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PERISHABLE REFRIGERATED PRODUCTS AND HOME PRACTICES SURVEY

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ABSTRACT

The "Perishable Refrigerated Products and Home Practices Survey" was a two-part survey developed to better understand consumers' perceptions and their current level of understanding regarding the proper handling and storage of perishable refrigerated foods. Past studies (e.g. Anonymous, 1997a; Anonymous, 1999a) have demonstrated a lack of consumer knowledge in such areas involving food safety practices.

In recent years, there have been a number of large food recalls (i.e. Anonymous, 1997b; Anonymous, 1999b; CDC, 1999) due to the presence or possible presence of foodborne pathogens. Part of this study analyzed consumers' knowledge and attitudes towards the recalled products. A large number of foodborne outbreaks also occur in the household. After examining participant responses concerning food handling practices, (i.e. improper temperature control and lack of food rotation habits), the practices of many of the participants were not suitable to prevent possible foodborne contamination.

Open dates and time-temperature integrators (TTI's), especially when used together, can assist consumers in purchasing fresh foods (Taoukis and Labuza, 1989a, b). However, numerous past studies have indicated consumer confusion regarding the meaning of open dates; and the results of this study confirm that the confusion continues. This may be due in part to the fact that there is no federally mandated, uniform open dating legislation in this country. TTI's are a fairly new device on the U.S. marketplace. While participants in this study were optimistic about the potential benefits of TTI's, 76% of consumers were unfamiliar with the device.

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CHAPTER 1. INTRODUCTION

Purpose

Funded by The Retail Food Industry Center (TRFIC), a survey was conducted in New Brighton, Minnesota, to collect objective data on consumers' understanding of the following:

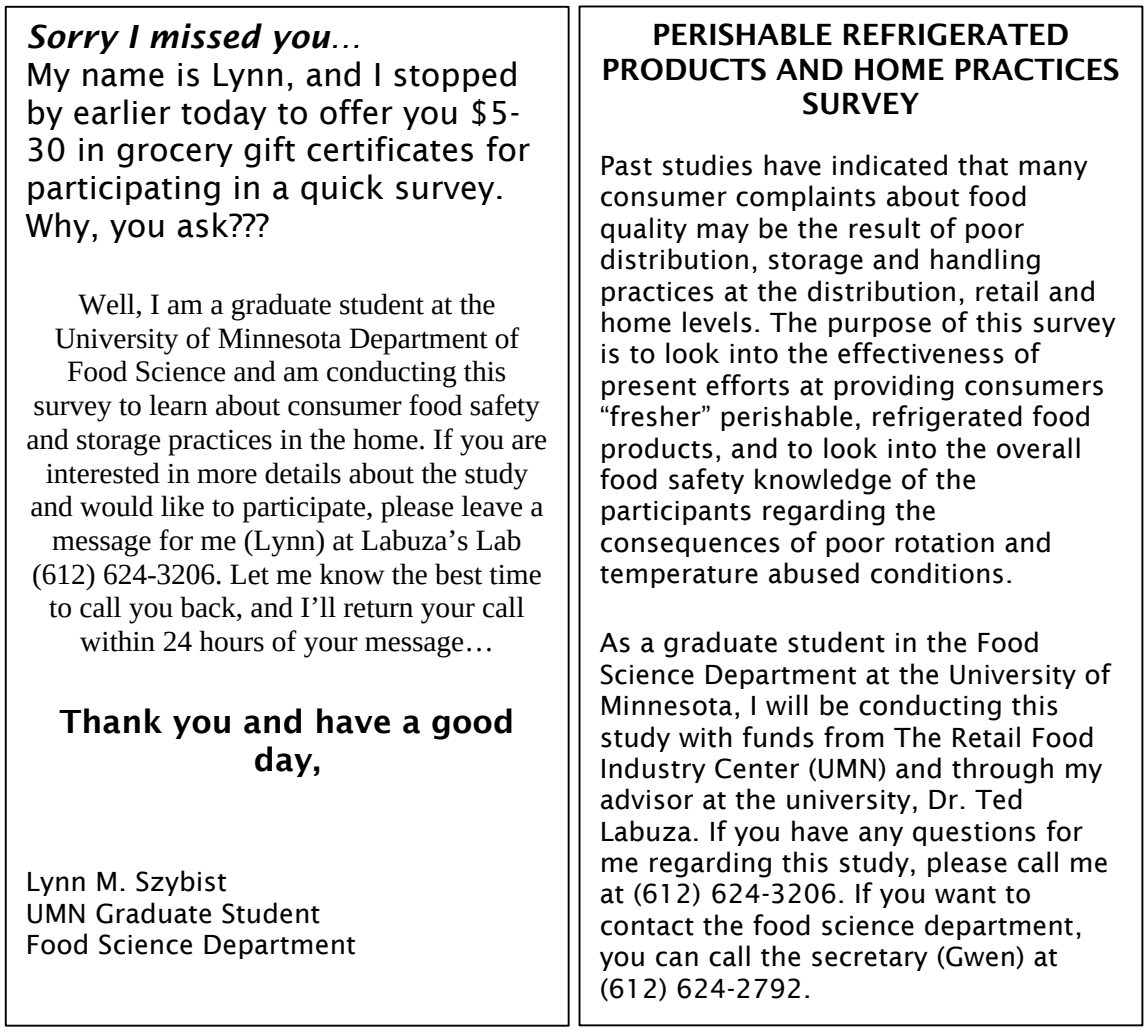
- Open dates
- Time-temperature integrators (TTI's)
- Proper home food handling techniques
- Refrigerator rotation techniques

Results from this study demonstrated a continuing lack of knowledge by the consumer concerning open dates, current events regarding food safety, and home food safety techniques. Such results support the need for more consumer-friendly open dating legislation.

Study Design

A two-part, door-to-door survey was conducted in a primarily middle-upperclass neighborhood. The participants were selected randomly because of their proximity of residence to the Silver Lake Cub Foods store, which was using the 3M TTI on its ground beef and prepackaged hamburger products. Most homes in this survey were within two to five miles of the grocery store.

The principal investigator (PI) was accompanied by a second person at all times to ensure her safety while conducting the survey. The second person, who was always a female, was to wait outside the participants' homes and to carry the gift certificates and hand-outs.



Sorry I missed you…
My name is Lynn, and I stopped by earlier today to offer you $5-30 in grocery gift certificates for participating in a quick survey. Why, you ask???

Well, I am a graduate student at the University of Minnesota Department of Food Science and am conducting this survey to learn about consumer food safety and storage practices in the home. If you are interested in more details about the study and would like to participate, please leave a message for me (Lynn) at Labuza's Lab (612) 624-3206. Let me know the best time to call you back, and I'll return your call within 24 hours of your message…

Thank you and have a good day,

Lynn M. Szybist
UMN Graduate Student
Food Science Department

PERISHABLE REFRIGERATED PRODUCTS AND HOME PRACTICES SURVEY

Past studies have indicated that many consumer complaints about food quality may be the result of poor distribution, storage and handling practices at the distribution, retail and home levels. The purpose of this survey is to look into the effectiveness of present efforts at providing consumers "fresher" perishable, refrigerated food products, and to look into the overall food safety knowledge of the participants regarding the consequences of poor rotation and temperature abused conditions.

As a graduate student in the Food Science Department at the University of Minnesota, I will be conducting this study with funds from The Retail Food Industry Center (UMN) and through my advisor at the university, Dr. Ted Labuza. If you have any questions for me regarding this study, please call me at (612) 624-3206. If you want to contact the food science department, you can call the secretary (Gwen) at (612) 624-2792.

Figure 1. "Sorry I missed you" hand-out
Figure 2. "Perishable Refrigerated Products and Home Practices Survey" hand-out (Both hand-outs were reformatted to fit the allotted amount of space.)

When the surveyors came to a home where nobody answered the door, they would leave a bright orange hand-out entitled "Sorry I Missed You…" (Figure 1). If potential participants were busy or wanted additional information before participating in the survey, they were given a bright yellow hand-out entitled "Perishable Refrigerated Products and Home Practices Survey" (Figure 2).

Part I of the survey was completed by participants in the presence of the PI. Participants then received a $5 Cub Foods gift certificate and were given the option of participating in Part II of the survey. Part II required respondents to record their perishable refrigerated food purchases for 2-2 ½ weeks. As an incentive, a $25 Cub Foods gift certificate was offered upon completion. All names and addresses of participants were recorded and signatures were collected after they received their gift certificates.

Prior to conducting this survey, pilot testing was conducted on a random basis to ensure participants' understanding of the questions and to access the time necessary to complete Part I of the survey. The study design and written materials were then submitted and approved by the University of Minnesota Committee on Human Subjects in Research.

CHAPTER 2. SURVEY PART I

From June 9, 1999 through July 7, 1999, 101 consumers participated in Part I of the survey. After the PI introduced herself and briefly explained the survey (Appendix A), potential participants were asked to read and sign a consent form (Appendix B) before filling-in the actual survey (Appendix C). The survey was estimated to take approximately 15 minutes to complete. After the participants completed the survey, the PI entered the participants' homes to record the temperature and model of their refrigerator. The participant was also given the option to record this information him/ herself if (s)he did not feel comfortable inviting the PI into his/ her home.

When conducting the survey, the method of administration was altered based on feedback from the prospective participants. For example, in the original script, consumers were immediately informed that they would receive a gift certificate in return for filling-out the survey. While this approach may have attracted student participation, many homeowners immediately thought the researchers were trying to sell something in return. Most homeowners seemed to be more responsive when the PI introduced the survey in terms of research being conducted at the University of Minnesota and stating lastly that a gift certificate would be given in return for their time. On days when the surveyors wore white, several participants also commented that they initially assumed that they were representing a religious group.

In regards to the time participants' actually spent taking the survey, respondents took longer than originally expected. Each survey, including refrigerator temperature measurements, took an average of 25 minutes to complete. The range was about 20-45 minutes per household.

The data from these surveys were initially coded and entered into Excel 4.0 (Appendix D). The data was then transferred into Statistical Package for the Social Sciences (SPSS) for statistical analysis.

Sample Population

Data was organized regarding demographic characteristics of the sample population. Compared to the 1994 Continuing Survey of Food Intake by Individuals and 1990 Census data (Table 1) which report 51.1% and 51.3% of the U.S. population to be female, 65% of the participants in this survey were women (Figure 3) and between the ages of 35-54 years old (Figure 4). An impressive 91% of the participants had some degree of schooling beyond high school (Figure 5) verses the nation's average of 46% (CSFII-1994) and 45% (1990 Census) of all U.S. adults. It was decided that asking for the participants' household income would be awkward since the PI was entering their homes, but estimated figures are given in Table 1. From visual observation most of those surveyed were Caucasian. Almost 89% of the participants often or always did the grocery shopping in their homes (Figure 6).

	CSFII- 1994	1990 Census
HOUSEHOLD INCOME	$40,440	43,133
Northeast (19.8%)	41,343	47,938
Midwest (23.6%)	41,023	41,597
South (34.6%)	37,738	39,987
West (22.0%)	43,249	45,595
SEX		
Female	51.1%	51.3%
Male	48.9%	48.7%
EDUCATION		
< High School	16.3%	18.3%
High School or GED	25.2%	22.4%
1-3 Years College	16.9%	19.9%
4 Years College	8.5%	9.1%
5 or More Years College	9.3%	4.7%
Child or not asked	23.6%	22.7%

(Carlson et al., 1998)

Table 1. Summary statistics of data set (average)

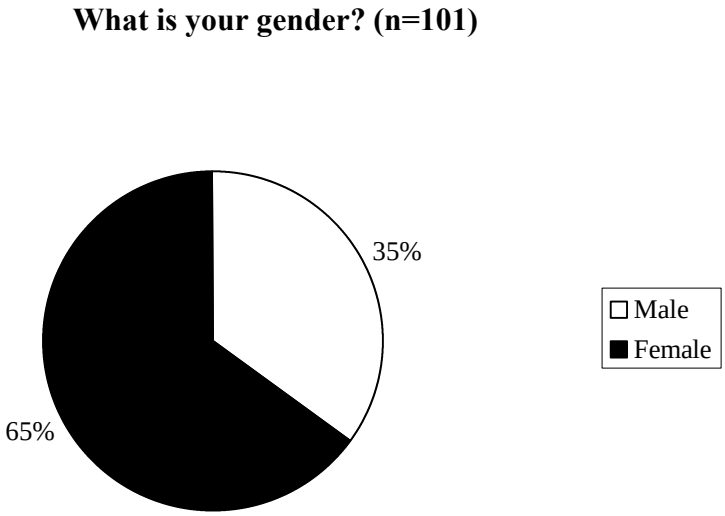


Figure 3. The sample population according to gender

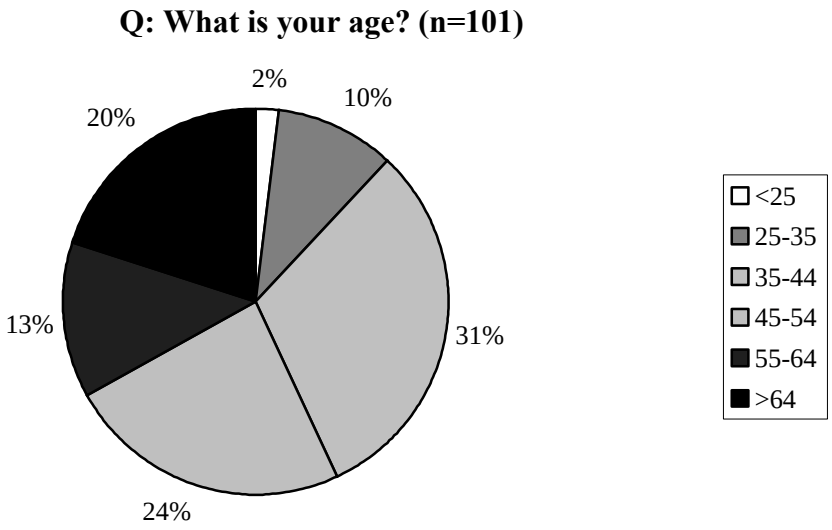


Figure 4. The sample population according to age

Q: Which category reflects your education? (n=101)

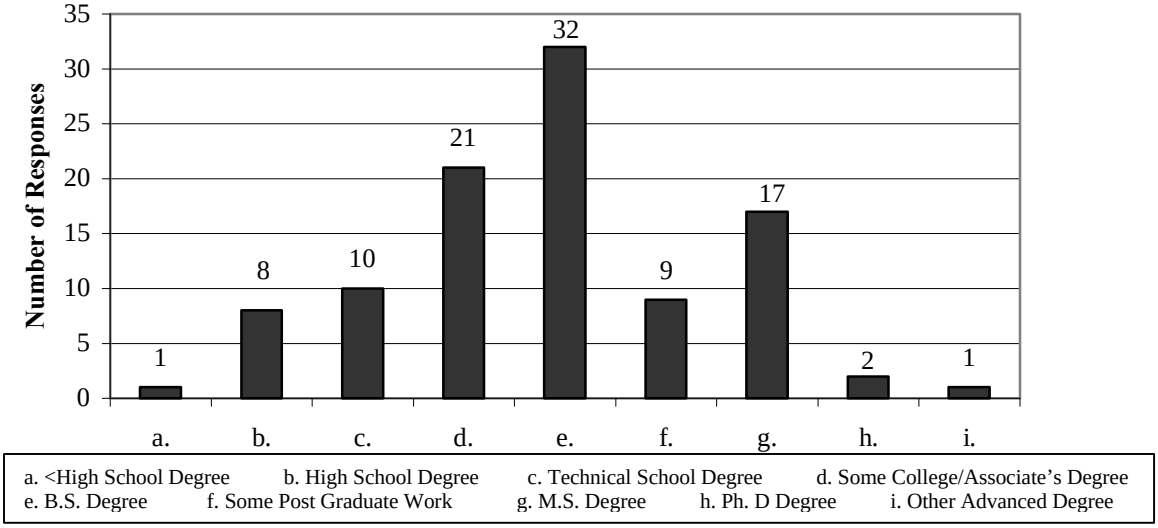


Figure 5. The sample population according to highest level of education

Q: How often do you do the grocery shopping for yourself/ your household? (n=100)

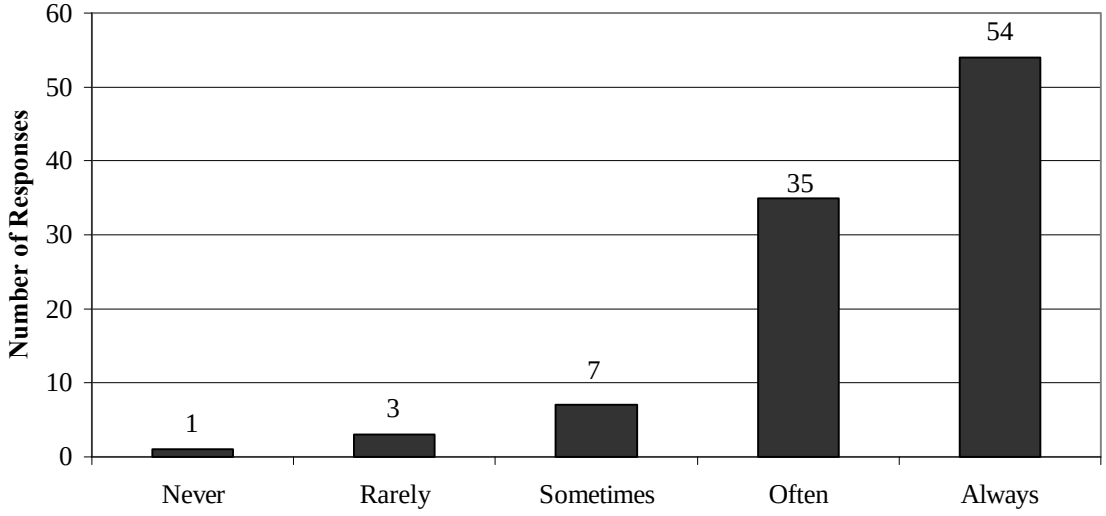


Figure 6. The sample population according to grocery shopping frequency

Results Concerning Basic Food Safety Practices and Knowledge

The first section of the survey was concerned with the participants' practices and knowledge concerning food safety. The results in this survey were compared to results from two extensive food safety surveys conducted in 1997 (Appendix E) and 1999 (Appendix F) by Audits International (Anonymous, 1997a; Anonymous, 1999a). The purpose of the Audits International studies were as follows: (1) to demonstrate the lack of food safety practices in consumers' homes in order to raise public awareness, (2) to personalize individuals' inadequate home food safety practices, (3) and to encourage more and better home food safety programs.

