourced beef steaks that did not utilize RNAi technology. Another alternative is that respondents may have felt socially responsible when given admirable qualities in the scenario.

In the choice experiment, hypothetical bias may exist in the willingness to pay estimates. Even with the use of a cheap talk script, the WTP estimated by respondents may be overstated given the hypothetical study and products. In future research in this subject area, two groups of respondents could be used – one given the cheap talk script and one without. Using this approach, the WTP estimates can be compared to each other to check if the cheap talk script had an impact on surveyor responses.

6.3 Future Research

This study only looked at acceptance and willingness to pay for RNA interference technology within the United States. As the global population increases, much of the growth will occur in developing countries where modern agricultural technologies are not heavily utilized as they are in developed countries. International consumers may have different perceptions and concerns for the technology being used within their own countries. In addition, international trade and policy must also be considered. While U.S. consumers may be accepting of the technology, international consumers may be apprehensive of the technology resulting in the

implementation of policies to design the importation of products using ingredients derived from RNAi technology.

While this study focused on consumer acceptance, another aspect to consider is producer acceptance. It would be interesting to analyze and determine the acceptance of RNAi technology with livestock producers and other key players in the supply chain, such as wholesalers and retailers. Previous studies have shown that consumers are less likely to accept genetically engineered fresh foods and meat products (Lusk, McFadden, and Rickard, 2015). Along the terms of the consumer side of the food industry, there have been few studies about consumer acceptance of RNAi technology in fruits, vegetables and processed foods. Future studies could investigate more into the application of RNAi technology in different livestock species or different types of food.

Information is limited about the human health effects of consuming meat or beef products utilizing RNAi technology. Past studies have explored the use of RNAi technology in crops. If significant studies provide results of the impact of these types of products on human health, further consumer surveys can employ this information in assessing willingness to pay and acceptance of RNAi in the food sector.

In regards to information processing and knowledge, a set of questions could have been asked in a way to assess the retention of RNAi information on respondents. If respondents were asked questions in which they would have to recall the information provided to them in the external links or information treatments, it may have provided a way to assess the validity of impact of the RNAi information provided to respondents in the survey. In that mindset, an analysis could have been conducted to see if a correlation of duration and consumer knowledge exist.

Chapter 6 - References

Aaker, D.A., R. Batra, and J.G. Myers. (1992). *Advertising Management*. Englewood Cliffs, NJ: Prentice Hall.

Allen, H.K., U.Y. Levine, T. Looft, M. Bandrick, and T.A. Casey. (2013). "Treatment, Promotion, Commotion: Antibiotic Alternatives in Food-Producing Animals. Trends in Microbiology.21(3):114-119.

Bettman, J.R. and P.W. Park (1980). "Effects of Prior Knowledge and Experience and Phase of Choice Process on Consumer Decision Processes: A Protocol Analysis. Journal of Consumer Research. 7:234-248.

Bradford, B.J., C.A. Cooper, M.L. Tizard, T.J. Doran, and T.M. Hinton. (2016). "RNA Interference-based Technology: What Role in Animal Agriculture?" Animal Production Science. http://dx.doi.org/10.1071/AN15437

Bruhn. C.M. (2003). "Consumer Attitudes toward Biotechnology: Lessons for Animal-related Applications. Journal of Animal Science. 81:196-200.

Bureau of Labor Statistics. (2016a). *Databases, Tables & Calculators by Subject: All Uncooked Beef Steaks, per lb.* Retrieved January 1, 2016, from: http://data.bls.gov/timeseries/APU0000FC3101?data_tool=XGtable

Bureau of Labor Statistics. (2016b). *Databases, Tables & Calculators by Subject: Steak, Sirloin, USDA Choice, Boneless, per lb.* Retrieved January 1, 2016, from: http://data.bls.gov/timeseries/APU0000703613?data_tool=XGtable

Camerer, C.F., and G. Loewenstein. (2004). "Behavioral Economics: Past, Present and Future." In C.F. Camerer, G. Loewenstein, and M. Rabin. (eds.), *Advances in Behavioral Economics*. Princeton, NJ: Princeton University, 3-51.

Cameron, T.A. (1988). "A New Paradigm for valuing non-market goods using referendum data: Maximum likelihood estimation by censored logistic regression." Journal of Environmental Economics and Management. 15: 355-379.

Cameron, T.A. and J. Quiggin. (1994). "Estimation Using Contingent Valuation Data from a Dichotomous Choice with Follow-up Questionnaire." Journal of Environmental Economics and Management. 27: 218-234.

Chen, S. and S. Chaiken. (1999). "The Heuristic-Systematic Model in its Broader Context." In S. Chaiken and Y. Trope. (eds.) Dual Process Theories in Social Psychology. New York: Guilford Press, 73-96.

Colson, G., M. Rousu, and W.E. Huffman. (2008). "Consumers' Willingness to Pay for New Genetically Modified Food Products: Evidence from Experimental Auctions of Intragenic and Transgenic Foods." Selected paper for the American Agricultural Economics Association Annual Meeting, Orlando, Florida.

Cox, D. N., and G. Evans. (2008). "Construction and Validation of a Psychometric Scale to Measure Consumers' Fears of Novel Food Technologies: The Food Technology Neophobia Scale." Food Quality and Preference 19 (8): 704–10. doi:10.1016/j.foodqual.2008.04.005.

Croney, C.C., M. Apley, J.L. Capper, J.A. Mench, and S. Priest. (2012). "Bioethics Symposium: The Ethical Food Movement: What Does it Mean for the Role for Science and Scientists in Current Debates about Animal Agriculture?" Journal of Animal Science. 90(5):1,570-1,582.

Czajkowski, M., N. Hanley, and J. LaRiviere. (2016). "Controlling for the Effects of Information in a Public Goods Discrete Choice Model." Environmental and Resource Economics. 63(3):532-544.

Donald Danforth Plant Science Center. (2014). "Advocacy Group Urges Caution over Agricultural RNAi." Retrieved from: https://www.danforthcenter.org/news-media/news-releases/news-item/(genomeweb)-advocacy-group-urges-caution-over-agricultural-rnai

Dorward, A. (2013). Agricultural labour productivity, food prices and sustainable development impacts and indicators. *Food Policy*. 39:40-50.

Engel, J., R. Blackwell, and P. Miniard. (1995). *Consumer Behavior*. Fort Worth, TX: Dryden Press.

Fatka, J. (2015). Consumer food confusion growing: new survey reveals different trends in leading consumer concerns about food supply and food safety. Feedstuffs, 87(19), 9. Retrieved July 27, 2016, from http://go.galegroup.com.er.lib.k-state.edu/ps/i.do?id=GALE%7CA415562016&v=2.1&u=ksu&it=r&p=AONE&sw=w&asid=f15016bd8ab5f9b355dbb132ca7bc06a

Feuerstein, A. (2010). "7 Firms Developing RNAi Drugs." TheStreet.com.

Food and Drug Administration. (2015a). "AquAdvantage Salmon Fact Sheet." Retrieved June 10, 2016, from Genetically Engineered Animals: http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm473249.htm

Food and Drug Administration. (2015b). "FDA Take Several Actions Involving Genetically Engineered Plants and Animals for Food." Retrieved June 10, 2016, from Press Announcements: http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm473249.htm

Food and Drug Administration. (2016). "What is the Meaning of 'Natural' on the Label of Food?". Retreived June 10, 2016, from FDA Basics: http://www.fda.gov/aboutfda/transparency/basics/ucm214868.htm.

Fox, J.A., D.J. Hayes, and J.F. Shogren. (2002). "Consumer Preferences for Food Irradiation: How Favorable and Unfavorable Descriptions Affect Preferences for Irradiation Pork in Experimental Auctions. Journal of Risk and Uncertainty. 24:75-95.

