

# Consumer Perceptions of Three Food Safety Interventions Related to Meat Processing

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## SUMMARY

A focus group study with 37 residents of Manhattan, Kansas, was conducted to examine consumers' risk perceptions of foodborne illnesses from eating beef. The four focus-group sessions were designed to determine (1) relative preferences for alternative combinations of public food safety measures (Hazard Analysis Critical Control Points [HACCP], carcass pasteurization, irradiation) and private protection (home preparation of rare, medium, and well-done hamburgers); (2) how who is at risk (children vs. adults) influences preferences; (3) whether consumers would pay a premium for increased product safety arising from the adoption of three different innovations in processing plants; and (4) how to improve risk communication about foodborne illnesses and protection against them. Although participants seemed aware of many food safety practices, misinformation and misconceptions also were found. The majority of the participants preferred hamburgers that were well-done and steam-pasteurized or medium and irradiated. For a 5-year-old child, the majority chose hamburgers that were well-done, and steam-pasteurized or well-done and irradiated. Concerning willingness to pay, the majority of participants preferred steam-pasteurized ground beef to regular ground beef when the two were priced the same. Results indicated that new technologies available for food safety interventions provided marginal value to participants. Participants also expressed a need for more information.

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## INTRODUCTION

Foodborne disease outbreaks caused by *Escherichia coli* O157:H7 in ground beef have caused increased consumer concern about the safety of red meats. The US Centers for Disease Control and Prevention (CDC) estimate that of the annual cases of disease caused by *E. coli* O157:H7 (4,900 to 9,800), 49 percent are due to consumption of undercooked ground beef (2).

To become more prevention-oriented and to address pathogen control, the United States Department of Agriculture (USDA) has established programs that eliminate or reduce bacterial contamination of meat products throughout the food system, from production to consumption. Innovations in meat processing such as Hazard Analysis Critical Control Points (HACCP), carcass steam pasteurization, and irradiation are available commercially for slaughter and processing plants to achieve these standards. Irradiated meat can be purchased in some parts of the United States, but capacity for production is low currently.

Food safety is perceived to be as much a societal issue as one that is under the control of the individual and is perceived to involve credibility and trust in risk regulators as well as individual choice regarding risk control and risk exposures (4). A portion of foodborne illnesses result from voluntary and entirely avoidable behavior, although this is not well quantified, such as eating raw foods of animal origin or engaging in unsafe food preparation practices. Contaminated beef looks and smells normal, and, in the case of *E. coli* O157:H7, the number of organisms required to cause disease is probably very small, although this is not certain. To prevent food-borne illnesses, proper handling procedures and cooking temperatures are required. Research shows that people tend to underestimate relatively large risks such as heart disease and heart attacks and overestimate relatively small risks such

as botulism, a foodborne illness caused by *Clostridium botulinum*. The latter phenomenon is described as the *overoptimistic bias* (9). Recent studies have assessed the public's perception of food safety risks. Prior studies have assessed consumers' overall knowledge of, and public concern about, food safety (1, 3, 5). Our study also assessed food safety knowledge and perceptions, but in addition provided information on three processing innovations that can enhance the safety of meat.

The objectives of this study were to determine: (1) relative preferences for alternative combinations of public food safety (HACCP, carcass pasteurization, irradiation) and private protection (home preparation of rare, medium, and well done hamburgers); (2) how who is at risk (children vs. adults) influences preferences; (3) whether consumers would pay a premium for the higher levels of product safety arising from the adoption of three different innovations in slaughter and processing plants; and (4) how to improve risk communication about foodborne illnesses and protection against them.

One means of accomplishing these objectives is to solicit consumer reactions to food safety issues through consumer focus-group sessions. The focus group is one of the most frequently used qualitative research methods (6). For example, a study by USDA/FSIS (11) showed that the focus group is a reliable method for determining consumer barriers to the use of meat thermometers.