The 1997 Audits International Survey evaluated the practices of 106 households. Their observations included meal preparation, service, post-meal cleanup and leftover storage practices. The surveyors in that study recorded the participants' violations as major (not likely to cause foodborne illness but are often considered as a contributing factor) or critical (can potentially lead to a foodborne illness or injury). Ninety-six percent of the observed households in the 1997 study performed at least one critical violation (Anonymous, 1997a). Based on Audits International standards, overall less than 1% of the households met the minimal criteria for acceptable performance.

To compare the performances in 1997 with the more current study in 1999, the 1997 results were reviewed and gauged against the updated Audits International food safety standards. After modifications were made, households meeting the acceptable performance level in 1997 went from less than 1% to 4%.

In 1999, the food safety auditors not only looked at the food safety practices of the participants but also attempted to resolve whether the deficiencies in consumers' food safety practices stemmed from a lack of motivation or a lack of knowledge. One hundred and twenty-

one households were audited, and unlike the 1997 survey, the consumers were also asked to answer 4-6 questions regarding food safety knowledge. The overall results from the 1999 survey found that only 69% of the households performed a critical violation, and the overall percentage of acceptable performance was 26%. When a critical violation occurred, the follow-up questions revealed that it was usually a result of "lack of knowledge" (62%) rather than from a "perceived

onymous, 1999a). While the 1999 Audits International Survey demonstrated an increase in consumers' food safety knowledge compared to the 1997 survey, both studies still prove that there is much need for improvement.

Refrigerator Temperature

In this study, participants were first asked what they thought the average temperature of refrigerated foods should be. As shown in Figure 7, about three-fourths of the participants knew that the correct answer was 40°F. At 20-30°F (which 18 participants chose), the foods would freeze, and 50°F (as selected by five individuals) is dangerously high.

In the Audits International Surveys, approximately 65% (1997) and 32% (1999) of the participants were cited for violating the recommended maximum refrigerator temperature. Participants were given a major violation if their refrigerators ranged between 42-45°F and a critical violation for temperatures greater than 45°F. Using the same parameters, the participants' refrigerator temperatures were recorded in this study using an Atkins Digital Microprocessor Thermocouple Thermometer with Connected Probe (Series 330). Temperature measurements were taken where the milk or an alternative beverage was stored. After placing the thermometer probe under the chosen beverage, the refrigerator door was shut and the temperature reading was taken after approximately two minutes or longer.

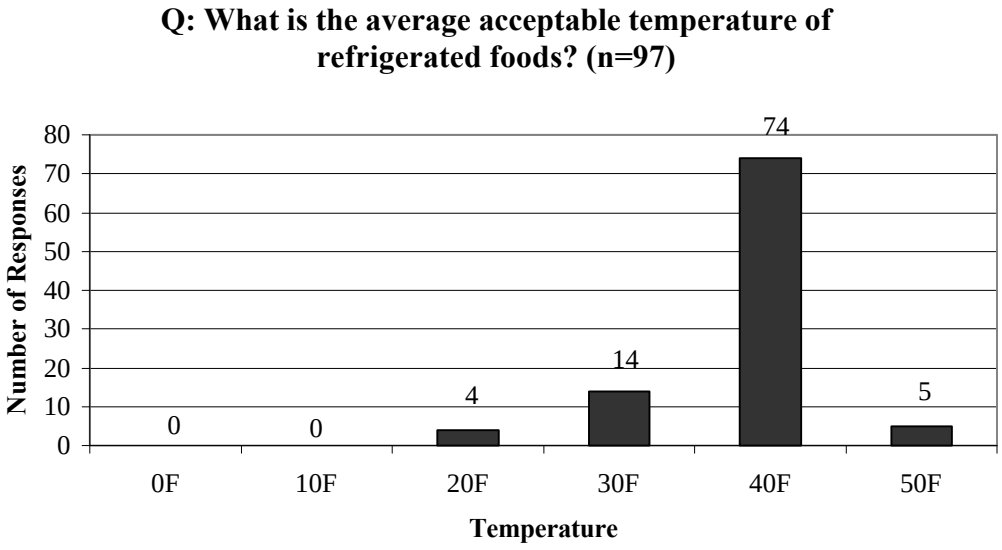


Figure 7. Consumer responses as to the average acceptable temperature of refrigerated foods

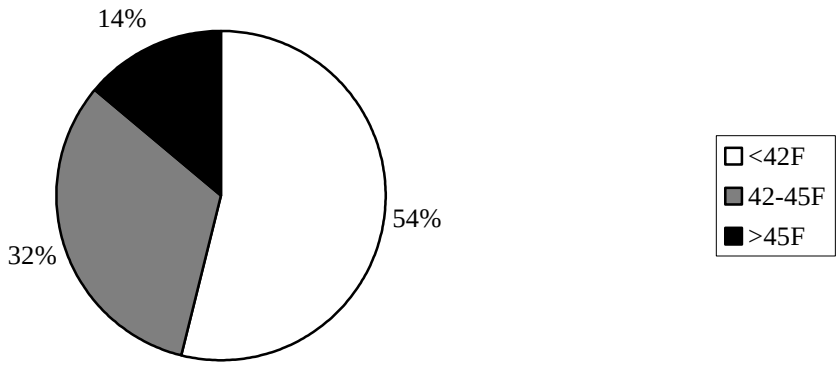


Figure 8. Participant refrigerator temperature results divided into categories of acceptable (<42°F), unacceptable (42-45°F), and dangerously unacceptable

The measurements ranged from 35°F to 54.9°F with a mean temperature of 41.9°F. The average temperature measured in this survey was just lower than the 43°F average reported by Audits International in a 1989 survey (Audits International, 1990).

Despite the fact that most consumers knew the temperature should be about 40°F, 46% of the participants' refrigerators were at an unacceptable temperature (Figure 8). This is better than the 1997 Audits International Survey results but still alarming. Thirty-two percent of the participants kept their refrigerators between the unacceptable range of 42-45°F, a major violation, while 14% of the refrigerators were dangerously high at above 45°F, a critical violation according to the Audits International Report.

When asked about the significance of proper temperature control, 92% of the participants strongly agreed or agreed that keeping his/ her refrigerator at the recommended temperature was important. Figure 9 shows that the most important reason for temperature control was "To prevent foodborne diseases"(82%). "Keeps foods longer (maintain quality)" was the second most important reason (67%), and "Tastes better" was least important (81%).

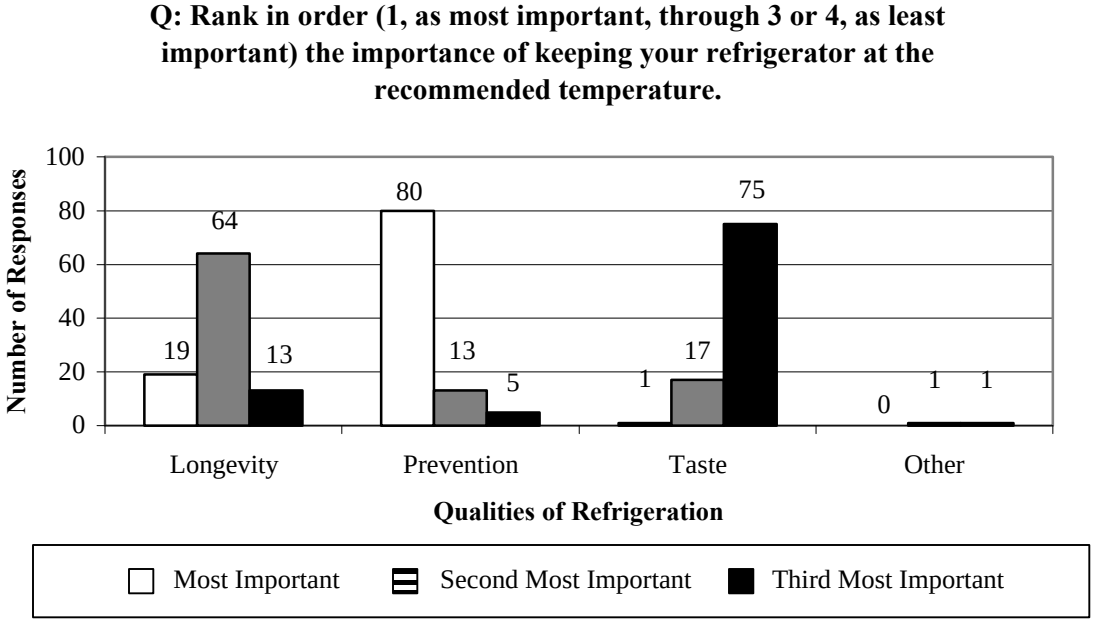


Figure 9. Consumer responses as to the importance of proper refrigerator temperatures

Other reasons for keeping their refrigerator at the recommended temperature included preserving the color of the food, preventing food waste, and decreasing the smell or odor of foods.

In a Nabisco Foods Co. study concerning ingredient and food storage, it was concluded that most homeowners were not aware of the importance of proper refrigeration and the effects of temperature abuse on food (Beard III, 1991). In that study, seven out of 14 homes had refrigerator thermometers, and temperatures ranged from 32-55°F. Only one freezer in 11 had a thermometer, and overall temperatures ranged from 5-20°F. In this study, only eight out of 101 household refrigerators were equipped with a thermometer. A sparse seven out of 97 homes had a thermometer in their freezer. The freezer temperatures according to the consumers' thermometers ranged from –5°F to 31.2°F. The average age of the refrigerators in this study was 8.9 years, ranging from 3 months to 35 years old. From visual observations of the completed surveys, there was not a significant correlation between the age of the refrigerator and proper temperature conditions.

Refrigerated Foods and Recommended Temperature Information on Labels

In an in-store study by Labuza and Szybist (1999), several refrigerated foods were noted to contain recommended storage temperatures on their labels. Table 2 shows an example of open dates with temperature information on flavored dip products. The recommended temperature on the Old Home's dip products may be confusing for the consumer because in this case, very similar products of the same size were labeled with two different recommended temperature ranges. In one example, the printed temperature range spans over 11°F.

When participants in this survey were asked how often they read the labels on refrigerated food products, 59% of the participants never or rarely read the labels and 25% said they sometimes do. Many people commented that they had never seen a temperature mentioned on the label of refrigerated products. When asked if the recommended temperature would affect where they store such products, almost 70% of the consumers said that they would stick the product in their refrigerator wherever it fits, regardless if they had read the label or not.

FLAVORED DIPS		
Product & Address	***Open Date***	***Printed Dates***
(12 oz) **Gourmet Award Blue Cheese Dip & Dressing** Gourmet Award Foods St. Paul, MN 55114	When properly refrigerated between 33 & 40 this product will retain its wholesomeness for one week beyond date on carton.	6 22
(8 oz) **Old Home's Pride** (Various Flavors) **Dip** Old Home Foods, Inc. St. Paul, MN 55103	Quality assured 7 days beyond date on bottom if properly refrigerated (33-44).	June 2, 1998 to June 30, 1998
(8 oz) **Old Home's Pride** (Various Flavors) **Snack Dip** Old Home Foods, Inc. St. Paul, MN 55103	Quality assured 7 days beyond date on bottom if properly refrigerated (40-44).	June 25, 1998 to July 9, 1998

(Labuza and Szybist, 1999)

Table 2. Current open dating practices on flavored dip containers
(Collected on 5/ 31/ 98)

Recent Food Recalls

In the past two years there have been a number of major food recalls that have received widespread media attention. Participants were asked how familiar they were with these events and whether or not they effected their buying habits.

In 1997, Hudson Foods recalled 25 million pounds of ground beef nationwide with suspected *E. coli* O157:H7 contamination (Anonymous, 1997b). In the beginning of 1999, 21 deaths (15 adults and 6 miscarriages/ stillbirths) were linked to ready-to-eat meat products from Bil Mar Foods, the meat division of the Sara Lee Corp, that were contaminated with *Listeria monocytogenes* (CDC, 1999).

Regarding these meat recalls, 64% of consumers were fairly familiar with the events (Figure 10). According to Figure 11, the recalls affected the buying habits of 53 of the consumers. Out of those 53 consumers, 22 respondents stated that they avoided the recalled products for about one to two months, and another 22 participants still do not purchase them. On the other hand, 14% of all of the respondents stated that they were not afraid of contamination. "Other" comments regarding consumer buying habits spanned from "No, I think it was a bit blown out of proportion" to "I became vegetarian".

Q: ...How familiar are you with these events (Hudson ground beef and Sara Lee Corp ready-to-eat meat recalls) from the media...? (n=101)

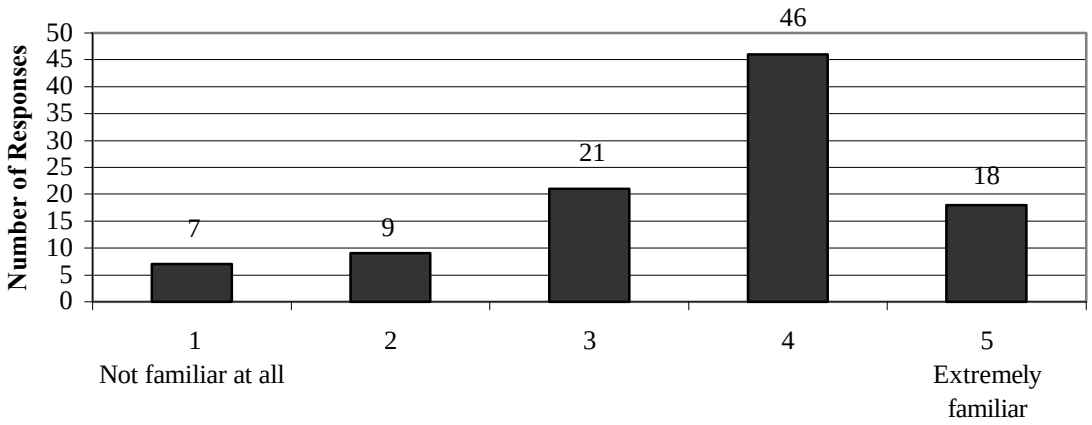


Figure 10. Consumer familiarity with the recent meat recalls

Q: Did such events effect your buying habits in the meat department? (n=101)