Frewer, L. J., C. Howard, and J. I. Aaron. (1998). "Consumer Acceptance of Transgenic Crops." Pesticide Science 52 (4): 388–93. doi:10.1002/(SICI)1096-9063(199804)52:4<388::AID-PS740>3.0.CO;2-F.

Frewer, L.J., A. Fischer, J. Scholderer, and W. Verbeke. (2005). "Food Safety and Consumer Behaviour. IN W.M.F. Jongen and M.T.G. Meulenberg (eds.), Innovation in Agri-food Systems: Product Quality and Consumer Acceptance. Wageningen: Wageningen Academic Press.

Frewer, L.J., C. Howard, D. Hedderley, and R. Shepherd. (1997). "The Elaboration Likelihood Model and Communication about Food Risks." Risk Analysis. 17:759-770.

Gao, Z. and T.C. Schroeder. (2009). "Effects of Label Information on Consumer Willingness-to-Pay for Food Attributes." American Journal of Agricultural Economics. 40:339-346.

Giannakas, K. (2002). "Information Asymmetries and Consumption Decisions in Organic Food Product Markets." Canadian Journal of Agricultural Economics 50: 35–50. doi:10.1111/j.1744-7976.2002.tb00380.x.

Gillman, C. (2012). U.S. Consumer Groups Demand GMO Labeling, Question Food Safety. Reuters, March 27th. Retrieved July 28, 2016 from Reuters: http://www.reuters.com/article/us-usa-food-idUSBRE82Q10820120327.

Golan, E., F. Kuchler, and L. Mitchell. (2001). "Economics of Food Labeling." Journal of Consumer Policy. Vol. 24(2): 117-184.

Gonsalves, D., C. Gonsalves, S. Ferreira, K. Pitz, M. Fitch, R. Manshardt, and J. Slightom. (2004). "Transgenic Virus Resistant Papaya: From Hope to Reality for Controlling Papaya Ringspot Virus in Hawaii." APSnet Features. Online. doi: doi:10.1094/APSnetFeature-2004-0704

Greene, C. (2016). Organic Market Overview. U.S. Department of Agriculture Economic Research Service. May 26th. Retrieved July 28, 2016, from http://www.ers.usda.gov/topics/natural-resources-environment/organic-agriculture/organic-market-overview.aspx.

Greene, W.H. (2003). Econometric Analysis. Upper Saddle River, NJ: Prentice Hall, fourth edition.

Grunert K.G. (2005). “Food Quality and Safety: Consumer Perception and Demand.” European Review of Agricultural Economics. 32:369-391.

Gwin, L. C.A. Durham, J.D. Miller, and A. Colonna. (2012). “Understanding Markets for Grass-Fed Beef: Taste, Price, and Purchase Preferences. Journal of Food Distribution Research. 43(2):91-111.

Harper, R. (2007). “Safety Concerns Boosting Organics.” *Supermarket News*. Nov.26th. *Business Collection*. Retrieved July 28, 2016, from http://go.galegroup.com.er.lib.k-state.edu/ps/i.do?&id=GALE|A171703317&v=2.1&u=ksu&it=r&p=ITBC&sw=w&authCount=1#.

Hoban, T.J. (2002). *American Consumers’ Awareness and Acceptance of Biotechnology*. Washington, D.C. National Agricultural Biotechnology Council.

Hobbs. J.E. (2004). “Markets in Metamorphosis: The Rise and Fall of Policy Institutions.” In G. Van Huylenbroeck, W. Verbeke and L. Lauwers (eds.), Role of Institutions in Rural Policies and Agricultural Markets. Amsterdam: Elsevier, 199-212.

Humane Society of the United States. (2016). Humane Eating. Humane Society of the United States. Retrieved July 28, 2016, from http://www.humanesociety.org/issues/eating/.

Huffman, W.E., J.F. Shogren, M. Rousu, and A. Tegene. (2003). “Consumer Willingness to Pay for Genetically Modified Food Labels in a Market with Diverse Information: Evidence from Experimental Auctions.” Journal of Agricultural and Resource Economics. 28(3):481-502.

International Service for the Acquisition of Agri-Biotech Applications. (2008). “Pocket K No. 34: RNAi for Crop Improvement.” Retrieved from: https://isaaa.org/resources/publications/pocketk/34/default.asp

Jacobsen, S., M. Sorensen, S.M. Pedersen, and J. Weiner. (2013). “Feeding the World: Genetically Modified Crops versus Agricultural Biodiversity.” Agronomy for Sustainable Development. 33(4):651-662.

Kahneman, D. and A. Tversky. (1973). “On the Psychology of Prediction.” Psychological Review. 80:237-251.

Kochhar, R. (2014). “10 Projects for the Global Population in 2050“. Pew Research Center. http://www.pewresearch.org/fact-tank/2014/02/03/10-projections-for-the-global-population-in-2050/.

Knight, S. and H. Herzog. (2009). “All Creatures Great and Small: New Perspectives on Psychology and Human-Animal Interactions.” Journal of Social Issues. 65(3):451-461.

Lancaster, K.J. (1966). “A New Approach to Consumer Theory.” Journal of Political Economy. (74):132-157.

Lee, H. and Z. Yun. (2015). “Consumers’ perceptions of organic food attributes and cognitive and affective attitudes as determinants of their purchase intention toward organic food.” Food Quality and Preference. 39:259-267.

Liaukonyte, J., N.A. Streletskaya, H.M. Kaiser, and B.J. Rickard. (2013). Consumer Response to “Contains” and “Free of” Labeling: Evidence from Lab Experiments. *Applied Economics Perspectives and Policy*. 35(3):476-507.

Lusk, J.L. (2003). “Effect of Cheap Talk on Consumer Willingness-to-Pay for Golden Rice.” American Journal of Agricultural and Applied Economics 85: 840-856.

Lusk, J.L. (2013). Technical Information on Survey Questions and Methods. Food Demand Survey.

Lusk, J.L. and K.H. Coble. (2005). “Risk Perceptions, Risk Preference, and Acceptance of Risky Food.” American Journal of Agricultural Economics. 87(2): 393-405.

Lusk, J.L., L.O. House, C. Valli, S.R. Jaeger, M. Moore, J.L. Morrow, and W.B. Traill. (2004). “Effect of Information about Benefits of Biotechnology on Consumer Acceptance of Genetically Modified Food; Evidence from Experimental Auctions in the United States, England, and France.” European Review of Agriculture Economics 31 (2): 179–204. doi:10.1093/erae/31.2.179.

Lusk, J.L. B.R. McFadden, and B.J. Rickard. (2015). “Which Biotech Foods are Most Acceptable to the Public?” Biotechnology Journal. 10: 13-16.

Lusk, J.L., R. Roosen, & J.A. Fox. (2003). “Demand for Beef and Cattle Administered Growth Hormones of Fed Genetically Modified Corn: A Comparison of Consumers in France, Germany, the United Kingdom, and the United States. American Journal of Agricultural Economics. 85(1):16-29.

Lusk, J.L. and T.C. Schroeder. (2004). “Are Choice Experiments Incentive Compatible? A Test with Quality Differentiated Beef Steaks.” American Journal of Agricultural Economics. 86:467-482.

McCluskey, J.J. and J.F.M. Swinnen. (2004). “Political Economy of the Media and Consumer Perceptions of Biotechnology.” American Journal of Agricultural Economics. 86:1,230-1,237.

McFadden. D. (1974). “Conditional Logit Analyses of Qualitative Choice Behavior.” Frontiers of Econometrics. 105-142.

Nehra, N. and N. Taylor. (2015). "Improving Crops with RNAi." The Scientist. Retrieved from: http://www.the-scientist.com/?articles.view/articleNo/43020/title/Improving-Crops-with-RNAi/.

Olynk, N.J., G.T. Tonsor, and C.A. Wolf. (2010). "Consumer Willingness to Pay for Livestock Credence Attribute Claim Verification." Journal of Agricultural and Resource Economics. 35:261-305.