## METHODOLOGY

After approval had been obtained from the Institutional Review Board for Research Involving Human Subjects, which is required for conducting surveys at Kansas State University, 37 subjects participated in four focus groups of 7 to 13 participants. Each subject was on a list of 200 single-family households of Manhattan, Kansas, residents; the list had been purchased

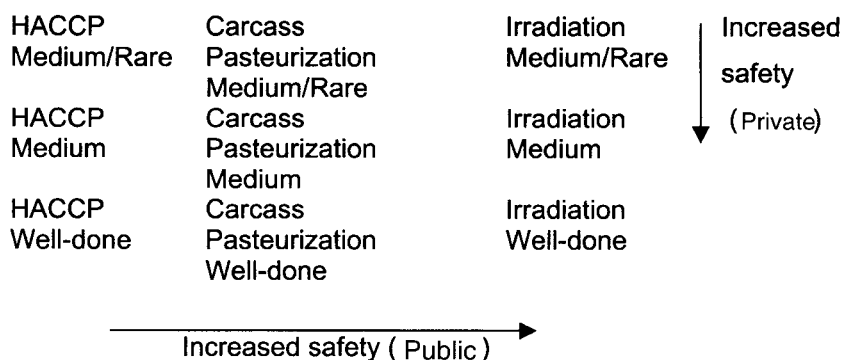
from a market research company. A letter sent to the selected households invited the primary grocery shopper to attend a focus-group session. Individuals responsible for food purchases and food preparation were believed to provide the most accurate information regarding beef purchases and consumption. The invitation letter contained information on general topic, dates of the study, and approximate time commitment.

One week after the first letter was sent, the households were contacted via phone to determine availability and willingness to participate in one of four focus-group sessions. If interest in participation existed, three screening questions were asked to determine whether the individual purchased and consumed ground beef. Individuals who indicated that they were vegetarians, were employed in the beef industry, or raised their own cattle were eliminated as participants, because of the belief that individuals with these backgrounds might unduly bias the outcomes of the sessions.

The focus-group sessions were conducted in Manhattan, Kansas, in a room designed for such research. A trained moderator who used a pre-developed set of questions and protocols conducted all sessions to ensure that each group covered the same topics. All focus-group sessions were recorded on audiotapes that were then transcribed for use in the analysis. Specific comments of individuals were noted. Each session lasted approximately 1.5 hours. Prior to the beginning of each focus-group session, the participants were asked to respond in writing to a one-page questionnaire about demographic characteristics and beef consumption. They were also asked to indicate the frequency of beef consumption per week.

During the introduction, the moderator discussed the general nature and purpose of a focus group, the role of the moderator, and the general objective of the study. The moderator's guide included 33 questions divided into

**Figure 1.** Public/private food safety interventions



**Figure 2.** 3X3 set of risk-reduction strategies from

Degree-of-doneness	Hamburger A (Standard hamburger from HACCP process)	Hamburger B (HACCP process with Carcass Pasteurization)	Hamburger C (HACCP with Carcass Pasteurization and Irradiation)
Medium/Rare			
Medium			
Well done			

two sections. The first section included questions about participants' meat consumption habits, their knowledge of food safety, and their food safety concerns. These questions were broad in scope and designed to establish discussions in the groups.

The second section was designed to meet the study objectives. Information about technologies used to reduce microbial contamination in meat was distributed. Participants described their perceptions of the risk of illness from a hamburger produced by use of these innovations and indicated their interest in purchasing this hamburger. The innovations were (A) HACCP programs in meat processing, (B) carcass pasteurization, and (C) irradiation. At the time of the study, irradiated ground beef

was not available in Manhattan. Hamburger "A" was described as having been produced under a HACCP program, and participants were informed that HACCP was currently the required industry standard. Hamburger "B" was described as having been produced under HACCP but with the addition of steam pasteurization of the animal carcass. Hamburger "C" was described as an irradiated hamburger produced with HACCP and steam pasteurization. Thus, the innovations represented additions of food safety interventions.