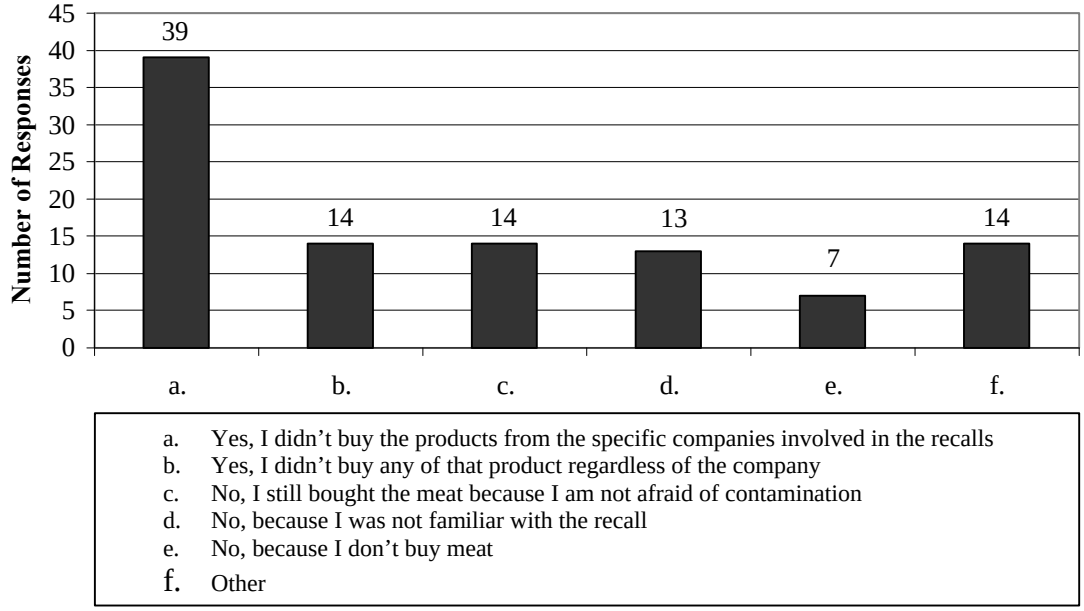


Figure 11. The effect of the meat recalls on consumer buying habits

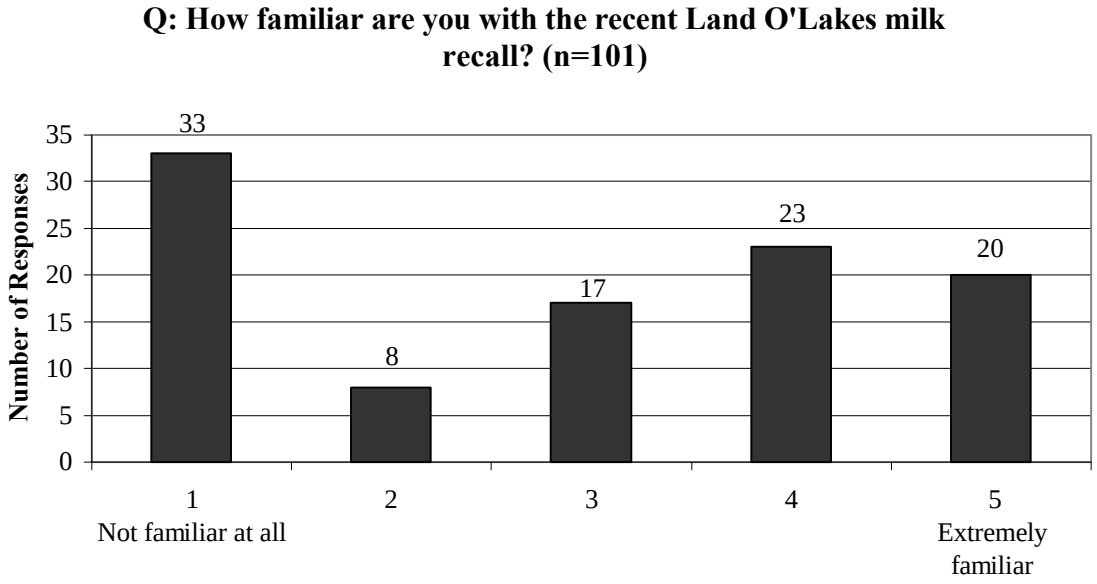


Figure 12. Consumer familiarity with the recent Land O'Lakes milk recall

In February of 1999, a major recall in a local company, Land O'Lakes, affected Minnesota along with seven other states. On February 10 and 11, the Land O'Lakes Company recalled 10 oz. cartons of milk because of possible *Listeria monocytogenes* contamination (Anonymous, 1999b), the same bacteria involved in the Bil Mar Foods recall.

The financial losses were minimal compared to the meat recalls and fortunately there were no reported illnesses or injuries in this incident. Still 58% of respondents were somewhat to extremely familiar with the recall (Figure 12). In this case, only 10% of the consumers stated that they avoided the recalled product for one to two months. Despite being somewhat familiar with the recall, 20% of consumers never avoided it at all.

Q: How often do you thaw your meat in the following ways? (Check a box in each row, i-v)

	Never	Rarely	Sometimes	Often	Always
i. In the refrigerator, the night before use (n=96)	6	18	33	**37**	6
ii. In the microwave (n=95)	17	18	**33**	30	3
iii. On the countertop the day of use (n=91)	**32**	26	28	14	0
iv. In the sink submerged in water (n=92)	**44**	38	14	4	0
v. In the sink submerged in running water(n=90)	**61**	24	13	1	0
vi. What are other ways you've done it?					

Table 3. The percentage of consumer responses regarding meat thawing practices (The most common answer in each row is in boldface.)

Meat Preparation

When asked about meat preparation (including beef, pork, chicken and/ or fish), 81% of participants responded that they prepare meat often (62%) or extremely often (19%). The consumers were then asked about their meat thawing habits. According to Audits International (Anonymous, 1997a; Anonymous, 1999a), there are four ways to properly thaw meats:

1. In the refrigerator
2. Under running drinkable water at 70°F or lower within two hours
3. As part of the cooking process
4. In a microwave (followed by immediate cooking)

In this study, the meat thawing practice of "in the refrigerator, the night before use" was the most common method, followed by thawing foods in the microwave. Some participants also mentioned that they thaw the meat as part of the cooking process. However, approximately 42% of respondents sometimes or often thaw their meats on the countertop the day of use.

Such a practice is strongly discouraged because many food pathogens thrive at room temperature. Consumers also thawed their meat more often in just water rather than in cool running water (Table 3).

Results Concerning TTI's and Ground Beef

As shown in Figure 13, almost 85% of the respondents prepared ground beef at least every other week. While most people look and smell the ground beef to test its freshness/ safety, very few consumers actually test the internal temperature with a thermometer (Table 4), which is the most effective household way to guarantee its safety. For ground beef products, the meat must be heated to an internal temperature of 155°F for no less than 15 seconds to ensure that pathogens, which are invisible to the naked eye, are destroyed (Anonymous, 1997a).

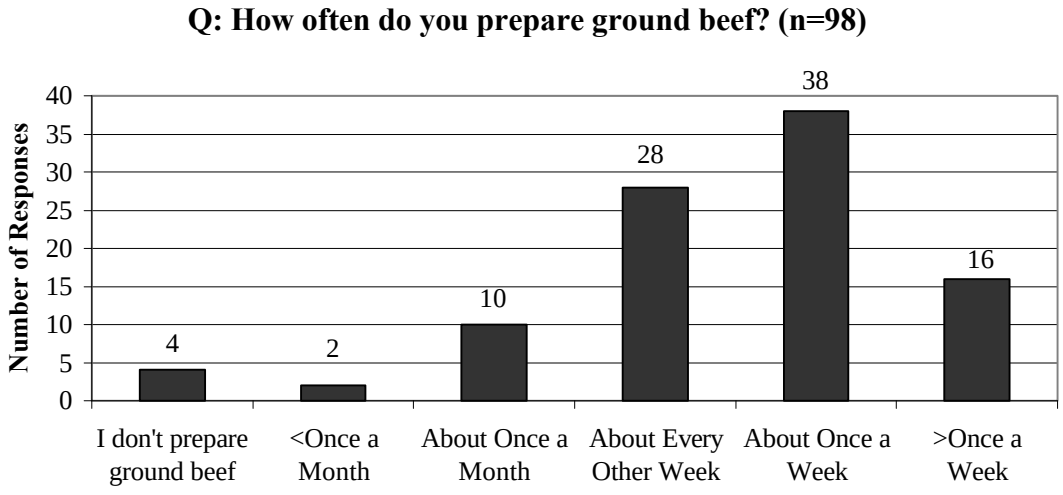


Figure 13. Consumer responses as to their frequency of ground beef preparation

Q: How often do YOU test the safety or freshness of your ground beef in the following ways? (Check a box in each row, i-v)

	Never	Rarely	Sometimes	Often	Always
i. By smelling it (n=95)	6	10	**31**	30	24
ii. By looking at it (n=95)	7	3	23	**37**	30
iii.Use a thermometer to test the internal temperature to 160°F when cooked (n=90)	**77**	11	6	4	2
iv. Rely on the date given on the package (n=94)	14	6	21	**36**	22
v. Don't worry about. Trust that it's safe. (n=85)	**55**	11	19	13	2

Table 4. The percentage of consumer responses regarding practices used to test the safety or freshness of ground beef (The most common answer in each row is in boldface.)

Q: Have you bought any ground beef in the past month where the freshness of the product was questionable? (n=98)

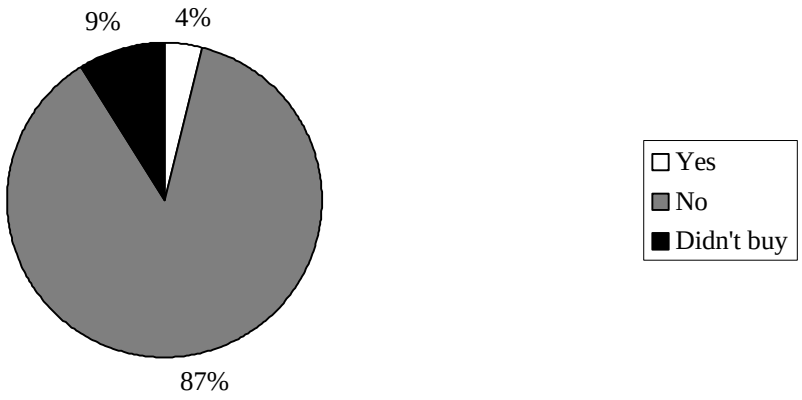


Figure 14. Consumer responses as to the freshness of recent ground beef purchases

Also, while many participants stated that they rely on the open date as a measure of safety or freshness, most of them do not rely that the ground beef product is going to be safe when they purchase it (Table 4). This is in spite of the fact that 87% of the consumers did not purchase any ground beef in the past month where the freshness of the product was questionable (Figure 14).

The "freshness" and safety of ground beef is not only determined by the age of the product but also by the temperature history to which it is exposed. In November of 1998, the Cub Foods store near the location of the survey began implementing the 3M time-temperature integrators on some of the ground beef products. Signs and informative pamphlets were displayed adjacent to the meat cases to educate the consumer about the tags. The device had also been featured in the local newspaper and both local and national television news stories. A picture and a brief description of a TTI were printed directly onto the survey (Figure 15).

The Fresh Test is a device that looks like a label and is placed on a food package. The "label" changes color over time to indicate abusive (improper) temperature conditions or indicate the end of the product's shelf-life.

Figure 15. Picture and description of the 3M TTI as represented to the survey participants

Despite the media attention and in-store advertisements, 76% of the consumers had never seen the TTI's at the supermarket (Figure 16), and the same percentage was not familiar with the device at all (Figure 17). However, after explaining the purpose and function of the tags, all of the consumers believed that the device could be somewhat to extremely useful (Figure 18).

A few of the participants were slightly more skeptical when they were asked if they thought such a device was dependable (Figure 19). Several people commented that the device was probably dependable, though, because it was made by 3M, a local company.

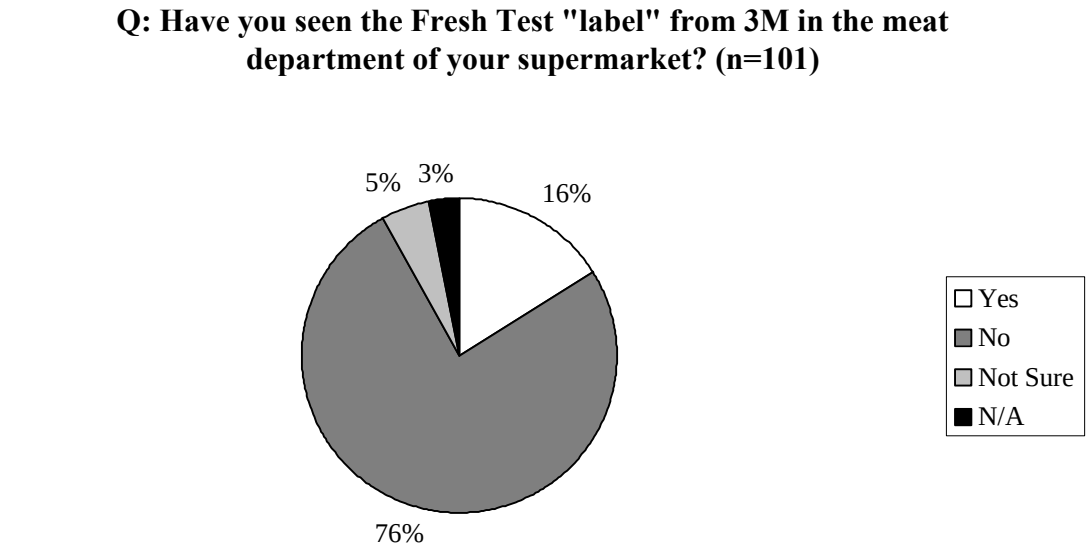


Figure 16. Consumer responses regarding whether or not they had seen TTI's in their supermarket

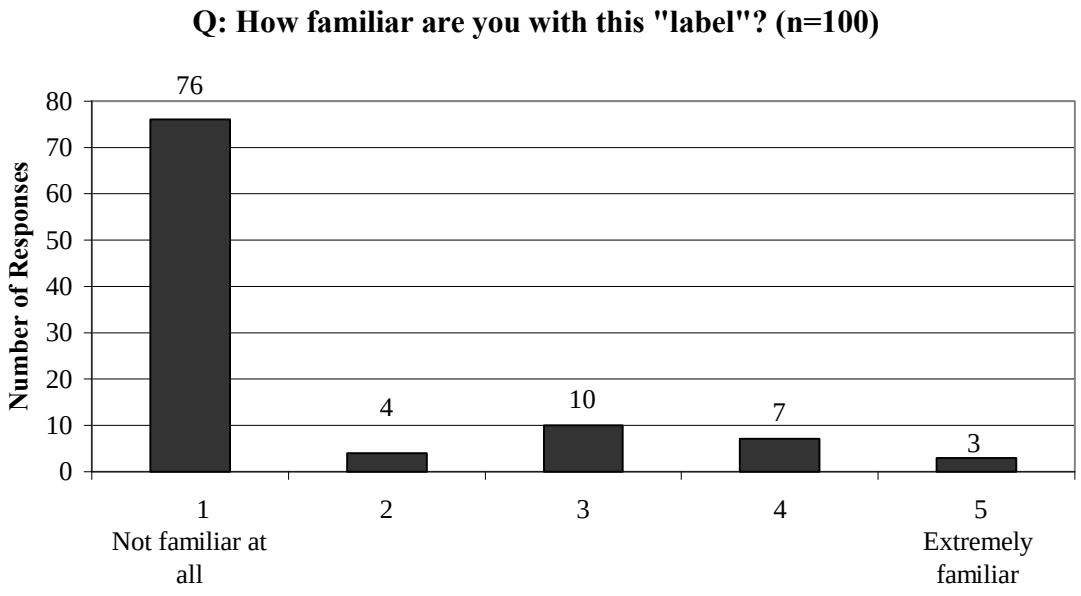


Figure 17. Consumer responses as to their familiarity of TTI's

Q: ...Do you believe that such a device can be useful? (n=100)

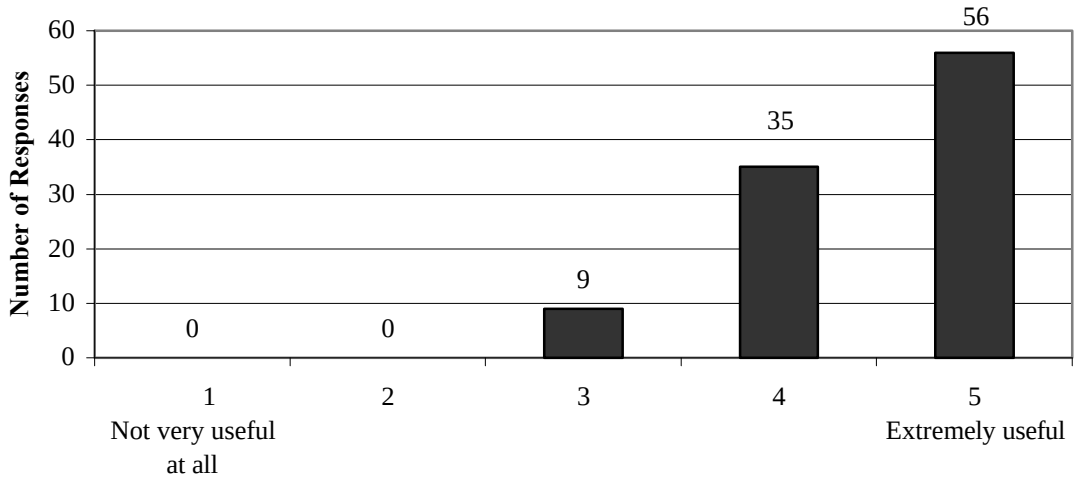


Figure 18. Consumer responses as to the usefulness of TTI's

Q: Do you think that this device is dependable? (n=99)