Ouma, E. A. Abdulai, and A. Drucker. "Measuring Heterogeneous Preferences for Cattle Traits among Cattle-Keeping Households in East Africa." American Journal of Agricultural Economics. 89:1,005-1,019.

The Pennsylvania State University. (2016). More on Goodness-of-Fit and Likelihood Ratio Tests. Retrieved June 10, 2016, from PSU Department of Statistics: https://onlinecourses.science.psu.edu/stat504/node/220

People for the Ethical Treatment of Animals. (2016). Vegetarian 101. People for the Ethical Treatment of Animals. Retrieved from July 28, 2016, from http://www.peta.org/living/food/vegetarian-101/.

Philpott, T. (2015). "New Monsanto Spray Kills Bugs by Messing with Their Genes." Mother Jones. Retrieved from: http://www.motherjones.com/tom-philpott/2015/08/coming-farm-field-near-you-gene-silencing-pesticides-RNA-RNAi.

Pozo, V.F., G.T. Tonsor, and T.C. Schroeder. (2012). "How Choice Experiment Design Affects Estimated Valuation of Use of Gestation Crates." Journal of Agricultural Economics. 63:639-655.

Rabinowicz, E. (1999). "EAAE presidential address. Redesigning the CAP to meet the challenges of EU enlargement and the WTO: what can agricultural economic research contribute?" European Review of Agricultural Economics. 26:265-281.

Radecki, C.M. and J. Jaccard. (1995). Perceptions of Knowledge, Actual Knowledge, and Information Search Behaviour. *Journal of Experimental Social Psychology.* 31:107-138.

Regalado, A. (2015). "The Next Great GMO Debate." MIT Technology Review. August 11, 2015. https://www.technologyreview.com/s/540136/the-next-great-gmo-debate/.

Rousu, M., W.E. Huffman, J.F. Shogren, and A. Tegene. (2007). "Effects and Value of Verifiable Information in a Controversial Market: Evidence from Lab Auctions of Genetically Modified Food." Economic Inquiry. 45(3):409-432.

Schroeder, T.C., G.T. Tonsor, J.M.E. Pennings, and J. Mintert. (2007). "Consumer Food Safety Risk Receptions and Attitudes: Impacts on Beef Consumption across Countries." The B.E. Journal of Economic Analysis & Policy. Vol. 7: Iss. 1 (Contributions). Article 65

Shew, A.M., D.M. Danforth, L.L. Nalley, R.M. Nayga, Jr., F. Tsiboe, and B.L. Dixon. (2016). "Consumers' Willingness-to-Pay for RNAi versus Bt Rice: Are all biotechnologies the same?" Selected paper for Agricultural and Applied Economics Association Annual Meeting, Boston Massachusetts.

Smith, M.D., F. Asche, A.G. Guttormsen, and J.B. Wiener. (2010). "Genetically Modified Salmon and Full Impact Assessment." Science. 330: 1,052-1053.

Smith, T.A. and B. Lin. (2009). Consumers Willingness to Pay a Premium for Organic Produce. U.S. Department of Agriculture Economic Research Service. Retrieved July 28, 2016, from: http://www.ers.usda.gov/amber-waves/2009-march/consumers-willing-to-pay-a-premium-for-organic-produce.aspx#.V5rJr_krKCg

Smith-Spangler, C., M.L. Brandeau, G.E. Hunter, J.C. Bavinger, M. Pearson, P.J. Eschbach, V. Sundaram, H. Liu, P. Schirmer, I. Olkin, D.M. Bravata. (2012). "Are Organic Foods Safer or Healthier than Convention Alternatives?: A Systematic Review." Annals of Internal Medicine. 157(5):794-811.

Thornton, P.K. (2010). "Livestock Production: Recent Trends, Future Prospects." The Royal Society. 365(1,554):2,853-2,867.

Tonsor, G.T. (2011). "Consumer Inferences of Food Safety and Quality." European Review of Agricultural Economics. 38 (2): 213–35. doi:10.1093/erae/jbr011.

Tonsor, G.T., T.C. Schroeder, and J.L. Lusk. (2012). "Consumer Valuation of Alternative Meat Origin Labels. Journal of Agricultural Economics. 64(3): 676-692.

Tonsor, G.T. and R.S. Shupp. "Cheap Talk Scripts and Online Choice Experiments: 'Looking Beyond the Mean.'" (2011). American Journal of Agricultural Economics. 93 (4): 1,015-1,031.

Tonsor, G.T. and C.A. Wolf. (2009). "Drivers of Resident Support for Animal Care Oriented Ballot Initiatives." Journal of Agricultural and Applied Economics. 42:419-428.

Tonsor, G.T., C.A. Wolf, N. Olynk. (2010). "Consumer Voting and Demand Behavior Regarding Swine Gestation Creates." Food Policy. 34(6):492-498.

Verbeke, W. (2005). "Agriculture and the Food Industry in the Information Age." European Review of Agricultural Economics 32 (3): 347–68. doi:10.1093/eurrag/jbi017.

U.S. Census Bureau. (2014a). *Selected Population Profile in the United States*. Retrieved June 10, 2016, from American Fact Finder: http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk.

U.S. Census Bureau (2014b). *Educational Attainment in the United States*: 2014 – Detailed Tables. Retrieved June 10, 2016, from Education Attainment:

http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_14_5YR_S1501&src=pt.

U.S. Department of Agriculture. (2015). "Meat and Poultry Labeling Terms." Food Safety and Inspection Service. Retrieved June 10, 2016, from: http://www.fsis.usda.gov/wps/portal/fsis/topics/food-safety-education/get-answers/food-safety-fact-sheets/food-labeling/meat-and-poultry-labeling-terms/!ut/p/a1/jZHfT4MwEMf_Fh94LC0yl803QmIEHWQhatcXU7ZrISktaTsJ_vUyjSYzm-7u6e4-39wvzDDFTPO3VnLfGs3VIWbzV7Im82iZkrxcRnckK57X5UOakkV1MwGbP4AivlB_xhLynz6_oMG1XaUriVnPfYNaLQymEjzi2g1gHabCmB1yXIAfkeBbj1wD4L8LitegWi0x7YAfVDvUm73ydvwpIQ-2c_gFs-NpSDR5VsTV7D4vYlLOfgMnzvUFnL_HtLBUpv78zSbRdbyYNrMgwIIN93ZKN9737jYgARmGIZTGSAXh1nQBOSVpjPOYHpO4757o-2MiqgyxehyuPgCErj8l/#14

Zamore, P.D. (2006). "RNA Interference: Big Applause for Silencing in Stockholm." *Cell*. 127(6):1,083-1,086. doi: http://dx.doi.org/10.1016/j.cell.2006.12.001

Appendix A - Survey Instrument

Research on food shopping behavior

This is a short survey designed to obtain important information from U.S. consumers. This project is being conducted by Kansas State University faculty and graduate students.
We want to emphasize that your participation in this survey is entirely voluntary and all your responses will be kept in strict confidence. Typical demographic questions are included to ensure our sample is representative of U.S. consumers and will remain strictly confidential. If you wish to comment on any questions, please feel free to do so at the end of the survey.
We very much appreciate your assistance with this important project and look forward to receiving your completed survey. If you have any questions or comments regarding this survey, please feel free to contact Dr. Glynn Tonsor by email (gtonsor@ksu.edu) or by phone (785-532-1518).