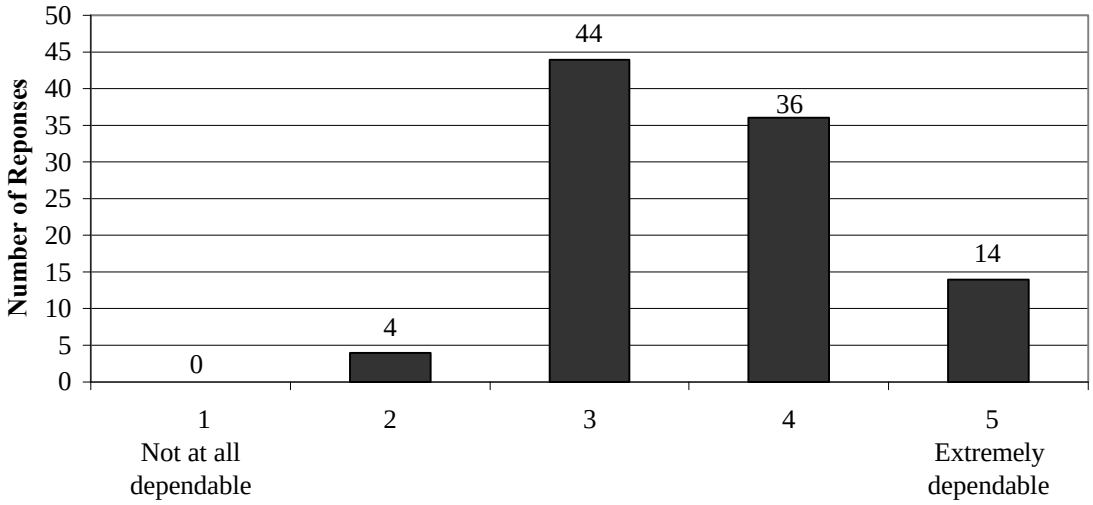


Figure 19. Consumer responses as to the dependability of TTI's

Results Concerning Open Dates

The final questions of the survey concentrated on consumers' use and understanding of open dates. As shown in Figure 20, all of the participants in this survey claimed to look at the open dates on refrigerated products to some extent.

Table 5 shows that in this survey, milk was the product that consumers most often checked for an open date. Many respondents stated that for all of the refrigerated products listed, they always checked for an open date.

In a 1971 study, 62% of 628 people in the survey stated that they sometimes sort through packages to find the freshest product. From that same group, 74% claimed that while sorting through dated products, they would usually find some products that were fresher than others (Anonymous, 1971). The current study found that 81% of participants (n=99) sometimes, often, or always sorted through products to find the package with the longest number of days left according to its given date (Figure 21).

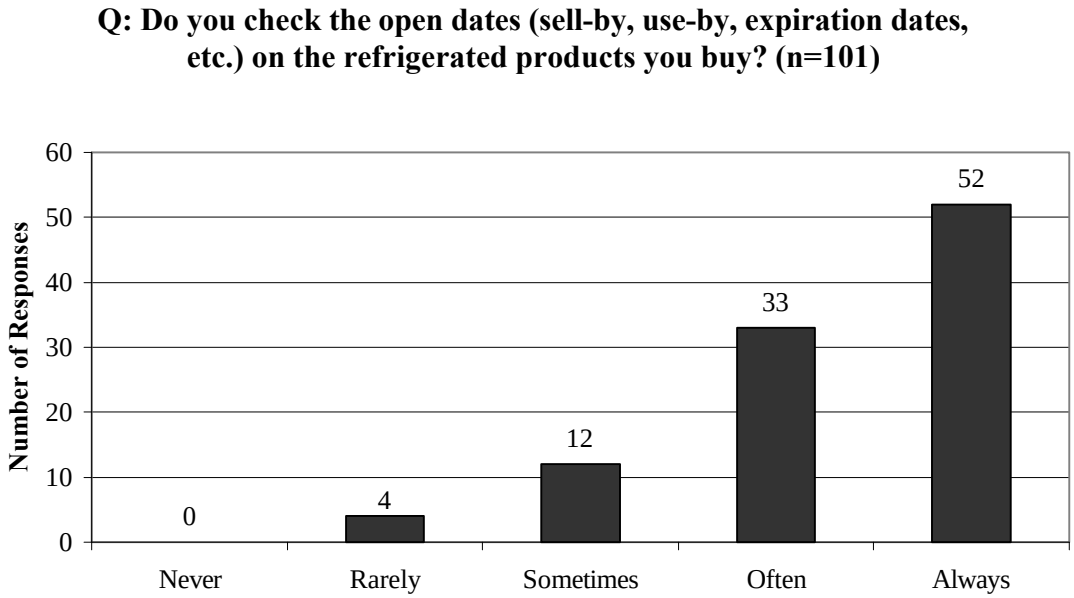


Figure 20. Consumer responses as to their frequency of checking for open dates

Q: How often do you check the open date on the following refrigerated products? (Check a box in each row, i-vi)

	Never	Rarely	Sometimes	Often	Always	I don't buy this product
i. Milk (n=100)	3	4	8	17	**66**	2
ii. Orange Juice (n=100)	8	11	14	15	**42**	10
iii. Ground Beef (n=100)	5	8	12	16	**51**	8
iv. Yogurt (n=99)	2	7	9	17	**44**	20
v. Pre-cut salads and vegetables (n=100)	8	12	14	10	**45**	11
vi. Eggs (n=99)	13	18	15	10	**40**	3

Table 5. The percentage of consumer responses regarding use of open dates on particular food items (The most common answer in each row is in boldface.)

Q: Do you sort through refrigerated products at the grocery store to find the product with the longest number of days left according to its given date? (n=99)

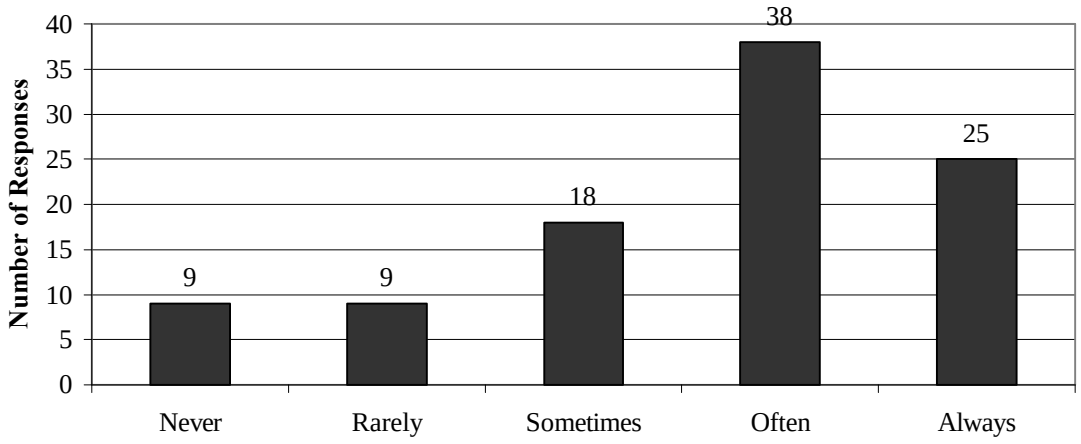


Figure 21. Consumer responses as to their frequency of sorting through open dated products

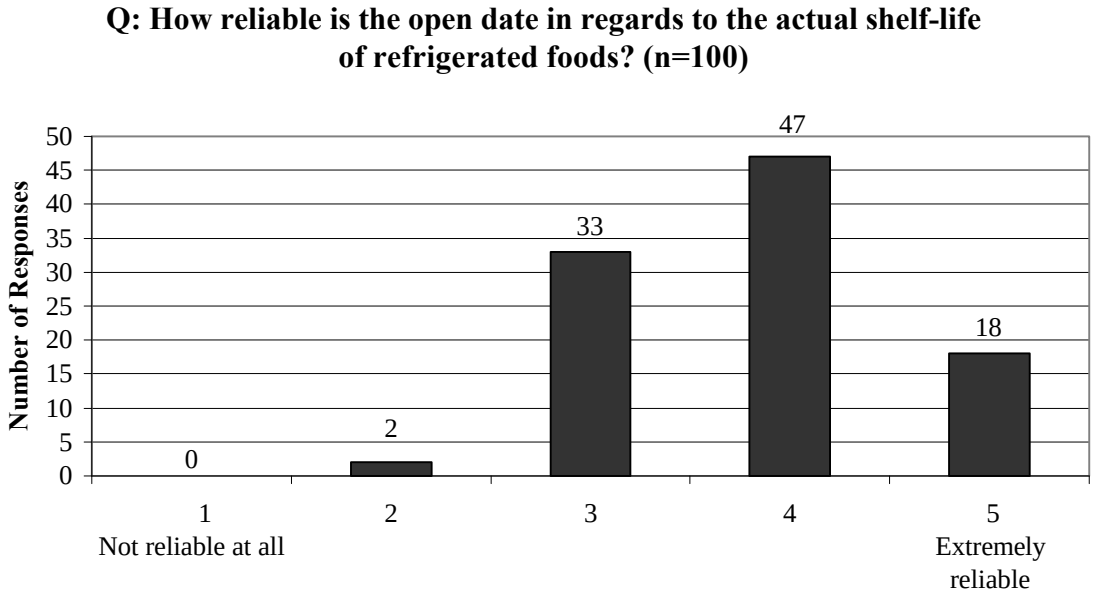


Figure 22. Consumer responses as to the reliability of open dates

Concerning the reliability of open dates (Figure 22), 65% thought that the date was reliable or extremely reliable, and another 33% thought the date was somewhat reliable. This is in spite of the fact that within the past 12 months, at least 36% of the consumers had purchased refrigerated foods, especially pre-cut salads and vegetables, that had spoiled before the open date (Table 6).

Q: In the past 12 months, have you purchased any of the following foods and noticed that it spoiled before the open date? (Check a box in each row, i-iv)

	Yes	No	Didn't notice or consider the date	Didn't purchase
i. Milk (n=98)	12	**82**	2	4
ii. Orange Juice (n=99)	2	**83**	6	9
iii. Ground Beef (n=98)	4	**84**	3	9
iv. Yogurt (n=97)	7	**70**	2	20
v. Pre-cut salads and vegetables (n=97)	19	**67**	3	11
vi. Eggs (n=98)	2	**85**	7	6

Table 6. The percentage of consumer responses regarding foods spoiling prior to their open date (The most common answer in each row is in boldface.)

Q: For each of the following columns (milk, breakfast cereal, and ground beef), please mark the one answer that best represents the date on its package. (Answer i-iii)

	i. MILK (n=98)	ii. BREAKFAST CEREAL (n=98)	iii. GROUND BEEF (n=98)
When it was packaged…	6 (9)	16 (8)	12 **(34)***
Last day it should be sold…	**49 (74)***	27 **(35)**	**43** (31)
Last day it should be used or eaten…	42 (15)	**29** (26)*	35 (31)
Have never noticed a date on a package of this product…	3 (2)	**29** (31)	10 (26)

Numbers in parentheses represents 1979 OTA results. * Asterisks represent the "correct" answer

Table 7. The percentage of consumer responses regarding the meaning of open dates on particular food products (The most common answer in each row is in boldface.)

The Office of Technology Assessment (OTA) is the research branch of the U.S. Congress committed to developing background papers. In 1979 they published their report examining the effects and feasibility of a mandatory open dating legislation. The questions shown in Table 7 come from the 1979 study and were used in the present study.

Just as in 1979, about a third of the respondents still did not even realize that breakfast cereals were dated. In regards to the ground beef, the OTA study claims that the date referred to the day meat was packaged. However, after observations were made at four of the major grocery stores in the area (Byerly's, Lunds, CUB and Rainbow), only Byerly's ground beef label represented the day it was packed. The other stores used "sell-by" or "use or freeze-by" dates on their packages. There is also a meat market within New Brighton, MN, which uses only the "sell-by" date. The lack of consistency on dating particular food products, such as ground beef, makes it difficult for the consumer to understand the dates. It also should be noted that ground beef is not required to be dated under Minnesota law, so such practices were voluntary.

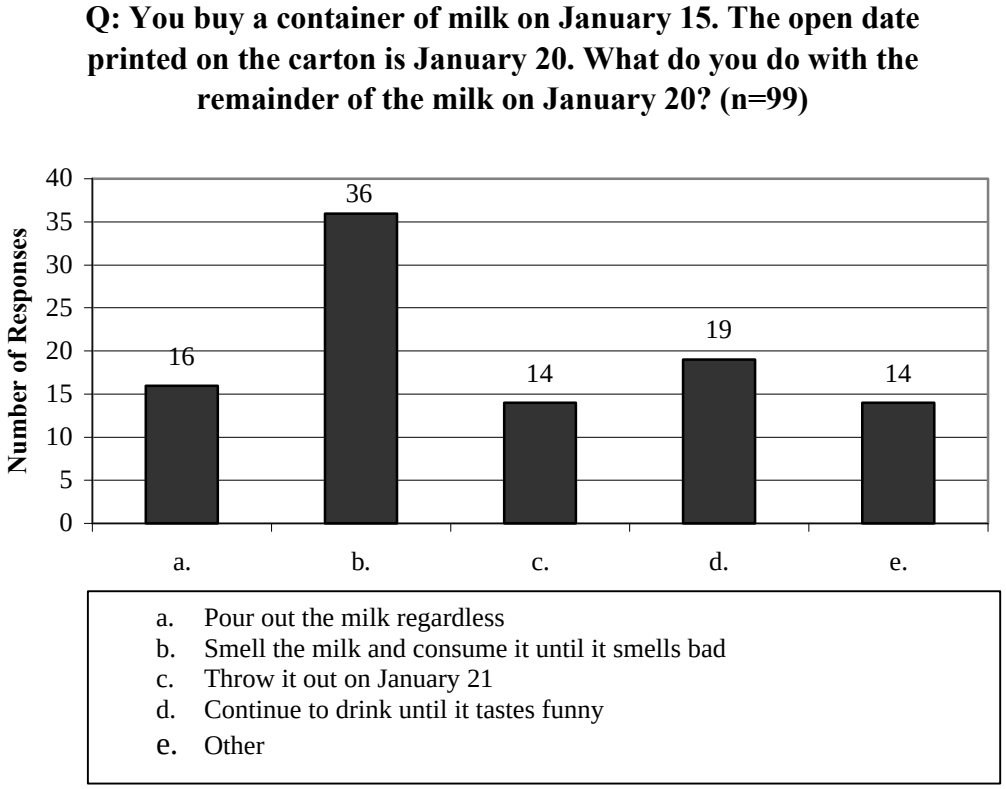


Figure 23. Consumer responses as to their milk storage habits in regards to the open date

Compared to the OTA study, a significantly lower percentage of participants (Table 7) understood the meaning of open dates used on milk containers. This was further evident when consumers were asked about their milk storage habits when the product reached the date on the container. Despite the fact that milk is given a sell-by date (which represents when the product should be sold at the retail level to give consumers an adequate time for home storage before the end of shelf-life), 16% of consumers stated that they would pour out the milk on the date printed on the carton regardless (Figure 23). Another 14% would throw away the milk the next day. Many respondents (about 19%) relied on unfavorable organoleptic changes to determine the

actual end of shelf-life of their milk. “Other” comments included using the milk for cooking after the date had past or that the milk never lasts that long in their households.

Discussion and Conclusion

Similar to the results reported in the Audits International Survey, data in this survey concerning the basic food safety practices and knowledge of the participants were insufficient to ensure against foodborne illnesses at home. Temperature abuse was a major source of potential danger as 46% of the refrigerator temperatures were not at a safe reading, and 42% of the respondents sometimes or always thawed their meat on the countertop. Furthermore, in regards to ground beef preparation, using a thermometer to test cooked meat products was not a common practice in consumers’ homes.

Listeria monocytogenes is another area of concern pertaining to food safety. While a majority of consumers were at least somewhat familiar with the major recent meat and Land O’Lakes recalls, 20% of respondents did not avoid the Land O’Lakes milk product despite the fact that 21 deaths in the Bil Mar Foods (Sara Lee Corp) recall were being reported around the same time and involved the same suspected microbial contamination.

Concerning TTI’s, although most respondents were not familiar with the device, all of the participants believed that it could be somewhat useful. They also thought that it would be dependable to some extent.

Finally, although all of the respondents looked at the open dates to some degree, the misconceptions regarding its meanings continued. Today, fewer people seem to understand the meaning of the open date on milk containers than 20 years ago, despite the fact that it is the product on which consumers most often check for a date. Most consumers believe the date is

somewhat to extremely reliable and 63% of respondents often or always sort through open dated products to find foods with the longest number of days left according to its given date. This is in spite of the fact that 36% of respondents had purchased one of the listed food products within the past year which had spoiled before the given date.

CHAPTER 3. SURVEY PART II

Usually while the participants' refrigerator temperatures were being taken for Part I of this study, the PI would explain Part II. Participants interested in continuing onto the second part of the study were then asked to read and sign a consent form (Appendix G). Part II would begin on the day of that participant's next grocery shopping trip. Before putting their groceries away, participants were asked to record their newly purchased refrigerated perishable food items on the sheet(s) provided (Appendix H), and directions for properly recording the data were provided on the backside of these recording sheets (Appendix I). Data was to be collected for 2-2 ½ weeks. Originally, the study was written to require participants to record their food items for 45 days. In the State of Minnesota, open dates must be printed on perishable products if the food's shelf-life is estimated at 90 days or less. Since 90 days seemed like an unreasonable amount of time to expect participant cooperation, the number of days was cut in half. After pilot testing was conducted by two of this study's contributors, including the PI, two weeks was determined to be a reasonable amount of time to gather the necessary data and keep the interest of the participants. Figuring that the households may not buy groceries and start their data collecting that very day, the PI would come back to collect their data after 2 ½-3 weeks from the initial visit.

There were a total of seven columns to be filled-in. The first five columns asked for the following: (1) "Date of Purchase", the day that the particular food was bought; (2) "(Size) Product Brand & Description", the size of the product as labeled on the package, the product or company name and the common name of the food; (3) "Company Name & Address", which is required by law to be present on the label; (4) "Explanation of Open Date", meaning the actual description of the date such as "sell-by", "use-by", etc.; and (5) the "Printed Date", or the actual

date printed or indented into the package. These columns were to be filled-in by the participants before they put their perishable groceries into the refrigerator.

As the participants ate or discarded a recorded food product, (s)he was to fill-in the last two columns. “Your ‘end’ date” represented the date the food package was discarded. The final column “Your method of ‘End of Product’ (e.g. consumed, threw-out, etc.)” asked the participants to record why they discarded the package. The respondents were asked to record the final information in regards to discarding the package in order to avoid confusion. In some cases, for example, the consumer used a food product in a recipe, e.g. eggs in cake. The PI was interested in how long it took for the whole carton of the eggs to be used and not how long it took to eat the eggs in the cake. As for fresh fruits and vegetables, only dated prepackaged produce were to be recorded. Any food which was frozen for any period of time, e.g. ground beef, was not to be recorded.

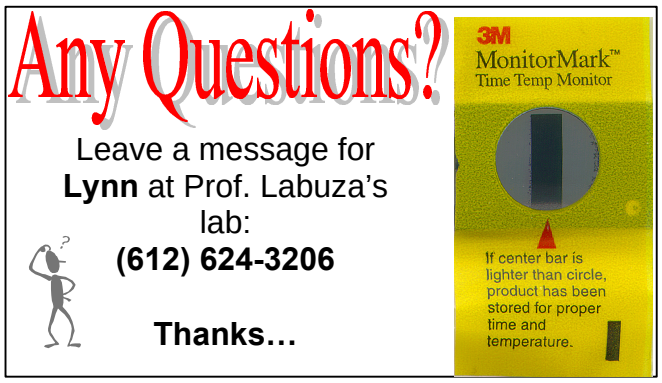


Figure 24. Survey Part II magnet

After this explanation, if the participants were still interested in participating in Part II of the study, they were handed one or more copies of the recording sheet(s) and given a magnet (Figure 24). The magnet provided the name of the PI and the PI's lab phone number where the participants could call in case they had any questions or concerns.

After approximately 2 ½-3 weeks later, the PI returned to the participating households to collect Part II. The PI was not accompanied by a second surveyor at that time because she did not enter the homes. If the participant was home, the PI collected his/ her sheets and asked the participant for a signature in return for the $25 gift certificate. Many homeowners were not present, however, when the PI returned to collect their data. In those cases, the PI would put a short message (Figure 25) with a self-addressed and pre-paid envelope in the participants' mailboxes. After receiving their recording sheets, the $25 gift certificate was sent directly to the households by mail. The data from these surveys were organized and entered into Excel 4.0 for analysis (Appendix J).

Hello…

I came over today to pick-up part II of my survey on refrigerator rotation practices. Please put your papers in the attached stamped envelope and send them to me at my office at the UMN. As soon as I receive your survey, I'll send you the $25 gift certificate.

Thank you for your participation and your help with my research…

Lynn
UMN Food Science Dept.
(w) (612) 624-3206

Figure 25. Letter asking for participants to send in Part II (Document reformatted to fit allotted amount of space.)

Sample Population

The concept for Part II of this survey came from a Nabisco study in 1991 where an inventory study was conducted in 30 households. The goal of this study was to find 50 people to participate in Part II in anticipation that at least 30 of the households would complete the survey over two weeks. Initially, almost all of the participants in Part I of this study were asked to participate in the second part. As the number of participants for Part II increased, though, the PI became more selective and only asked selected participants if they were interested. The selection of participants was generally determined by the participants' level of understanding in Part I and their overall perceived interest in the study.

A total of 54 of the original 101 participants agreed to partake in Part II of the study. By August 1, 45 participants had completed Part II. Eight of the surveys were unusable, leaving a total of 37 surveys to analyze. From these 37 households, demographic information was collected. As shown in Figures 26 to 29, the sample population participating in Part II was representative of the overall sample population of Part I. Both parts averaged 65% female participation with about half of the population between the ages of 35-54 years old. Most of the participants sought some level of schooling after high school and did most of the grocery shopping in their households.

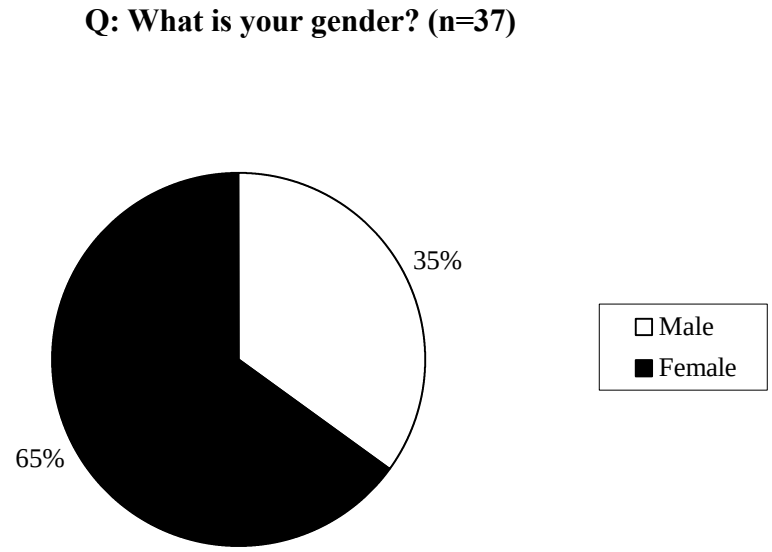


Figure 26. The sample population in Part II according to gender

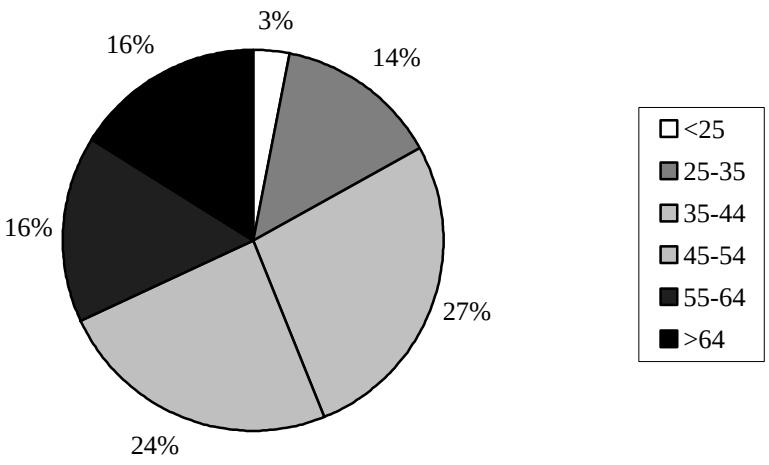


Figure 27. The sample population in Part II according to age

Q: Which category reflects your education? (n=37)

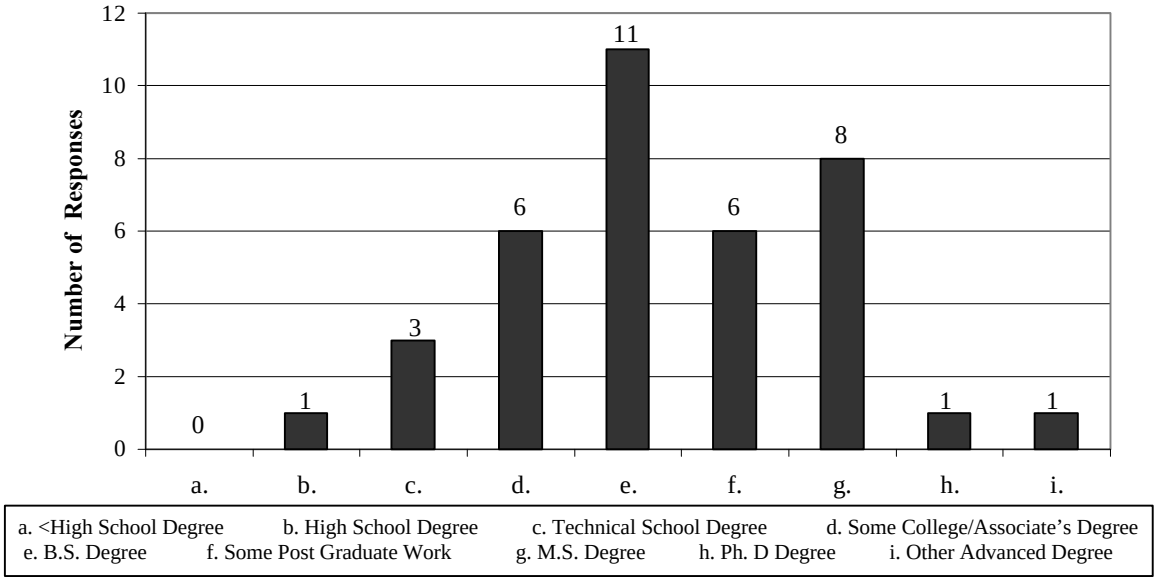


Figure 28. The sample population in Part II according to highest level of education

Q: How often do you do the grocery shopping for yourself/ your household? (n=37)

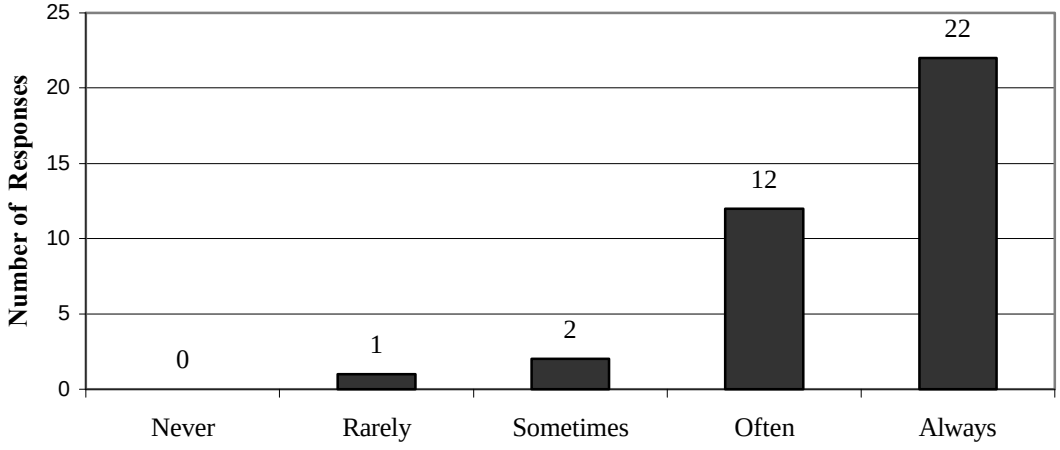


Figure 29. The sample population in Part II according to grocery shopping frequency

PRODUCTS	STORAGE TIME (WEEKS)	
	Average	Range
Canned Goods	12.3	1-104
Ethnic Foods	10.9	1-52
Condiments	11.6	1-156
Baking Products	21.6	1-260
Dry Goods/Pasta, Mixes	17.7	1-156
Breakfast Cereals	12.0	1-150
Cookies, Crackers, Snacks	7.6	0.3-26
Coffee, Juices, Beverages	36.3	1-156
Dog/Cat Food	11.0	1-28
Paper Products	--	1-52

(Beard III, June 1991)

Table 8. Storage time of products in consumer pantries

Storage Results

Pantry Closets Rotation Study

The purpose of Part II of this study was to better understand the rotation habits of consumers regarding perishable refrigerated foods. The idea for Part II was inspired by a study published by T.D. Beard III at Nabisco Foods Co. in 1991. His overall study was conducted to better determine the reason for increased complaints and customer dissatisfaction. As part of the study, Beard III evaluated the home storage practices of 30 households and their pantry closets. The study revealed “home warehouse” as the least understood area of the kitchen (Beard III, 1991). Table 8 shows results from his study.

Careless storage practices were a common problem, especially with baking products, dry goods, condiments and breakfast cereal. This may lead to increased consumer dissatisfaction of a product, stale and rancid products, and the presence of insects. Rotation of food products was extremely poor and many households did not date their products. An open date may not only

assist retailers with stock rotation but may also be beneficial in managing household stocks (Beard III, 1991).

Beard's study looked at non-refrigerated products. The importance of stock rotation practices of refrigerated products was not examined, especially perishable refrigerated products. An open date assists in efficient rotation practices, which is extremely important with perishable foods because of their limited shelf-lives.

Perishable Refrigerator Products Rotation Study

Data from the participants' recording sheets was reviewed and organized by product category. Milk, orange juice, ground beef, yogurt, pre-cut salads and vegetables, and eggs were some of the more common products recorded by the respondents and were further analyzed. Cheese was also a common purchase, but the shelf-life of the product in the consumers' refrigerators was generally longer than the extent of this study.

Table 9 shows the results from Part II of this study. The first two columns provide the same information as was gathered in the Beard study (Table 8). The third column represents the number of days between the date of purchase and the open date on the product. In the final column, the number of days between the actual 'end' date of the product and the open date were calculated. Note that some of the "average" number of days and the "ranges" may be slightly lower than the actual number because most participants only recorded food products for 14-18 days.

Product	Home Refrigeration Storage Time (Days)		Time between Purchase Date & Open Date (Days)		Time between 'End' Date & Open Date (Days)	
	Ave.	***Range***	***Ave.***	***Range***	***Ave.***	***Range***
Milk (n=108)	6.3	1-21	13.3	3-18	7.1	(-8)- 15
Orange Juice (n=16)	8.9	4-14	37.3	6-55	28.3	(-3)- 43
Ground Beef (n=12) *(n=7)**	4.8 *(0.5)**	1-22 *(0-1)**	0.8 *(0.9)**	0-2 *(0-2)**	-4.0 *(0.3)**	(-21)- 0 *((-1)-1)**
Yogurt (n=43)	5.4	0-19	21.1	3-34	15.4	(-8)- 34
Pre-cut Salads (n=13)	5.6	0-17	7.0	3-13	1.0	(-5)- 7
Eggs (n=12)	8.7	1-17	22.2	9-36	12.6	2-22

* The numbers in parentheses were averaged after five of the responses were removed from the calculations
** Negative numbers represent the number of days past the printed date

Table 9. Storage time of products in consumer refrigerators

1. Milk

Milk was the most popular purchase recorded in this study. Out of 108 total samples, 85 cartons reached the 'end' point during the duration of this study. Three of the cartons were discarded 1-2 days after the printed date. One consumer noted that a container of milk was discarded eight days *before* the printed date because it smelled funny. Another participant consumed the milk eight days *after* the printed date.

The average number of days of home storage was 6.3 days. In one household, the milk was stored for three weeks before it was completely consumed. Most consumers purchased the milk with 13.3 days remaining before the printed date on the carton.