Consumer Survey

1. Please indicate your gender: *(check one*)
   a. Male
   b. Female

2. What is your present age?
   a. ___ years old. (*fill-in the blank*)

3. The best description of the highest degree education you obtained is:
   a. Did not graduate from high school
   b. Graduated from high school
   c. Associate's or trade degree earned
   d. Bachelor's college degree earned
   e. Graduate or advanced college degree earned

4. What best describes your race?
   a. American Indian
   b. Asian or Pacific Islander
   c. Black or African American
   d. Mexican or Latino
   e. White or Caucasian
   f. Other (please describe): _____

5. Your primary state of residence is: _____. (*drop-down menu of 50 states*)

6. How many adults (18 years or older), including yourself, live in your household? ___ (*fill-in the blank*)

7. How many children under the age of 18 live in your household? _____ (*fill-in the blank*)

8. Your annual, pre-tax household income is:
   a. Less than $25,000
   b. $25,000-$49,999

c. $50,000-$74,999
d. $75,000-$99,999
e. $100,000-$124,999
f. $125,000-$149,999
g. $150,000-$174,999
h. $175,000 or more

9. How much would you estimate your household spends each week for total food consumption including eating at home, in restaurants, take-out orders, etc.? $_____ (Please provide your best estimate.)

10. What is your primary source for news stories and current events?
    a. Physical newspapers
    b. Online newspapers
    c. Popular magazines
    d. Social media
    e. Radio broadcast
    f. TV broadcast
    g. Other (please describe): _____

11. Approximately, how often does your household consume the following products?
Matrix rows:
Ground beef or hamburger
Steak
Chicken
Pork
Fish

Matrix columns:
    a. Never
    b. Less than once a week
    c. About once a week
    d. 3-4 times a week
    e. At least every day of the week

12. Do you consider yourself a vegetarian or vegan?
    a. Yes
    b. No
        i. Do you most closely associate yourself with being:
            a. Vegetarian
            b. Vegan
            c. Both

13. Consumers purchase food from many sources. What best describes where you typically purchase beef products for at-home consumption?
    a. Supermarket retailer (e.g. Wal-Mart, Kroger, Safeway)
    b. Targeted retailer (e.g. Whole Foods, Trader Joe's)

c. Convenience store (e.g. 7-Eleven)
d. Farmers' market
e. Direct from a farmer
f. Other (please describe): _____

14. Have you ever purchased the following beef products?
Matrix rows:
Organic beef steak
Natural beef steak
Animal welfare assured beef steak
Grass-fed beef steak
Antibiotic-free beef steak
Hormone-free beef steak
USDA Choice beef steak
USDA Select beef steak
Matrix columns:
a. Yes
b. No
c. I Don't Know

15. The U.S. Bureau of Labor Statistics reports the average price of beef steaks in November of 2015 was **$7.79**. What is the maximum price you would pay for a one pound, boneless beef steak possessing the following labels?
Matrix rows:
Organic
Natural
Animal welfare assured
Grass-fed
Antibiotic-free
Hormone-free
USDA Choice
USDA Select
Matrix columns:
a. $0
b. $0.01-$2.00
c. $2.01-$4.00
d. $4.01-$6.00
e. $6.01-$8.00
f. $8.01-$10.00
g. $10.01-$12.00
h. $12.01-$14.00
i. $14.01-$16.00
j. Over $16.00

16. How concerned are you about the following attributes of beef and methods of production?

Matrix rows:
Animal welfare (well-being of cattle used in beef production)
Food safety (eating the beef will not make you sick)
Price (the price you pay)
Taste (the flavor of the beef in your mouth)
Naturalness (made without modern food technologies and ingredients)
Antibiotic use (information on whether cattle received antibiotics or not)
Hormone use (information on whether cattle received hormones or not)
Labeling of beef products (information on production practices used)

Matrix columns of:
NOT AT ALL CONCERNED 1 – 2 – 3 – 4 – 5 – 6 – 7 VERY CONCERNED

17. What portion of the beef cattle produced in the U.S. do you think are given antibiotics?
    a. 10% or less
    b. 11-30%
    c. 31-50%
    d. 51-70%
    e. 71-90%
    f. 91% or more

18. What portion of the beef produced in the U.S. do you think are graded USDA Choice?
    a. 10% or less
    b. 11-30%
    c. 31-50%
    d. 51-70%
    e. 71-90%
    f. 91% or more

Information Treatments (Statements and Definition of Attributes); Cheap Talk Script
The next portion of this survey presents you with multiple different sets of hypothetical pairs of beef steaks available for purchase in a retail store where you typically shop. All products have been USDA inspected and are of the same size and weight. Prices vary for each product and are all in $/lb. units. Besides the attributes listed below, each beef steak possesses the same characteristics (e.g., similar color, freshness, packaging date, etc.) For each pair of beef steaks, please select the one you would purchase or neither if you would not purchase either product. For your information in interpreting alternative steaks note:

Antibiotic Use:

- *Used* means the product was produced utilizing antibiotics.
- *Free* means the product was produced without utilizing antibiotics.
- *No claim* means that no claims on antibiotic use are being made.

USDA Grade is the evaluation of the meat quality given by the U.S. Department of Agriculture where:

- *Choice* means the beef steak is high quality and will be very tender, juicy, and flavorful.
- *Select* means the beef steak is very uniform in quality, but may lack some of the juiciness and flavor of higher grades.

RNAi Use:

- *Used* means the product was produced utilizing RNAi technology.
- *Free* means the product was produced not utilizing RNAi technology.
- *No claim* means that no claims on RNAi use are being made.

Suppose the Food and Drug Administration has given {no approval/approval/approval with mandatory labeling} for the following beef steaks.

RNA interference (RNAi for short) is a natural process of gene silencing in cells – think of it as a genetic switch that when turned off, tells the body to stop making a certain protein. {Info Treatment}. For more information on RNAi, please review the following resources:

Title 1 (Source 1)
Title 2 (Source 2)

Please answer the following questions. The experience from previous similar surveys is that people often state a higher willingness to pay than what one actually is willing to pay for the good. It is important that you make your selections like you would if you were actually facing these choices in your retail purchase decisions, noting that allocation of funds to purchase beef steak means you will have less money available for other purchases.

19. CE Scenario #1
20. CE Scenario #2
21. CE Scenario #3
22. CE Scenario #4
23. CE Scenario #5
24. CE Scenario #6
25. CE Scenario #7 (if applicable)

26. If given the opportunity involving real money, how certain are you in the selections you indicated previously? Please select one number on the certainty scale below:
VERY UNCERTAIN 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10 VERY CERTAIN

{only shown in given CE design 3} RNA interference (RNAi for short) is a natural process of gene silencing in cells – think of it as a genetic switch that when turned off, tells the body to stop making a certain protein. {Info Treatment}. For more information on RNAi, please review the following resources:

Title 1 (Source 1)
Title 2 (Source 2){/only shown in given CE design 3}

27. Please consider the following statements:
Matrix rows:
I am willing to eat beef products produced with the use of RNAi technology.
I am willing to purchase beef products produced with the use of RNAi technology.
In general, I support the use of RNAi technology in beef production.
Matrix columns of:
STRONGLY DISAGREE 1 – 2 – 3 – 4 – 5 – 6 – 7 STRONGLY AGREE

28. Based on what you learned about RNAi, what is your impression or expectation of this technology in the beef industry?
Matrix rows:
Impact on health of beef cattle
Impact on production costs
Impact on price paid by consumers
Impact on taste of beef products
Impact on human health from beef consumption
Matrix columns of:
STRONGLY NEGATIVE 1 – 2 – 3 – 4 – 5 – 6 – 7 STRONGLY POSITIVE

29. What is your opinion on new technologies being implemented into the U.S. beef industry system?
Matrix rows:
New beef technologies are something I am uncertain about.
New beef products are not healthier than traditional beef products.
The benefits of new beef technologies are often grossly overstated.
There are plenty of tasty beef products around so we do not need to use new beef technologies to produce more.
New beef technologies decrease the natural quality of beef products.
New beef technologies are unlikely to have long-term negative human health effects.
New beef technologies give people more control over their beef product choices.
New beef products using new technologies can help people have a balanced diet.
New technologies in beef may have long-term negative environmental effects.
It can be risky to switch to new beef technologies too quickly.

Society should not depend heavily on new technologies in the beef industry to solve its food problems.
There is no sense trying out high-tech beef products because the ones I eat are already good enough.
The media usually provides a balanced and unbiased view of new beef technologies
Matrix columns of:
STRONGLY DISAGREE 1 – 2 – 3 – 4 – 5 – 6 – 7 STRONGLY AGREE

30. Please indicate your agreement with the following statements.
Matrix rows:
RNAi technology in beef production will not pose risks to my family and me.
My family and I could be exposed to great risks from RNAi technology in beef production.
The side-effects from eating RNAi technology in beef production are largely unknown.
There is little danger that RNAi technology in beef production will results in new disease for humans.
Matrix columns of:
STRONGLY DISAGREE 1 – 2 – 3 – 4 – 5 – 6 – 7 STRONGLY AGREE

31. What best describes your desirability of adopting RNAi technology in the beef industry for the following purposes or outcomes?
Matrix rows:
Keep beef production and processing in the U.S.
Lower the price paid by beef consumers
Improve the nutritional content of beef
Reduce use of antibiotics
Protect cattle from disease
Reduce use of hormones
Increase overall animal health
Reduce death in cattle
Increase carcass yield (the amount of meat produced per head)
Reduce use of feed additives
Reduce farmers' time involved in labor
Matrix columns of: VERY UNDESIRABLE 1 – 2 – 3 – 4 – 5 – 6 – 7 VERY DESIRABLE

32. Please rank how you would like improvements in ***QUALITYW*** to be achieved. (1 = most favored, 5 = least favored)
a. Change in magnitude and/or type of livestock feed additives used
b. Change in magnitude and/or type of antibiotics used
c. Change in magnitude and/or type of vaccines used
d. Change in magnitude and/or type of genetic technology used
e. Change in magnitude and/or type of RNAi technology used
    i. In your own words, please describe why you ranked RNAi technology as #?

33. Suppose a dine-in restaurant claims that 100% of its beef steaks are purchased from suppliers who use RNAi technology for the purpose of ***QUALITYY***. Would you be

willing to pay **$X** more for a beef steak meal from that restaurant compared to one from an alternative restaurant?

a. Yes, I would pay **$X** more
b. No, I would not pay **$X** more
    i. If Yes, repeat question and answers, but change X to X*2
    ii. If No, repeat question and answers, but change X to X/2

34. Suppose a dine-in restaurant claims that 100% of its beef steaks are purchased from suppliers who do not use RNAi technology for the purpose of ***QUALITYZ***. Would you be willing to pay **$Y** more for a beef steak meal from that restaurant compared to one from an alternative restaurant?
    a. Yes, I would pay **$Y** more
    b. No, I would not pay **$Y** more
        i. If Yes, repeat question and answers, but change X to X*2
        ii. If No, repeat question and answers, but change X to X/2

Thank you for your time in completing this survey. Your input will strengthen research and help obtain more accurate conclusions. If you wish to add any comments, please feel free to do so here:

Appendix B - Survey Designs

Design of Choice Experiment Designs 1, 2 and 3.						
	Option A			**Option B**		
Observations	**Price**	**Attribute 1**	**Attribute 2**	**Price**	**Attribute 1**	**Attribute 2**
1	3	1	1	3	0	1
2	3	0	0	2	1	0
3	2	1	0	3	1	0
4	2	0	0	2	0	1
5	2	0	1	1	0	0
6	1	0	1	3	1	1
7	1	0	0	3	0	0
8	1	1	1	2	0	0
9	1	1	0	1	1	1
Notes: Observations 3 and 7 were dropped because the same levels for each non-price attribute are used. Design 1 – attribute 1: RNAi Use; attribute 2: Antibiotic Use. Design 2 – attribute 1: RNAi Use; attribute 2: USDA Grade. Design 3 – attribute 1: Antibiotic Use; attribute 2: USDA Grade.						

Design of Choice Experiment Design 4.				
	Option A		**Option B**	
Observations	**Price**	**RNAi Use**	**Price**	**RNAi Use**
1	3	0	3	0
2	3	0	2	1
3	3	1	1	1
4	2	1	3	1
5	2	0	1	0
6	1	1	2	0
7	1	0	1	1
Note: Observation 1 was dropped because the same price and attribute levels are used.				

Appendix C - Summary Statistics

Summary Statics for Variables			
Variable	**Description**	**Mean or Frequency**	**Std. Dev.**
Gender	1 if individual is female, 0 otherwise Male Female	0.51 1,470 (49%) 1,530 (51%)	0.50
Age	Age in years 18-24 25-34 35-44 45-54 Over 55	41.93 458 (15%) 629 (21%) 600 (20%) 713 (24%) 600 (20%)	15.12
Education: Raw	Highest degree education received Did not graduate from high school Graduate from high school Associate's or trade degree earned Bachelor's college degree earned Graduate or advanced college degree earned	2.96 106 (4%) 1,235 (41%) 618 (21%) 749 (25%) 292 (10%)	1.09
Education	1 if bachelor's degree or higher, 0 otherwise	0.35	0.48
Race	American Indian Asian or Pacific Islander Black or African American Mexican or Latino White or Caucasian Other	33 (1%) 127 (4%) 259 (9%) 240 (8%) 2,284 (76%) 57 (2%)	
Region	Northeast Midwest South West	557 (19%) 686 (23%) 1,057 (35%) 700 (23%)	
Adults	Number of adults in household	2.17	1.00
Children	Number of children in household	0.78	1.10
Income	Annual income ($) Less than 25,000 25,000-49,999 50,000-74,999 75,000-99,999 100,000-124,999 125,000-149,999 150,000-174,999 175,000 or more	 720 (24%) 1,074 (36%) 572 (19%) 302 (10%) 83 (3%) 83 (3%) 84 (3%) 82 (3%)	
Food Expenditure	Average weekly household expenditure on food ($)	258.00	

Primary News Source	Physical newspapers Online newspapers Popular magazines Social media Radio broadcast TV broadcast Other	113 (4%) 535 (18%) 23 (1%) 786 (26%) 130 (4%) 1,319 (44%) 94 (3%)	
Meat Consumption	Number of meals at household of the respective products: Ground beef or hamburger: Never Less than once a week About once a week 3-4 times a week At least every day of the week Steak: Never Less than once a week About once a week 3-4 times a week At least every day of the week Chicken: Never Less than once a week About once a week 3-4 times a week At least every day of the week Pork: Never Less than once a week About once a week 3-4 times a week At least every day of the week Fish: Never Less than once a week About once a week 3-4 times a week At least every day of the week	 143 (5%) 649 (22%) 1,398 (47%) 765 (26%) 45 (2%) 256 (9%) 1,669 (56%) 869 (29%) 169 (6%) 37 (1%) 49 (2%) 254 (8%) 1,167 (39%) 1,145 (47%) 115 (4%) 309 (10%) 1,159 (39%) 1,216 (41%) 275 (9%) 41 (1%) 365 (12%) 1,009 (45%) 39 (34%) 1,344 (8%) 243 (1%)	
Vegetarian/ Vegan	Vegetarian Vegan Both	10 (0%) 10 (0%) 00 (0%)	
Food Source	Supermarket retailer (e.g. Wal-Mart, Kroger, Safeway) Targeted retailer (e.g. Whole Foods, Trader Joe's) Convenience store (e.g. 7-Eleven)	2,461 (82%) 245 (8%) 25 (1%)	