For the most part, the containers were ½ gallon to one gallon in size, and a "sell-by" date usually was printed on the milk cartons. There were also some dates without an explanation and one "use-by" date recorded. By the time most households had reached the end of the product, there were 7.1 days remaining until the printed date. In other words, most of the milk products in this study had not even reached the "sell-by" date or the date when the product should be removed from the grocers' shelves to still have an adequate amount of time for home storage and consumption. As for the three products that were discarded 1-2 days after the date, the milk was probably either temperature abused or thrown-out because of a misunderstanding about the date's actual meaning. The products were also sitting in the refrigerator for 10, 10, and 15 days since the day of purchase. If the milk container was opened on one of the first days it was purchased, then it is possible that the milk did spoil. As for the milk that was discarded eight days before the sell-by date, the product had also been in the consumer's refrigerator for 7 days. If the container was opened for several days and the refrigerator temperature was too high, this could explain the premature spoilage.

2. Orange Juice

From the 16 recorded containers of orange juice in this study, 11 of them were consumed and none were discarded. The orange juice was stored for an average of 8.9 days in the refrigerator. When most consumers purchased their juice, there was an average of 37.3 days before the product reached its printed date. There was only one "use-by" date written and three "Best if sold by" dates. The rest of the open dates were "sell-by". Even by the time the consumer finished the product, there was still an average of 28.3 days remaining before the open date. Only one consumer indicated that the product was consumed after the "sell-by" date.

The open shelf-life dates on orange juice are significantly longer than the dates on milk. Many of the purchased products had over a month left before they even reached the open date. Therefore, even if some of the products suffered from slightly temperature abused conditions (where the product would experience a shorter shelf-life), all of the juice recorded in this study was consumed faster than any negative sensory changes could be noticed.

3. Ground Beef

There were two averages calculated for the ground beef data. The top set of data represents figures from all 12 recorded samples, while the second set of numbers in parentheses are from only seven of the samples. After reviewing all of the data, it was assumed that some of the ground beef was probably frozen and that some of the participants erroneously recorded this data. All of the figures for the ground beef data was from the “sell-by” date, and not from the “use or freeze by” date that was also printed on some packages.

From the 12 samples in this study, the average number of refrigerator storage days was 4.8. The range of refrigerator storage, however, was from one to a questionable 22 days. In fact, five of the samples supposedly were stored in the refrigerator for seven days or more. Most of the product was purchased with only 0-2 days until the open date and the product was consumed up to 21 days after the open date.

The figures in parentheses represent the seven products with less than seven days of refrigerator storage. From these figures, the ground beef averaged only 0.51 days of refrigerator storage. The actual ‘end’ date of the product ranged from “one day before” to “one day after” the -by” date, and overall these products were consumed an average of 0.29 days before the open date.

4. Yogurt

From the 57 recorded samples of yogurt, 43 were consumed by the end of this survey and only one was discarded. Most of the yogurt was stored in the refrigerator for only 5.4 days and had an average of 15.4 days until reaching its “sell-by” date. Most of the products contained a sell-by date or only a printed date, e.g. the Dannon brand.

Only three people consumed the product after the “sell-by” date, indicating that there was sufficient rotation practices at the retail and home levels to move the product quickly. In the only sample that was discarded, there were still 16 days until the printed date on the container, but the consumer threw-out some of the product because it “didn’t look good”. The product was a 32 oz container of yogurt, so most likely, the container was opened several times before finally reaching an unacceptable appearance. There were 12 labeled samples that were 28 oz or larger.

5. Pre-Cut Salads and Vegetables

Initially packaged mushrooms and baby carrots were recorded in this section, but the mushrooms contained a “packed on” date (which might skew the data) and the shelf-life of the carrots were significantly longer than the other recorded products; these products were eliminated from the calculations.

The products that were considered in this category were all most likely CAP/ MAP (controlled atmosphere/ modified atmosphere packaging) to extend the shelf-lives. On average, the products were purchased with just a week left to the open date. The “use-by” or “best-if-used-by” dates were most commonly used.

Out of twenty recorded samples, 13 were fully consumed and one was discarded because of browning. On average, there was only one day between the open date to the actual date of final consumption. One product was consumed five days after the "best-if-used-by" date.

6. Eggs

Out of the 21 samples of eggs, only 12 of them were consumed during the allotted period of time. From the consumed samples, the average number of refrigerator storage was 8.7 days. That figure is probably lower than the actual average because many of the participants did not consume the whole carton in the 2 ½ week period. All of the recorded figures showed that the eggs were consumed before the expiration date. A few of the packages contained "sell-by" dates.

Discussion and Conclusion

Out of the 204 perishable refrigerated food products purchased, recorded, and evaluated in Part II of the survey, there was a total of six products discarded. Two of the products were discarded before the open dates, three were discarded one or two days after the "sell-by" dates, and one was on the "best-if-used-by" date. Although it is not possible to determine the exact reasons why these products had to be wasted, temperature abuse may have been a contributing factor. Four of the products were milk, one was a pre-cut salad, and the other was a container of yogurt. Whether these products were abused in the summer heat during transportation or stored at improper refrigerator temperatures, according to the open date, none of these products should have been spoiled if they were kept in ideal conditions.

Overall, most of the foods were purchased with a significant number of days left until the printed date. This was especially true for the sell-by dates on most orange juice and yogurt

products as well as the expiration dates on most of the eggs. All of the products were purchased before the printed date, which indicates that either there were efficient stock rotation practices at the grocery store level or that the consumers sorted for the youngest products.

CHAPTER 4. CONCLUSION

During the last several decades, the government and food industry have made attempts to ensure that Americans have the safest and freshest food products in the world. Efforts such as Safe Handling Labels on meat and Hazard Analysis Critical Control Points (HACCP) plans in the food industry have been in place to ensure consumers can purchase only foods of high quality. Even if the food leaves the place of manufacture without incident, though, distributors, retailers and consumers must then take proper measures to ensure that the food is handled properly. The current study demonstrates that appropriate steps are not being taken, however, by the average consumer.

As evident in this study, many consumers are lacking in the basic food safety skills. Although many people were somewhat familiar with the major food recalls of recent, most consumer practices were not sufficient to prevent non-safe and/ or lower quality foods in the average household. Lack of temperature control proved to be a major problem in the home.

Open dating can be used as an indication of freshness on food products, and many consumers use the dates although many do not understand their meanings. A federally, regulated uniform open dating system is necessary to make the practice more consistent and consumer-friendly. While open dates can not guarantee a product's safety, used in conjunction with TTI's, it can help the food industry guarantee high quality products once the food leaves the place of manufacture. The open date gives consumers an idea of the amount of shelf-life left on their foods, while the TTI makes distributors, retailers and consumers more accountable for maintaining proper temperature conditions throughout the duration of the product's shelf-life. The use of TTI's is also not regulated at this time; however, results from this current study strongly support the need for an open dating/ TTI regulation in order to benefit the consumer.

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APPENDICES

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APPENDIX A. SURVEY SCRIPT

SURVEY SCRIPT

Hello, my name is Lynn from the University of Minnesota Food Science Department, and I am here to offer you $5-$30 in grocery gift certificates if you would be willing to take some time to fill-in my survey about food safety and food handling temperatures. There are two parts to this survey. If you are willing to complete the first part, I will give you the $5 certificate for your time. It will take about 15 minutes. After you complete this, I would like to give you details about a second part of this study. You do not have to participate in both parts.

The first part of this survey will involve a written survey and either my taking the temperature of your refrigerator or having me explain to you exactly how you can obtain this data by yourself while I wait here (assuming I'm standing outside of the door). If you need some time to think about this, I can schedule an appointment to come back next week or I can give you this contact sheet, where you can reach either me or Gwen, one of the departmental secretaries.

APPENDIX B. SURVEY CONSENT FORM PART I

CONSENT FORM

Subject: PERISHABLE REFRIGERATED PRODUCTS & HOME PRACTICES SURVEY Part I

Dear Participant:

You are invited to be in a research study that focuses on perishable refrigerated products as well as home practices associated with the storage of perishable refrigerated products. You were selected randomly as a possible participant because of your proximity of residence to a major retail outlet. We ask that you read this form and ask any questions you may have before agreeing to be in the study.

This study is being conducted at the University of Minnesota by Dr. Ted Labuza and Lynn Szybist at the Department of Food Science and Nutrition and Joann Peck at the Carlson School of Management.

Background Information:

The purpose and focus of this study is to assess consumers' understanding of the following:

- Open dates (sell-by, use-by, expiration date, etc.)
- Time-temperature integrators or TTI's (a device placed a food package which changes color over time to indicated abusive (improper) temperature conditions or indicate the end of the product's shelf-life)
- Proper home food handling techniques

Results from this study will assist in forming more consumer-friendly open dating legislation and serve as an indication of the TTIs' impact at the retail level.

Procedures:

If you agree to be in this study, we are asking that you answer the questions of this survey and to allow us to check the temperature and model of your refrigerator. It should take about 15 minutes. If you prefer that we not enter your home, specific instructions will be provided to allow you to gather this data yourself.

Risks of Being in the Study:

The study has no foreseeable risks to the participants.

Incentives:

Part I participants will receive a $5 grocery store gift certificate.

Confidentiality:

The records of this study will be kept private. In any sort of report we might publish, we will not include any information that will make it possible to identify a subject. Research records will be kept in a locked file; only researchers will have access to the records.

Voluntary Nature of the Study:

Your decision whether or not to participate will not affect your current or future relations with the University of Minnesota. If you decide to participate, you are free to withdraw at any time without affecting those relationships.

Contacts and Questions:

The researchers conducting this study are Dr. Ted Labuza (University of Minnesota faculty member), Lynn Szybist and Joann Peck (graduate students). You may ask any questions you have now or, if you have questions later, you may contact them at (612) 624-3206. If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher(s), contact Research Subjects' Advocate line, D528 Mayo, 420 Delaware Street Southeast, Minneapolis, Minnesota 55455; telephone (612) 625-1650.

You will be given a copy of this form to keep for your records, if you prefer.

Statement of Consent:

I have read the above information. I have asked questions and have received answers. I consent to participate in the study.

Signature _____
Date_____

Signature of Investigator _____
Date_____

APPENDIX C. SURVEY PART I

**Note: The format of the survey was slightly altered to fit the allotted amount of space.*

Survey Number_____

Part I: PERISHABLE REFRIGERATED PRODUCTS AND HOME PRACTICES SURVEY

For the following questions, please circle only ONE answer unless otherwise specified and complete all of the questions.

1. What is the average acceptable temperature of refrigerated foods?
a. 0°F b. 10°F c. 20°F d. 30°F e. 40°F f. 50°F

2. I feel that keeping my refrigerator at the recommended temperature is important.
a. Strongly Disagree b. Disagree c. Neutral d. Agree e. Strongly Agree

--Rank in order (1, as most important, through 3 or 4, as least important) the importance of keeping your refrigerator at the recommended temperature?
_____ Keeps foods longer (maintain quality)
_____ To prevent foodborne diseases
_____ Tastes better
_____ Other_____

3. You buy two refrigerated food products (A and B). The label on A says to store the product between 35°F & 40°F. Product B's label says to store the product between 40°F & 44°F.
In general, how often do you read the label on refrigerated food products?
a. Never b. Rarely c. Sometimes d. Often e. Always

Where do you store product A?
a. I never look at the label, so I would stick the product in my refrigerator wherever it fits.
b. I would look at the given temperatures but stick the product in my refrigerator wherever it fits.
c. On the door shelf
d. At the back of my refrigerator
e. At the top front part of my refrigerator
f. Other _____

Where do you store product B? ***(The choices are same as above)***
a. b. c. d. e. f.

4. Recently, there have been a number of meat recalls due to contamination with harmful bacteria. In 1997, there was a huge recall of Hudson <u>ground beef</u> products and in the beginning of 1999, the meat division of the Sara Lee Corp recalled several of their <u>hot dog and luncheon meat products</u>. How familiar are you with these events from the media (TV, newspapers, radio, etc.)?
(Choose <u>the number</u> on the scale which best represents your position)
Not familiar at all 1 2 3 4 5 **Extremely familiar**

--Did such events effect your buying habits in the meat department?
a. Yes, I didn't buy the products from the specific companies involved in the recalls
b. Yes, I didn't buy any of that product regardless of the company
c. No, I still bought the meat because I am not afraid of contamination
d. No, because I was not familiar with the recall
e. No, because I don't buy meat
f. Other_____

--If you answered a or b for the previous question, please answer the next question.
How long after hearing about the meat recall did you avoid the product?
a. 1-2 days b. 1 week c. 2 weeks d. 1 month e. 2 months f. I still don't purchase it

5. How familiar are you with the recent Land O'Lakes milk recall?
(Choose <u>the number</u> on the scale which best represents your position)
Not familiar at all 1 2 3 4 5 **Extremely familiar**

--How long after hearing about the Land O'Lakes milk recall did you avoid the recalled product?
a. 1-2 days b. 1 week c. 2 weeks d. 1 month e. 2 months f. I still don't purchase it
g. I didn't avoid it h. I never buy the product i. I was not familiar with the recall

6. Do you prepare meat (including beef, pork, chicken and/or fish)?
a. Never b. Rarely c. Sometimes d. Often e. Extremely often

--If you answered the previous question b, c, d, or e please answer the next question. If you circled a for question 6, please go on to question 10.

How often do you thaw your meat in the following ways? (Check a box in each row, i-v)

	Never	Rarely	Sometimes	Often	Always
i. In the refrigerator, the night before use					
ii. In the microwave					
iii. On the countertop the day of use					
iv. In the sink submerged in water					
v. In the sink submerged in running water					
vi. What are other ways you've done it?					

7. How often do YOU test the safety or freshness of your ground beef in the following ways? (Check a box in each row, i-v)

	Never	Rarely	Sometimes	Often	Always
i. By smelling it					
ii. By looking at it					
iii. Use a thermometer to test the internal temperature to 160°F when cooked					
iv. Rely on the date given on the package					
v. Don't worry about. Trust that it's safe.					

8. How often do you prepare ground beef?
a. More than once a week b. About once a week c. About every other week
d. About once a month e. Less than once a month f. I don't prepare ground beef

9. Have you bought any ground beef in the past month where the freshness of the product was questionable?
a. Yes b. No c. I didn't buy ground beef in the past month

10. Have you seen the Fresh Test "label" from 3M in the meat department of your supermarket?
a. Yes b. No c. Not sure d. I don't go into the meat department

11. How familiar are you with this "label"? (Circle the most appropriate <u>number</u>) ® ® ® ® ® ®
Not familiar at all 1 2 3 4 5 **Extremely familiar**

12. **The Fresh Test is a device that looks like a label and is placed a food package. The "label" changes color over time to indicate abusive (improper) temperature conditions or indicate the end of the product's shelf-life. Do you believe that such a device can be useful? (Circle the most appropriate <u>number</u>)**
Not very useful at all 1 2 3 4 5 **Extremely useful**

13. Do you think that this device is dependable? (Circle the most appropriate <u>number</u>)
Not at all dependable 1 2 3 4 5 **Extremely dependable**

14. Do you check the open date (sell-by, use-by, expiration date, etc.) on of the refrigerated products you buy?
a. Never b. Rarely c. Sometimes d. Often e. Always

15. How often do you check the open date on the following refrigerated products? (Check a box in each row, i-vi)

	Never	Rarely	Sometimes	Often	Always	I don't buy this product
i. Milk						
ii. Orange Juice						
iii. Ground Beef						
iv. Yogurt						
v. Pre-cut salads and vegetables						
vi. Eggs						

16. Do you sort through refrigerated products at the grocery store to find the product with the longest number of days left according to its given date?

a. Never b. Rarely c. Sometimes d. Often e. Always

17. You buy a container of milk on January 15. The open date printed on the carton is January 20. What do you with the remainder of the milk on January 20? (Circle the one answer that applies the most)

a. Pour out the milk regardless
b. Smell the milk and consume it until it smells bad
c. Throw it out on January 21
d. Continue to drink until it tastes funny
e. Other _____

18. In the past 12 months, have you purchased any of the following foods and noticed that it spoiled before the open date? (Check a box in each row, i-iv)

	Yes	No	Didn't notice or consider the date	Didn't purchase
i. Milk				
ii. Orange Juice				
iii. Ground Beef				
iv. Yogurt				
v. Pre-cut salads and vegetables				
vi. Eggs				

19. How reliable is the open date in regards to the actual shelf-life of refrigerated foods? (Circle the most appropriate <u>number</u>)

Not reliable at all 1 2 3 4 5 **Extremely reliable**

20. For each of the following columns (milk, breakfast cereal, and ground beef), please mark the one answer that best represents the date on its package. (Answer i-iii)

	i. MILK	ii. BREAKFAST CEREAL	iii. GROUND BEEF
When it was packaged…			
Last day it should be sold…			
Last day it should be used or eaten…			
Have never noticed a date on a package of this product…			

Thank you so much for your participation!!!

REFRIGERATOR AND PERSONAL INFORMATION

PERSONAL INFO.

1. What is your gender?

a. Male b. Female

2. What is your age?

a. less than 25 c. 35-44 e. 55-64
b. 25-34 d. 45-54 f. 65 or over

3. Which category reflects your education?

a. Less than a High School Degree
b. High School Degree
c. Technical School Degree
d. Some College/Associates Degree
e. Bachelor's Degree
f. Some Post Graduate Work
g. Master's Degree
h. Ph. D Degree
i. Other Advanced Degree

4. How often do you do the grocery shopping for yourself/ your household?

a. Always b. Often c. Sometimes d. Rarely e. Never

REFRIGERATOR INFO. (To be filled out by the surveyor)

1. What is the manufacturer of the refrigerator?_____
2. Approximately what is the age of this refrigerator?_____
3. Is there a thermometer in the refrigerator? Yes/ No
4. What is the temperature reading?_____
5. What is my temperature reading?_____
6. Is there a thermometer in the freezer? Yes/ No

Describe the style of the refrigerator.

APPENDIX D. SURVEY PART I DATA

If you would like a copy of the data contained in Appendix D, please contact the Retail Food Industry Center.

APPENDIX E. 1997 AUDITS INTERNATIONAL HOME FOOD SAFETY SURVEY

Audits International's Home Food Safety Survey

(Conducted Fourth Quarter of 1997)

Introduction

Current estimates of the number of cases of foodborne illness in the U.S. range upward from 80 million annually including more than 9,000 deaths. The deaths, the time lost due to illness, even the gastrointestinal discomfort for those who experience mild food poisoning make it overwhelmingly important that, as a society we do everything possible to minimize this problem.

There are many debates surrounding food safety including: whether foodborne illness is increasing; if bacteria are becoming stronger and more resistant; whether the population is becoming more susceptible; and if there is an impact of food supply globalization. Regardless of the outcome of these arguments, home food safety is an issue which must be at the forefront.

When it comes to issues like food safety, people's behavior at home is probably a good reflection of their knowledge or, at least, what they believe is important. Numerous reports exist describing what consumers can do to improve food safety in their own households. Yet, little information exists identifying the frequency that specific food handling practices are performed in a less than safe fashion. The lack of this specific information has allowed most of us to believe that food safety is "somebody else's problem".

While a great deal of research has been done on manufacturing, processing, and distribution, information on consumers has been largely anecdotal. The following survey was conducted in order to replace the consumer behavior information currently available, with data based on objective observation.

This study was designed to determine how often proper food safety practices are employed as part of home food preparation. If proper practices are lacking, the results of this study may prove useful in (1) raising public awareness of the most important issues, (2) personalizing the inadequacy of current practices, and (3) encouraging more and better public school and agricultureal extension programs on home food safety.

Methodology

Audits International routinely collects objective field information on issues of food safety as part of our foodservice facility inspection program. We have used our auditing and design resources to conduct this home food safety survey.

Data was collected from 106 households located in 81 North American cities.

Household selection ***was not*** random. Auditors asked acquaintances if they were willing to have their meal preparation practices evaluated as part of this survey. Those who participated knew they were being evaluated, probably believed they would perform well, and were better educated than the average U.S. population (73% college degree, 2% did not complete high school). It is our belief that each of these design biases suggest that the selected households were likely to perform better than if we had used an unannounced stratified random sampling.

Auditors observed meal preparation, service, post-meal cleanup and leftover storage. The inspection process required 45- 60 minutes of evaluation time but the evaluation was spread out over as much as four hours from preparation to final handling of leftovers. Each auditor utilized a consistent and objective critical control point approach for home evaluation in a similar fashion to the Audits International Food Safety Inspection conducted in restaurants. Performance was compared to standards from the 1997 U.S. Food Code.

The following issues were evaluated:

- temperature taking practices
- storage and rotation practices (time, temperature, etc.)

- hot and cold ingredient preparation and holding (time, temperature, and product handling)
- sanitation and chemical storage
- personal practices (cross-contamination, handwashing, safety-related habits)
- general kitchen condition (infestation, maintenance, plumbing, etc.)

Violations were categorized as minor, major, or critical. A critical violation is defined as one that, by itself, can potentially lead to a foodborne illness or injury. Major violations, on their own, are very unlikely to cause foodborne illness but are frequently cited as contributing factors. Although we collected information on minor violations, this report deals only with major and critical issues.

To be classified as acceptable, a home was allowed zero critical violations and no more than four major violations. This Audits International classification method has been used in foodservice institutions which have demonstrated the ability to consistently meet and exceed these criteria.

Results

Of the 106 households evaluated, less than 1% met the minimal Audits International criteria for acceptable performance. The average number of critical violations per household was 2.8 with a range from 0 to 8. At least one critical violation was observed in 96% of the households. The average number of major violations per household was 5.8 with a range from 2 to 9.

Discussion

The data generated by the Audits International Home Food Safety Survey demonstrate that poor food safety practices are universal in North America. Critical violations were found in 96% of participating households with an average of almost three per home. Ninety-nine percent of households performed unacceptably using Audits International's Foodservice evaluation system as well as widely accepted food safety standards. In effect, the survey demonstrates that safety is everyone's concern, not "somebody else's

This survey was designed to address performance, not individual perceptions or specific knowledge of food safety. When a violation was observed, there was no follow-up to identify if the violation was due to lack of knowledge or to perceive lack of importance. If possible, exploration of this issue should be incorporated into future studies.

Our foods may be the safest in the world, but that doesn't mean they are as safe as they can be. The threat of foodborne illness is real! At a minimum anyone preparing a meal should take the simple common sense precautions necessary to protect themselves, their families and their friends. We can complain about processing facilities, distribution systems, supermarkets, and restaurants, but we must also take responsibility for ourselves. Food safety starts on the farm and ends where food is consumed. Proper preparation at home is the last step, and in some cases, the last chance we have to protect ourselves.

Conclusion

The results of the study quantify the enormous magnitude of the food safety problem but do not address any of the following questions:

- Why is there such poor performance in an area that both the regulatory and scientific communities believe to be so important?
- Is the failure due to a lack of consumer knowledge or a general disbelief as to the importance of specific practices?
- Do consumers believe that safety has changed for the worse or do they believe that the increased attention to food safety is due to media hype?

- What measures can be taken to induce the public to stop blaming others and motivate a change in personal behavior?

What is evident from this study, is a need for change in attitude and behavior regarding food safety. For the food professional, greater emphasis must be placed on continuous training. And, it is important to understand that practices we have used are no longer adequate. When it comes to food safety, it is incumbent upon all food professionals to lead by example.

For the general public, it is critical that home cooks make conscious efforts to improve their safety practices. With a minimum of time and effort, immediate improvement can be made in four areas:

- avoiding cross-contamination
- washing hands at appropriate time during meal preparation
- cooking to the appropriate temperatures
- cooling leftovers properly

At least eighty million cases of foodborne illness and more than 9,000 deaths per year demand that something be done to improve food safety. It is time to re-evaluate and improve curricula in both the public education and agricultural extension systems. We hope that this survey can be used to heighten consumer awareness and to encourage improvements in food safety training and education.

Critical and Major Violation Definitions

Cooked product internal temperature too low	Cooking to less than the minimum safe internal temperature required to destroy pathogens (critical violation: Ground Beef less than 155F for 15 seconds; Poultry less than 165F for 15 seconds; Fish less than 145F for 15 seconds).
Cross-contamination	A practice causing the potential transfer of harmful substances or disease-causing micro-organisms from one food or food ingredient to another. Other than neglected handwashing, the most frequently observed forms of cross-contamination were (1) storage of raw materials above ready-to-eat foods, (2) utensils used for tasting being put back into food under preparation, (3) foods prepared in an unclean sink, (4) washed produce placed back into original container, (5) smallwares or equipment touching unsanitary surfaces and then used in food preparation, (6) cutting boards not washed or sanitized between uses, (7) unclean scissors or blade used to open bags of food, and (8) failure to wash whole produce.
Evidence of infestation	Any indication that a foodservic area is inhabited by pestes (insects/rodents).
Food handlers smoking/ eating/ drinking/ gum chewing	These habits encourage mouth-to-hand-to-food contamination and can lead to the introduction of a foreign substance to food which may cause a foodborne illness.
Hand drying towels unavailable	To prevent the use of aprons or clothing for drying hands, each handwashing sink should have towels available.
Hot and cold water available at all sinks	Failing to wash hands (1) when first starting to handle food, (2) after using the phone, (3) after touching face, hair, body or other people, (4) after handling garbage, dirty dishes or cleaning, (5) after using the restroom.
Hot ingredient holding too cool	Each faucet should allow hot and cold water to mix to a temperature of at least 110F
Improper chemical labeling	Failure to keep household chemicals in labeled containers.
Improper chemical storage	Chemicals stored in such a way that they may contaminant food, food contact surfaces, or equipment.
Improper cooling of leftovers	Any food that is not cooled after cooking or hot holding from 140F to

	70F in two hours and to 41F in an additional four hours for a total of less than six hours cooling time.
Improper glove usage	Failure to cover bandages with gloves may permit the introduction of pathogenic bacteria to food.
Improper handling of leftovers	Failure to transfer leftovers to a shallow pan less than two inches deep or to small containers. Large bulk slows cooling and permits prolonged bacterial growth.
Improper thawing procedures	Food not brought from frozen temperatures to those suitable for cooking by using one of four proper techniques: 1. In a refrigerator 2. Under running drinkable water at 70F or lower within two hours 3. As part of the cooking process 4. In a microwave (this method should always be followed by immediate cooking)
Insufficient thermometer use	Failure to regularly measure temperatures of held or prepared foods
Misuse of common cloth/ sponge/ towel	Separate cloths, sponges, and towels should be used for washing dishes, wiping counters and tables, wiping hands, and drying clean dishes. Using a common towel for more than one of these purposes could allow cross-contamination.
Product past manufacturer's "use-by" date	Expiration times are meant to maintain product quality and safety. Any ingredient past manufacturer's "use-by" date should be discarded.
Product stored uncovered	Ingredients stored in the refrigerator or dry storage must be covered to keep foreign objects out of food.
Refrigerated temperature too high	Refrigerated product and ingredient temperatures which permit rapid bacterial growth (critical violation: greater than 45F; major violation: 42-45F).
Severely damaged cans	Observation of any can which is swollen, or has flawed seals, seams, rust, dents or leaks.
Sick/ symptomatic food handlers	Food handlers with cold or flu-like symptoms may cause food to be contaminated.

Note: Definitions were adapted from the ServSafe® Serving Safe Food Certification Coursebook, Copyright 1995, by The Educational Foundation of the National Restaurant Association

1997 Audits International Survey: http://www.audits.com/survey.htm

APPENDIX F. 1999 AUDITS INTERNATIONAL HOME FOOD SAFETY SURVEY

Audits International's Home Food Safety Survey

(Conducted Second Quarter of 1999)

Introduction

In 1997, Audits International conducted the initial Home Food Safety Survey because previous studies had been based on consumer knowledge without actually measuring performance. Due to the fact that Audits International has expert food safety auditors across North America, evaluating actual performance seemed like a natural fit. An overall deficiency in safe food handling practices was observed when just one of 106 participants met the standards Audits International had used in over 20,000 foodservice safety evaluations to date. Critical violations (those which in and of themselves may cause foodborne illness, and deem an establishment unacceptable) were found in 96% of the households evaluated. Whether or not deficient food safety practices were being used was no longer the question; the question became why.

Are people lacking the education to be aware of potential food safety issues? Or is the motivation behind avoiding the issues not strong enough? The estimated number of cases of foodborne illness in the U.S. ranges upward from 6 million annually including more than 9,000 deaths. These figures have lead to an increased media attention, which has both educated and motivated the public. The desire to gauge the reasons behind the general population's deficient food safety practices prompted Audits International to conduct the second home food safety survey.

The 1997 study was strictly designed to determine how often proper food safety practices were employed as part of home food preparation. The 1999 study also attempted to determine whether key food safety deficiencies are caused by a lack of knowledge or the lack of sufficient desire to follow proper food safety practices (motivation). These results can be used not only to raise public awareness and personalize the inadequacies of current practices, but also to guide the government, industry, and the media further in promoting proper food safety.

Methodology

Audits International routinely collects objective field information on issues of food safety as part of our foodservice facility inspection program. We first used this expertise in foodservice evaluations to conduct the initial home food safety survey in 1997. This same experience served as a means to conduct a second home food safety survey in 1999.

1999 Design

Data was collected from 121 households located in the following 82 North American cities:

Akron	Cleveland	Hartford	Memphis	Richmond
Albany	Columbus	Houston	Milwaukee	Rochester
Albuquerque	Dallas	Indianapolis	Minneapolis	St. Louis
Anaheim	Davenport	Jackson	Mobile	Salt Lake City
Atlanta	Dayton	Jacksonville	Modesto	San Francisco
Bakersfield	Denver	Joliet	Nashville	Seattle
Baltimore	Detroit	Kansas City	New Orleans	Springfield, IL
Birmingham	El Paso	Knoxville	New York	Springfield, MO
Boston	Eugene	Las Vegas	Newark	Syracuse
Burbank	Fayetteville	Little Rock	Norfolk	Tampa
Calgary, AB	Fort Worth	London, ON	Omaha	Toledo
Charleston	Fresno	Long Beach, CA	Orlando	Tulsa
Charlotte	Grand Junction	Long Island	Phoenix	Washington, D.C.
Chattanooga	Grand Rapids, MI	Los Angeles	Pittsburgh	Waukegan, IL
Chicago	Green Bay	Louisville	Raleigh-Durham	West Palm Beach
Chico	Greensboro	Manchester	Rapid City	Wichita

Cincinnati Harrisburg

Households selected in 1997 were not included in this study. Household selection was not random. Auditors asked acquaintances if they were willing to have their meal preparation practices evaluated as part of this survey. Those who participated knew they were being evaluated, probably believed they would perform well, and were better educated than the average U.S. population (71% college degree, 1% did not complete high school). It is our belief that each of these design biases suggest that the selected households were likely to perform better than if we had used an unannounced, stratified random sampling.

Auditors observed meal preparation, service, post-meal cleanup and leftover storage. The inspection process required 45 - 60 minutes of evaluation time but the evaluation was spread out over as much as seven hours from preparation to final handling of leftovers. Each auditor utilized a consistent and objective critical control point approach for home evaluation in a similar fashion to the Audits International Food Safety Inspection conducted in restaurants. Performance was compared to standards from the 1997 U.S. Food Code.

The following issues were evaluated:

- temperature taking practices
- storage and rotation practices (time, temperature, etc.)
- hot and cold ingredient preparation and holding (time, temperature, and product handling)
- sanitation and chemical storage
- personal practices (cross-contamination, handwashing, safety-related habits)
- general kitchen condition (infestation, maintenance, plumbing, etc.)

Violations were categorized as major or critical. A critical violation is defined as one that, by itself, can potentially lead to a foodborne illness or injury. Major violations, on their own, are unlikely to cause foodborne illness but are frequently cited as contributing factors. *To be classified as acceptable, a home was allowed zero critical violations and no more than four major violations.* This Audits International classification method has been used in foodservice institutions which have demonstrated the ability to consistently meet and exceed these criteria.

When auditors observed a critical violation in any of six areas of high concern (ingredient cooking, handwashing, cross contamination, chemical storage, handling of leftovers, and cold ingredient holding), the auditor would try to determine why the violation was committed through a series of questions. The goal of this exercise was to determine whether the violations were due to either a lack of education or motivation.

All participants were given a short quiz (4-6 questions) in each of the high concern categories listed above. The purpose of this exercise was to determine the correlation between testing what consumers know versus testing what they do.

Revisions to the 1997 Study

The 1997 study originally found that of 106 households, less than 1% met the minimal Audits International criteria for acceptable performance. Households averaged 2.8 critical violations and 5.8 major violations. In order to gauge any improvement in the 18 months since that study, 1997 results had to be reviewed against the *current* food safety standards employed by Audits International. Changes were made based on conversations with leading regulators and industry experts. These include:

Refrigerated product selection -

Auditors recorded the temperature of products based on whether the product was hazardous, rather than the location in the refrigerator. The 1997 study required one product temperature from the interior of the refrigerator and one from the door. Although this change biased the temperature results favorably, it is reasonable because of its orientation to potentially hazardous foods.

Cutting board procedures -

Households were not be required to wash *and* sanitize a cutting board between uses. While washing is still a necessary step, not sanitizing a cutting board in the home would no longer merit a critical violation.

Leftover labeling -

Leftover items were no longer required to be dated and times (a major violation). Instead, refrigerators would be evaluated by how long leftovers had been present. Leftovers older than four days would result in a major violation.

After modifying the results of the 1997 study to reflect these changes, the percent of households deemed acceptable in the initial study increased from less than 1% to 4% (see Discussion section for further analysis). 1997 results refer to the revised results when referenced throughout the rest of the report.