	Farmers' market	48 (2%)	
	Direct from a farmer	52 (2%)	
	Other	169 (6%)	
Previous Purchases of Beef Product	Have you ever purchased the following beef products?		
	Organic beef steak:		
	Yes	881 (29%)	
	No	1,481 (49%)	
	I Don't Know	638 (21%)	
	Natural beef steak:		
	Yes	1,230 (41%)	
	No	889 (30%)	
	I Don't Know	881 (29%)	
	Animal welfare assured beef steak:		
	Yes	352 (12%)	
	No	1,439 (48%)	
	I Don't Know	1,209 (40%)	
	Grass-fed beef steak:		
	Yes	1,326 (44%)	
	No	910 (30%)	
	I Don't Know	764 (25%)	
	Antibiotic beef steak:		
	Yes	813 (27%)	
	No	1,193 (40%)	
	I Don't Know	994 (33%)	
	Hormone-free beef steak:		
	Yes	885 (30%)	
	No	1,165 (39%)	
	I Don't Know	950 (32%)	
	USDA Choice beef steak:		
	Yes	2,300 (77%)	
	No	355 (12%)	
	I Don't Know	345 (12%)	
	USDA Select beef steak:		
	Yes	2,131 (71%)	
	No	436 (15%)	
	I Don't Know	433 (14%)	
WTP for Beef Steak Labels	What is the maximum price you would pay for a one pound, boneless beef steak possessing the following labels?		
	Organic:		
	$0	426 (14%)	
	$0.01-$2.00	64 (2%)	
	$2.01-$4.00	218 (7%)	
	$4.01-$6.00	426 (14%)	
	$6.01-$8.00	735 (25%)	
	$8.01-$10.00	602 (20%)	

	$10.01-$12.00	316 (11%)	
	$12.01-$14.00	120 (4%)	
	$14.01-$16.00	55 (2%)	
	Over $16.00	38 (1%)	
	Natural:		
	$0	253 (8%)	
	$0.01-$2.00	83 (3%)	
	$2.01-$4.00	243 (8%)	
	$4.01-$6.00	533 (18%)	
	$6.01-$8.00	868 (29%)	
	$8.01-$10.00	585 (20%)	
	$10.01-$12.00	278 (9%)	
	$12.01-$14.00	82 (3%)	
	$14.01-$16.00	39 (1%)	
	Over $16.00	36 (1%)	
	Animal welfare assured:		
	$0	476 (16%)	
	$0.01-$2.00	92 (3%)	
	$2.01-$4.00	252 (8%)	
	$4.01-$6.00	492 (16%)	
	$6.01-$8.00	774 (26%)	
	$8.01-$10.00	543 (18%)	
	$10.01-$12.00	233 (8%)	
	$12.01-$14.00	75 (3%)	
	$14.01-$16.00	37 (1%)	
	Over $16.00	26 (1%)	
	Grass-fed:		
	$0	288 (10%)	
	$0.01-$2.00	74 (2%)	
	$2.01-$4.00	251 (8%)	
	$4.01-$6.00	507 (17%)	
	$6.01-$8.00	802 (27%)	
	$8.01-$10.00	620 (21%)	
	$10.01-$12.00	291 (10%)	
	$12.01-$14.00	95 (3%)	
	$14.01-$16.00	33 (1%)	
	Over $16.00	39 (1%)	
	Antibiotic-free:		
	$0	368 (12%)	
	$0.01-$2.00	71 (2%)	
	$2.01-$4.00	240 (8%)	
	$4.01-$6.00	478 (16%)	
	$6.01-$8.00	798 (27%)	
	$8.01-$10.00	645 (22%)	
	$10.01-$12.00	242 (8%)	
	$12.01-$14.00	88 (3%)	

	$14.01-$16.00	44 (1%)	
	Over $16.00	26 (1%)	
	Hormone-free:		
	$0	361(12%)	
	$0.01-$2.00	80 (3%)	
	$2.01-$4.00	236 (8%)	
	$4.01-$6.00	468 (16%)	
	$6.01-$8.00	786 (26%)	
	$8.01-$10.00	662 (22%)	
	$10.01-$12.00	251 (8%)	
	$12.01-$14.00	99 (3%)	
	$14.01-$16.00	30 (1%)	
	Over $16.00	27 (1%)	
	USDA Choice:		
	$0	130 (4%)	
	$0.01-$2.00	92 (3%)	
	$2.01-$4.00	277 (9%)	
	$4.01-$6.00	571 (19%)	
	$6.01-$8.00	963 (32%)	
	$8.01-$10.00	620 (21%)	
	$10.01-$12.00	221 (7%)	
	$12.01-$14.00	63 (2%)	
	$14.01-$16.00	34 (1%)	
	Over $16.00	29 (1%)	
	USDA Select:		
	$0	148 (5%)	
	$0.01-$2.00	97 (3%)	
	$2.01-$4.00	289 (10%)	
	$4.01-$6.00	583 (19%)	
	$6.01-$8.00	929 (31%)	
	$8.01-$10.00	605 (20%)	
	$10.01-$12.00	221 (7%)	
	$12.01-$14.00	61 (2%)	
	$14.01-$16.00	31 (1%)	
	Over $16.00	35 (1%)	
Beef and Method of Production Concerns	Concern about the following attributes of beef and methods of production:		
	Animal welfare	4.83	
	Food safety	5.92	
	Price	5.67	
	Taste	5.87	
	Naturalness	4.73	
	Antibiotic use	4.91	
	Hormone use	4.97	
	Labeling of beef products	5.07	

Consumer Knowledge	Portion of beef cattle produced in the U.S. believed are given antibiotics: 10% or less 11-30% 31-50% 51-70% 71-90% 91% or more Portion of beef cattle produced in the U.S. believed are graded USDA Choice: 10% or less 11-30% 31-50% 51-70% 71-90% 91% or more	 159 (5%) 321 (11%) 695 (23%) 860 (29%) 718 (24%) 247 (8%) 154 (5%) 492 (16%) 917 (31%) 831 (28%) 429 (14%) 177 (6%)	
RNAi Acceptance	Consider the following statements: I am willing to eat beef products produced with the use of RNAi technology. I am willing to purchase beef products produced with the use of RNAi technology. In general, I support the use of RNAi technology in beef production.	 3.74 3.75 3.57	
Impression or Expectation of RNAi	Impression or expectation of this technology in the beef industry Impact on health of beef cattle Impact on production costs Impact on price paid by consumers Impact on taste of beef products Impact on human health from beef consumption	 4.00 4.13 4.07 4.09 3.90	
Opinion on New Technologies Being Implemented into the U.S. Beef Industry	New beef technologies are something I am uncertain about. New beef products are not healthier than traditional beef products. The benefits of new beef technologies are often grossly overstated. There are plenty of tasty beef products around so we do not need to use new beef technologies to produce more. New beef technologies decrease the natural quality of beef products. New beef technologies are unlikely to have long-term negative human health effects. New beef technologies give people more control over their beef product choices.	5.11 4.59 4.67 4.59 4.67 3.68 4.17	

	New beef products using new technologies can help people have a balanced diet.	3.92	
	New technologies in beef may have long-term negative environmental effects.	4.76	
	It can be risky to switch to new beef technologies too quickly.	5.10	
	Society should not depend heavily on new technologies in the beef industry to solve its food problems.	4.75	
	There is no sense trying out high-tech beef products because the ones I eat are already good enough.	4.49	
	The media usually provides a balanced and unbiased view of new beef technologies	3.38	
RNAi Concern	Indicate your agreement with the following statements:		
	RNAi technology in beef production will not pose risks to my family and me.	3.54	
	My family and I could be exposed to great risks from RNAi technology in beef production.	4.52	
	The side-effects from eating RNAi technology in beef production are largely unknown.	5.10	
	There is little danger that RNAi technology in beef production will results in new disease for humans.	3.63	
Desirability of Adopting RNAi	Keep beef production and processing in the U.S.	5.16	
	Lower the price paid by beef consumers	5.05	
	Improve the nutritional content of beef	4.93	
	Reduce use of antibiotics	5.08	
	Protect cattle from disease	5.24	
	Reduce use of hormones	5.14	
	Increase overall animal health	5.17	
	Reduce death in cattle	5.03	
	Increase carcass yield (the amount of meat produced per head)	4.47	
	Reduce use of feed additives	5.00	
	Reduce farmers' time involved in labor	4.37	