Results

Overall Summary

Of the 121 households evaluated, 26% met the minimal Audits International criteria for acceptable performance. Households averaged 1.7 critical violations with a range from 0 to 5. At least one critical violation was observed in 69% of the households. Households averaged 3.2 major violations with a range from 0 to 8.

Critical Violations

Critical Violations	Households Observed (n=121) *Frequency (%)*
Cross contamination observed	31
Improper cooling of leftovers	29

Neglected handwashing	29
Improper food preparation techniques	21
Cleaning supplies or chemicals improperly stored/labeled	20
Finished internal cooking temperatures too low	19
Refrigerated ingredient temperatures too high	9
Disposable plastic gloves not properly used	4
Dented, rusted, or swelling cans present	2
Sick/symptomatic foodhandler preparing food	2

Note: Click here For definitions of Violations .

Major Violations

Major Violations	**Households Observed (n=121)** *Frequency (%)*
Improper thermometer use	79
Food handler smoking/eating/drinking/gum chewing	55
Common cloth/sponge/towel misused	49
Product present past "Use-by" date	46
Refrigerated ingredient temperatures too high	23
Clean dishes and pans not drying properly	17
Improper food preparation procedures	12
Cross contamination issues	12
Improper leftover procedures	11
Hand drying towels unavailable	5
Frozen ingredient temperatures too high	4
Pest activity evident in household	4

Note: Click here For definitions of Violations .

Education Versus Motivation

When auditors observed one of six chosen critical violations (cross contamination, handling of leftovers, handwashing, chemical storage, ingredient cooking, and cold ingredient holding) the auditor would point out the violation to the participant, then ask why the violation was committed. Responses were categorized either as lack of education (ex. "I was not aware I was doing it.") or lack of motivation (ex. "I don't think using proper practices is very important."). The responses offered by participants are as follows:

Violation*	**OA**	**CC**	**HL**	**HW**	**CS**	**IC**	**CH**
			Frequency (%)				
Educational Responses**	**62**	**65**	**61**	**59**	**67**	**65**	**70**
Motivational Responses	**38**	**35**	**39**	**41**	**33**	**43**	**30**
I don't think it is very important	11	16	6	19	5	0	20
I am willing to take the risk and ignore the guideline	7	10	6	9	10	0	0
It takes too much time to do it right	5	0	12	6	5	5	0
I have always done it this way and see no reason to change	5	3	3	6	0	19	0
I am confused by the multiple standards I have heard or read about	5	0	12	0	5	10	10
I don't agree with the safety principle	4	6	0	0	10	10	0

* OA = overall (combined); CC = cross contamination observed; HL = Improper cooling of leftovers; HW = Neglected handwashing; CS = cleaning supplies or chemicals improperly stored/labeled; IC = Finished internal cooking temperatures too low; CH = Refrigerated ingredient temperatures too high

** Examples of choices classified as educational responses were, "I wasn't aware I was doing it," and " I wasn't aware of the standard."

Testing Knowledge Versus Testing Performance

Upon completion of the observational portion of the evaluation, auditors quizzed participants in each of six areas of high concern. The following table lists how often participants were able to answer all quiz questions for a category correctly and how often the participant met all criteria during observation (i.e. didn't receive a critical violation).

Violation*	OA	CC	HL	HW	CS	IC	CH
	Frequency (%)						
All questions in quiz answered correctly**	37	55	23	79	60	7	0.8
All criteria met during observation	77	69	71	71	80	81	91

** OA = overall (combined average of other six columns); CC = cross contamination observed; HL = Improper cooling of leftovers; HW = Neglected handwashing; CS = cleaning supplies or chemicals improperly stored/labeled; IC = Finished internal cooking temperatures too low; CH = Refrigerated ingredient temperatures too high

Discussion

Overall Improvement

Over six times as many households met criteria in this study compared to the 1997 results (4% vs. 26%). The frequency of households receiving at least one critical violation decreased from 96% to 69%. The number of critical violations observed per household also decreased between studies, from an adjusted average of 2.3 to 1.7 critical violations per household.

Results	1977	1999
	Frequency (%)	
Household achieving acceptable standards	4	26
Number of critical violations per household	2.3	1.7
Number of critical violations per household	4.0	3.2

Although the increase in acceptable households is encouraging, nearly three-quarters of all households failed to meet criteria. The increase in acceptable households indicates that food safety awareness is reaching a higher level of consciousness, but further steps to motivate and educate the public are necessary.

Factors Causing Critical Violations

When a violation was observed, the follow-up questions identified that the violations were mostly due to lack of knowledge (62%) as opposed to a perceived lack of importance (38%). Based on this observation, attempting to change the population's food safety practices should continue to focus on education. One of the primary goals of the 2000 Home Food Safety Study will be to further investigate educational factors.

Media Driven Improvement

The increase in the frequency of acceptable households could be partially attributed to the recent attention the media is paying to food safety. While this study did not evaluate the *reasons* people change their practices, a non-published Audits International study conducted in 1998 investigated what was responsible for increasing awareness in food safety. Those participants not included in Audits International's 1997 study listed television (73%) and print media (63%) as the most significant reasons for raising their awareness of food safety, which could directly influence behavior. The responses given as what increased food safety awareness are listed below:

Frequency (%)

Television	73
Newspapers	53
Magazines	41
Family and friends	35
Government	10
Advice from doctors	6
Schooling	4

Knowledge Is a Poor Indicator

When it comes to food safety, it is difficult to measure what the general population does by what they know. The ability to demonstrate knowledge did not correlate to proper performance. As an example, 79% of all participants could correctly identify each of five instance when handwashing was necessary. However, 20% of the respondents that did correctly identify all instances still received a critical violation for neglected handwashing.

Conversely, lack of knowledge did not mean a violation was imminent. Very few participants demonstrated knowledge in cooking ingredient to proper temperature (7%). Even without this knowledge, 81% of all households still cooked their foods to proper temperatures.

Children Are a Motivating Factor

Households with young children were over three times as likely to achieve acceptable standards as those without children. Children in households where the head of the kitchen was under 50 years old were considered young. Of thirty-two households with children and a head of kitchen under 50 years old, 28% were deemed acceptable. Just one of 13 households without children and a head of kitchen under 50 years old was acceptable (8%).

Advancing Awareness in Food Safety Is Everyone's Business

The 1997 study demonstrated that food safety must become everyone's concern. The improvement in overall results found in 1999 implies that the general population is becoming more aware of food safety issues. The kitchen is often the last chance we have to limit the risks of foodborne illness. It is imperative that those who prepare meals in their homes understand the importance of proper food safety practices. It is because of this that Audits International plans to conduct a home food safety survey each year to help increase public awareness.

Conclusions

The results of the 1999 home food safety survey demonstrate six key issues:

- the situation is improving with regards to home food safety but we still have a long way to go;
- knowledge tests do not necessarily indicate performance - it is important to observe what people are doing;
- the majority of errors (critical violations) are based on is education (knowledge or conscious awareness) rather than motivation;

- families with small children are more motivated than those without;
- media appear to be the driving force behind the change;
- it is in all of our interests to keep the ball rolling.

Questions to be answered in the Audits International 2000 home food safety study include:

- Where does the population *as a whole* stand in their food safety practices? It is our belief that the sample chosen here would do better that the general population. In order to answer the question, it is necessary to incorporate a more random stratified sample.
- What do people really know about food safety? Are the violations attributed to education caused by not know the standards, or a lack of conscious awareness of what they are doing?

Home Food Safety Survey Definition of Terms

Clean dishes and pans not air drying properly	The process of stacking dishes or pans that are not completely dry in a fashion that could result in moisture trapped between two. This moisture provides an environment beneficial to some types of bacterial growth.
Common cloth/sponge/ towel misused	Separate cloths, sponges, and towels should be used for washing dishes, wiping counters and tables, wiping hands, and drying clean dishes. *Using a common towel for more than one of these purposes could allow cross-contamination.*
Cross contamination	A practice causing the potential transfer of harmful substances or disease-causing micro-organisms from one food or food ingredient to another. Other than neglected handwashing, the most frequently observed forms of cross-contamination were (1) failure to wash cutting board between uses, (2) storage of raw materials above ready-to-eat foods, (3) failure to wash whole produce, (4) cloth, sponge, or towel used in a manner resulting in a direct threat of cross contamination, (5) utensils not washed with soap before use, (6) food preparation done in a dirty sink.
Dented, rusted, or swelling cans present	Observation of any can which is swollen, or has flawed seals, seams, rust, dents or leaks.
Disposable plastic gloves not properly used	Failure to cover bandages with gloves may permit the introduction of pathogenic bacteria to food
Finished internal cooking temperatures too low	Cooking to less than the minimum safe internal temperature required to destroy pathogens (critical violation: Fruits and Vegetables < 140°F for 15 seconds; Commercially Pre-cooked Foods < 140°F for 15 seconds; Fish and Seafood < 145°F for 15 seconds; Beef <145°F for three minutes; Ground Beef <155°F for 15 seconds; Pork < 155°F for 15 seconds; Poultry <165°F for 15 seconds; Casserole for 15 seconds; Reheated Leftovers < 165°F for 15 seconds).
Food handlers smoking/eating/ drinking/gum chewing	These habits encourage mouth-to-hand-to-food contamination and can lead to the introduction of a foreign substance to food which may cause a foodborne illness.
Frozen ingredient temperatures too high	Frozen product and ingredient temperatures which could permit rapid bacterial growth (critical violation: >45°F; major violation: 29-45°F).
Hand drying towels unavailable	To prevent the use of aprons or clothing for drying hands, each handwashing sink should have towels available.
Hot and cold water available at all sinks	Each faucet should allow hot and cold water to mix to a temperature of at least 110°F.

Hot ingredient holding too cool	Maintaining hot foods temperatures which permit rapid bacteria growth (critical violation: <140°F; major violation: 140-144°F).
Improper chemical labeling	Failure to keep household chemicals in labeled containers.
Improper chemical storage	Chemicals stored in such a way that they may contaminate food, food contact surfaces, or equipment.
Improper cooling of leftovers	Any food that is not cooled after cooking or hot holding from 140°F to 70°F in two hours and to 41°F in an additional four hours for a total of less than six hours cooling time.
Improper food preparation techniques and procedures	Conducting food preparation using any of the below described procedures can be the direct cause of or serve as a contributing factor in foodborne illness: 1. Use of non-pasteurized eggs for uncooked egg-based products (critical) 2. Leaving hazardous items unattended at room temperature (critical) 3. Incorrect thawing practices (definition listed - major) 4. Use of non-chilled ingredients to make sandwiches or salads (major) Use of non pre-chilled ingredients to make sandwiches or salads (ex. tuna salad). Ingredients that are not pre-chilled increase the temperature of the final product and increase the risk of the product being inside the temperature danger zone (40-140°F).
Improper leftover procedures	The presence of leftovers older than 4 days present or leftovers cooled to 42-45°F after six total hours of cooling.
Improper thermometer use	Failure to regularly measure temperatures of held or prepared foods
Incorrect thawing practices	Reducing food temperatures incorrectly from frozen to temperatures suitable for cooking rather than by using one of four proper techniques: 1. In a refrigerator 2. Under running drinkable water at 70°F or lower within two hours 3. As part of the cooking process 4. In a microwave (this method should always be followed by immediate cooking)
Neglected handwashing	Failing to wash hands (1) when first starting to handle food, (2) after using the phone, (3) after touching face, hair, body or other people, (4) after handling garbage, dirty dishes or cleaning, (5) after using the restroom.
Pest activity evident in household	Any indication that a foodservice area is inhabited by pests (insects/rodents).
Product past "Use-by" date	Expiration times are meant to maintain product quality and safety. Any ingredient past manufacturer's "use-by" date should be discarded.
Refrigerated ingredient temperatures too high	Refrigerated product and ingredient temperatures which permit rapid bacterial growth (critical violation: >45°F; major violation: 42-45°F).
Sick/symptomatic food handler preparing food	Food handlers with cold or flu-like symptoms that may cause food to be contaminated.

Note: Definitions were adapted from the ServSafe® Serving Safe Food Certification Coursebook, Copyright 1995, by The Educational Foundation of the National Restaurant Association.

1999 Audits International Survey: http://www.audits.com/pr.html

APPENDIX G. SURVEY CONSENT FORM PART II

CONSENT FORM

Subject: PERISHABLE REFRIGERATED PRODUCTS & HOME PRACTICES SURVEY Part II

Dear Participant:

You are invited to be in a research study that focuses on perishable refrigerated products as well as home practices associated with the storage of perishable refrigerated products. You were selected randomly as a possible participant because of your proximity of residence to a major retail outlet. We ask that you read this form and ask any questions you may have before agreeing to be in the study.

This study is being conducted at the University of Minnesota by Dr. Ted Labuza and Lynn Szybist at the Department of Food Science and Nutrition and Joann Peck at the Carlson School of Management.

Background Information:

The purpose and focus of this study is to assess consumers' home food handling and refrigerator rotation techniques. Results from this study will assist in forming more consumer-friendly open dating legislation.

Procedures:

After partaking in Part I of this study, participates will be asked to continue onto Part II. Part II will be conducted over approximately a two week period and will ask the participants to keep a log of the refrigerated products they purchase and discard over this time frame.

Risks of Being in the Study:

The study has no foreseeable risks to the participants.

Incentives:

Part II participants will receive a $25 grocery store gift certificate.

Confidentiality:

The records of this study will be kept private. In any sort of report we might publish, we will not include any information that will make it possible to identify a subject. Research records will be kept in a locked file; only researchers will have access to the records.

Voluntary Nature of the Study:

Your decision whether or not to participate will not affect your current or future relations with the University of Minnesota. If you decide to participate, you are free to withdraw at any time without affecting those relationships.

Contacts and Questions:

The researchers conducting this study are Dr. Ted Labuza (University of Minnesota faculty member), Lynn Szybist and Joann Peck (graduate students). You may ask any questions you have now or, if you have questions later, you may contact them at (612) 624-3206. If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher(s), contact Research Subjects' Advocate line, D528 Mayo, 420 Delaware Street Southeast, Minneapolis, Minnesota 55455; telephone (612) 625-1650.

You will be given a copy of this form to keep for your records, if you prefer.

Statement of Consent:

I have read the above information. I have asked questions and have received answers. I consent to participate in the study.

Signature _____
Date_____

Signature of Investigator _____
Date_____

APPENDIX H. SURVEY PART II RECORDING SHEETS

**Note: This document has been reformatted to fit the allotted space.*

Survey Number _____

Date of Purchase	(Size) Product Brand & Description	Company Name & Address	Explanation of Open Date	Printed Date	Your "End" Date	Your Method of "End of Product" (i.e. consumed, threw-out)
6/ 01	(1/2 gallon) Land O'Lakes Skim Milk	Land O'Lakes, Inc. Arden Hills, MN	Sell-by	6/11	6/10	Consumed

APPENDIX I. SURVEY PART II DIRECTIONS

REFRIGERATED SURVEY (PART II) DIRECTIONS

1. Start this part of the survey after your next trip to the grocery store.

2. Before putting your newly purchased refrigerated products away, please record these foods on the opposite side of this paper in the following matter:
   - Initially, only the first five columns will be used.
   - Under the **"Date of Purchase"**, please record the present date.
   - Under **"(Size) Product Brand & Description"**, please record the size of the product as labeled on the package; the product brand, which may be the same as the company's name or may not be on" of the product or the common name (what it is).
   - The name of the **company and the address of the company** are required by law to be written somewhere on the label. Please record this information.
   - **"Explanation of the Open Date"** will be the "sell-by", "use-by", "best is used by", "quality assured 7 days beyond printed date if properly refrigerated", etc. information. Sometimes this information will not be directly next to the given date. Sometimes there is only a date and not an explanation. In such cases, please put a line
   - (---) through this box. Please check the package thoroughly for an explanation.
   - **"Printed Date"** will be the date printed onto or indented into the package. Check the package carefully; it can be found on the bottom, side, top or even on the plastic covering of the package.

3. The last two columns are to be filled in when you are finished with the product. **"Your 'end' date"** refers to the day you discard the package. The final column, **"Your method of 'End of Product' (i.e. consumed, threw-out, etc.)"**, is to describe why you have discarded the package, for example, you consumed the product, it went bad, etc.
   - If you finish a product because it is used in a recipe, please count that as the "end". For example, if you buy ricotta cheese for a lasagna, the day you make the lasagna and discard the package is the "End of Product" regardless of how long that lasagna sits in your refrigerator.

NOTES:

- Only record packaged fruits and vegetables that have a date on them.
- Do not record frozen foods.
- If you have any questions, please do not hesitate to contact Lynn (look at the magnet for more details).

APPENDIX J. SURVEY PART II DATA

If you would like a copy of the data contained in Appendix J, please contact the Retail Food Industry Center.