Summary Statistics for demographic variables by Choice Experiment design.				
Variable	**Design 1** (n = 750)	**Design 2** (n = 750)	**Design 3** (n = 750)	**Design 4** (n = 750)
Mean (Standard Deviation)				
Female	0.49 (0.50)	0.51 (0.50)	0.53 (0.50)	0.51 (0.50)
Age	41.53 (15.08)	42.38 (15.17)	42.02 (15.51)	41.77 (14.73)
Education	0.36 (0.48)	0.32 (0.47)	0.35 (0.48)	0.37 (0.48)
Adults	2.15 (0.95)	2.19 (1.01)	2.11 (0.96)	2.21 (1.10)
Children	0.80 (1.10)	0.77 (1.11)	0.76 (1.10)	0.77 (1.09)
Consumption:				
Groundbeef/hamburger	2.97 (0.84)	3.00 (0.86)	3.03 (0.83)	2.90 (0.87)
Steak	2.35 (0.74)	2.32 (0.77)	2.38 (0.77)	2.37 (0.78)
Chicken	3.43 (0.76)	3.44 (0.76)	3.40 (0.78)	3.46 (0.77)
Pork	2.56 (0.85)	2.47 (0.84)	2.52 (0.85)	2.55 (0.86)
Fish	2.41 (0.87)	2.41 (0.85)	2.42 (0.84)	2.42 (0.85)
Income				
Annual income ($)				
Less than 25,000	176	189	185	170
25,000-49,999	264	270	267	273
50,000-74,999	154	130	148	140
75,000-99,999	66	79	69	88
100,000-124,999	23	26	19	15
125,000-149,999	21	19	22	21
150,000-174,999	25	17	23	19
175,000 or more	21	20	17	24
Count (Percentage)				
Opt-out	2,222 (42.3%)	1,900 (36.2%)	1,866 (35.5%)	1,701 (37.8%)

Appendix D - Institutional Review Board Letter of Approval

KANSAS STATE UNIVERSITY | University Research Compliance Office

TO: Glynn Tonsor
Ag. Economics
Waters Hall

Proposal Number: 8080

FROM: Rick Scheidt, Chair
Committee on Research Involving Human Subjects

DATE: 1/22/2016

RE: Proposal Entitled, "Research on food shopping behavior and new technology acceptance"

The Committee on Research Involving Human Subjects / Institutional Review Board (IRB) for Kansas State University has reviewed the proposal identified above and has determined that it is EXEMPT from further IRB review. This exemption applies only to the proposal - as written – and currently on file with the IRB. Any change potentially affecting human subjects must be approved by the IRB prior to implementation and may disqualify the proposal from exemption.

Based upon information provided to the IRB, this activity is exempt under the criteria set forth in the Federal Policy for the Protection of Human Subjects, **45 CFR §46.101, paragraph b, category: 2, subsection: II.**

Certain research is exempt from the requirements of HHS/OHRP regulations. A determination that research is exempt does not imply that investigators have no ethical responsibilities to subjects in such research; it means only that the regulatory requirements related to IRB review, informed consent, and assurance of compliance do not apply to the research.

Any unanticipated problems involving risk to subjects or to others must be reported immediately to the Chair of the Committee on Research Involving Human Subjects, the University Research Compliance Office, and if the subjects are KSU students, to the Director of the Student Health Center.

203 Fairchild Hall, Lower Mezzanine, 1601 Vattier St., Manhattan, KS 66506-1103 | 785-532-3224 | fax: 785-532-3278 | k-state.edu/research/comply | comp

Appendix E - Choice Experiment Design Framework

Figure E.1 Framework of Choice Experiment Design 1

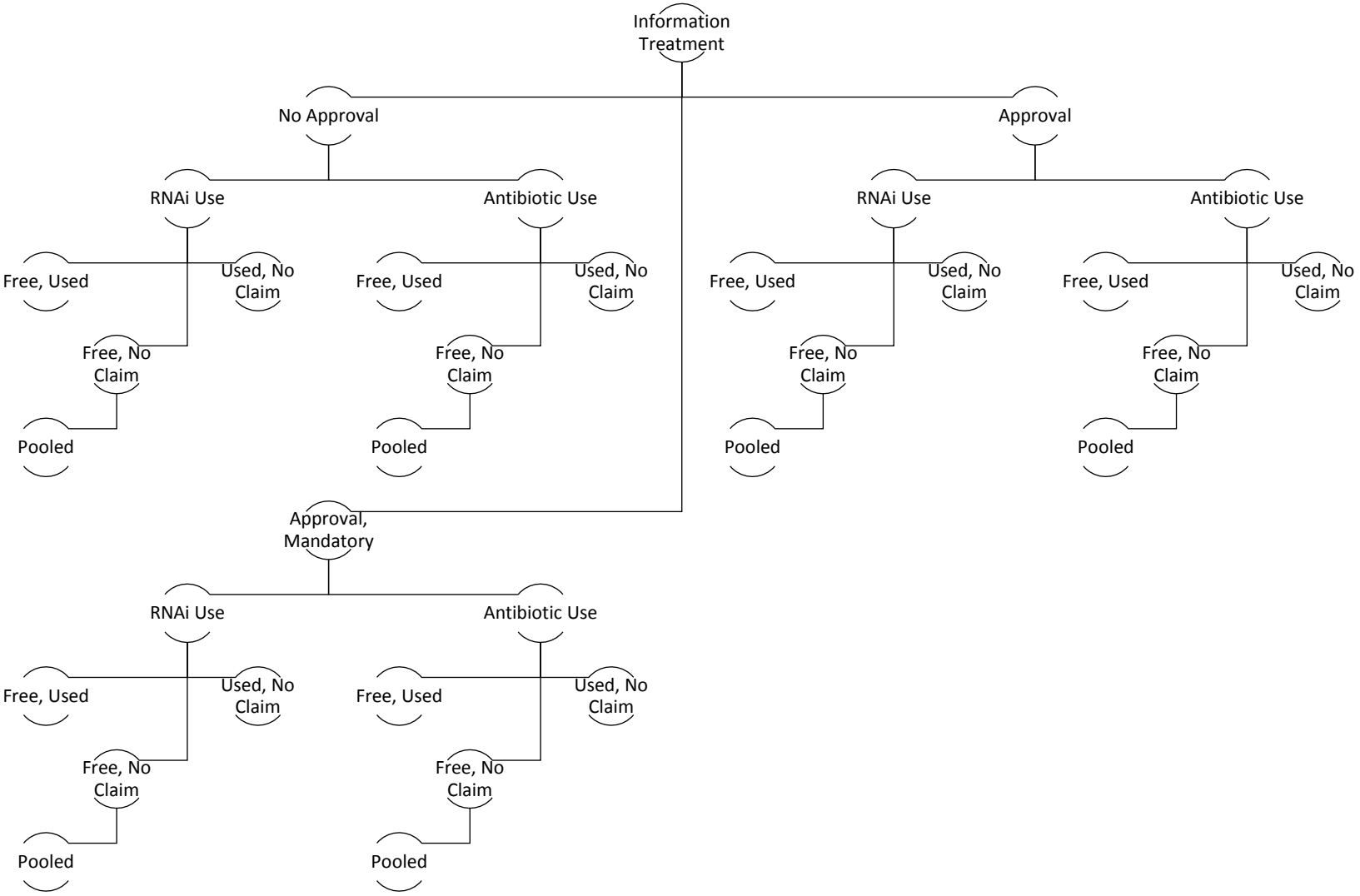

Figure E.2. Framework of Choice Experiment Design 2

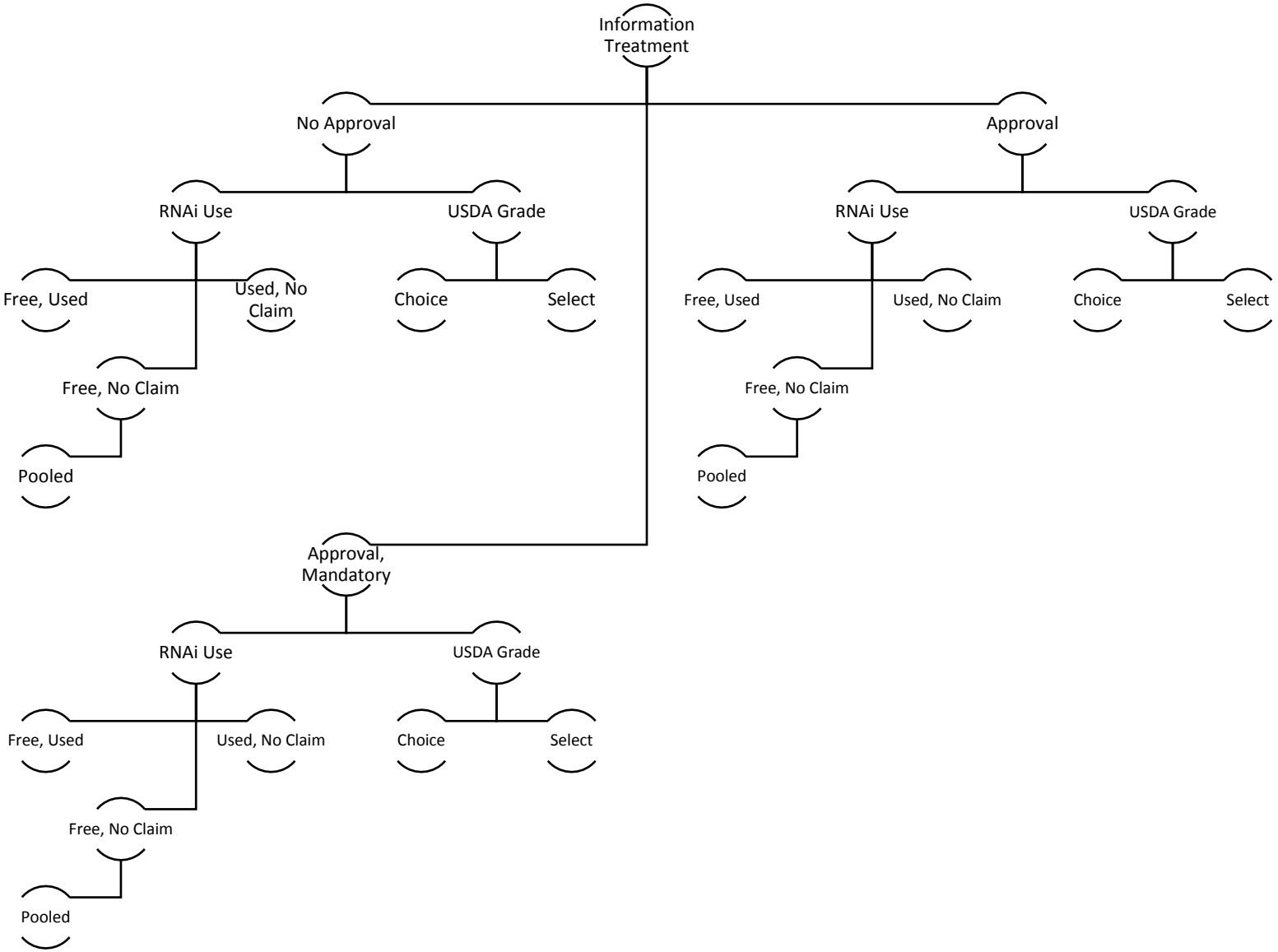

Figure E.3. Framework of Choice Experiment Design 3

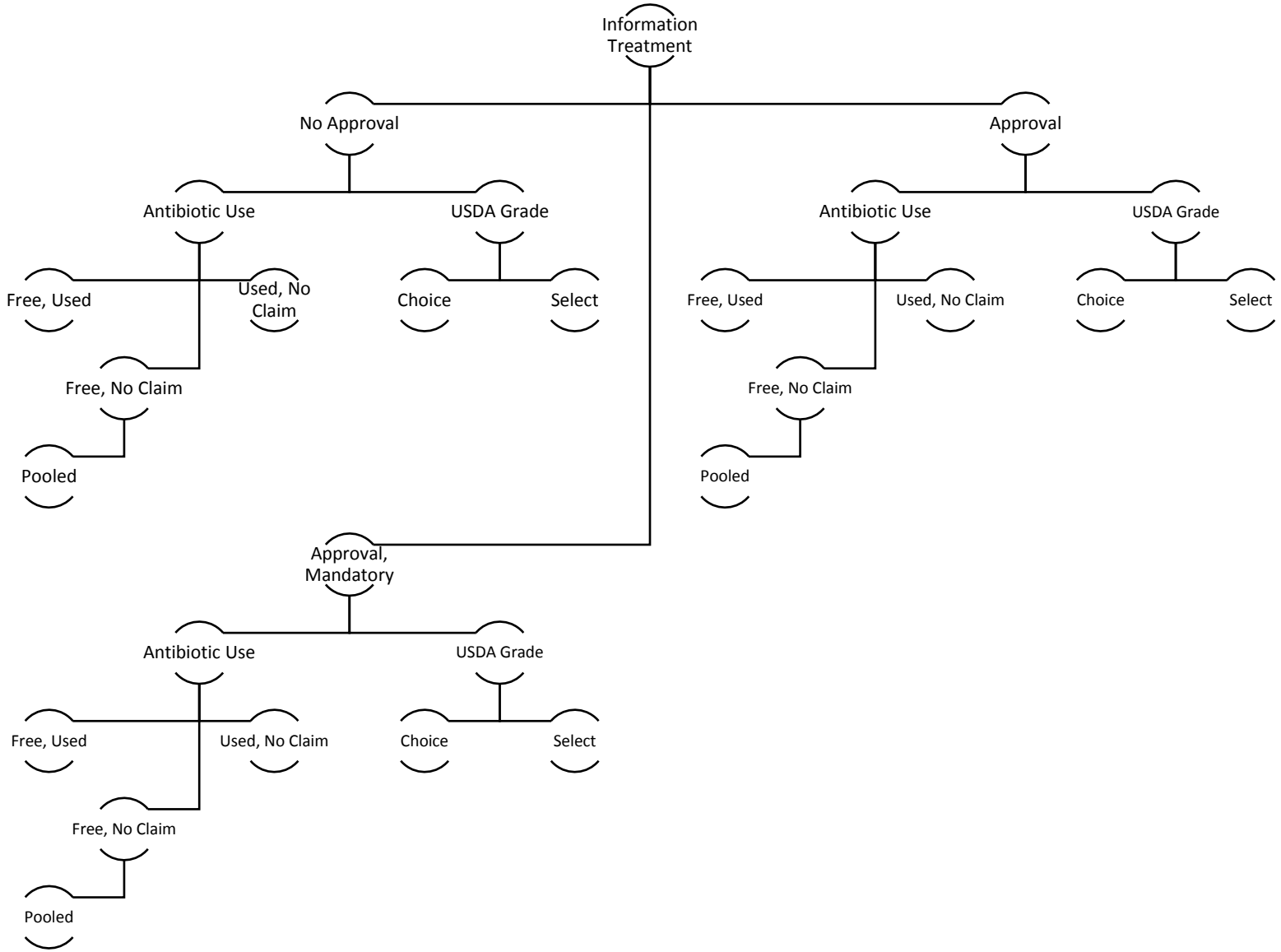

Figure E.4. Framework of Choice Experiment Design 4