In addition to this handout, two other props were distributed: (1) a full-color pamphlet describing the steam pasteurization process and (2) a black and white graphic of electron beam irradiation. A package of fresh, packaged ground beef

was displayed on the table as the moderator read the description of the HACCP program.

Following the discussion of meat safety innovations, we assessed the participants' preferred degree-of-doneness for hamburgers. Participants responded to questions on a set of three charts. Each participant could see one of the colored guides showing a hamburger in three different degrees of doneness (medium-rare, medium, and well-done) that were posted on the table.

After indicating their preferred degree of doneness, participants were asked the reason for their choice. This question aimed at finding out if this degree of doneness was chosen for safety or for taste. Then participants were asked to indicate which degree of doneness of hamburgers they would choose for a 5-year-old child. To find out if the availability of new safety-enhancing technologies altered their preference for degree of doneness of a hamburger, participants next were asked to indicate in a 3x3 grid the preferred hamburgers for themselves and for a 5-year-old child (Fig. 1).

The grid represented alternative strategies to reduce risk of *E. coli* O157:H7 infection from beef consumption: three levels of private protection and three levels of public protection. Consumers could choose how they prepare the meat (medium-rare, medium, well-done), thereby having some private control over the risk. Public risk reduction was represented by HACCP, steam pasteurization, and irradiation. Steam pasteurization was described as reducing *E. coli* O157:H7 risk by 99%, and irradiation by 100%. Thus, the grids gave participants a choice among nine hamburgers (Fig. 2).

It should be noted that participants first stated their preferred private risk-reduction strategy (degree of doneness) given the current standard mechanism for collective risk reduction (HACCP) and then stated their preference to move to an alternative risk-reduction strategy given the additional alternative combinations of private

**TABLE 1. Demographic profile of focus group participants in food safety interventions study, Manhattan, KS**

Characteristic	%
<b>Age:</b>	
25-35	10.8
36-49	73.0
50-64	13.5
60 & over	2.7
<b>Education level:</b>	
Less than high school	0
High school grad., G.E.D.	13.5
Some college experience	24.3
College	62.2
<b>Income:</b>	
\$25,000 or less	2.7
\$25,001 to \$50,000	51.3
\$50,001 to \$100,000	40.5
More than \$100,000	5.5
<b>Household size:</b>	
1-2	16.2
3-4	56.8
5+	27.0
<b># of children under 18 years:</b>	
0	18.9
1-3	75.7
4+	5.4
<b>Weekly beef consumption:</b>	
2-5 times	81.1
6-11 times	18.9

and collective actions (columns 2 & 3 in Fig. 1). For example, choosing medium-done meat with irradiation treatment rather than the well-done HACCP product represented a preference for a more-processed but less-done product.

The next three questions were designed to determine whether participants would be willing to pay a premium for ground beef that had

been treated with steam pasteurization or the combination of steam pasteurization/irradiation. If the answer to this question was yes, they were asked to identify the highest price per pound that they would be willing to pay, assuming that the type A hamburger costs \$1.60 per pound (the actual market price on the package of fresh ground beef). Next, participants again filled out

the 3x3 grid and answered the same three questions, assuming that they were choosing a hamburger for a 5-year-old child.

## RESULTS

### Demographic characteristics

The demographic characteristics of the focus-group participants are summarized in Table 1. The 37 participants ranged from 24 to 70 years in age. Seventy-three percent of them were age 36 to 49, and 86 percent were female. Of the total, 62.2 percent had graduated from college, whereas 13.5 percent had completed only a high school education. The mean household income for the sample was between \$50,000 and \$100,000 per year.

The total number of individuals comprising participants' households ranged from two to nine, with a mean of 3.8. The average number of children under the age of 18 years in participants' households was two. For weekly beef consumption, answers ranged from once a week to 11 times per week, with an average of almost five times.

### Consumption habits and awareness of food safety issues

*Favorite meats:* The first section of the focus-group questionnaire asked participants about their favorite meats or meat dishes. "Steak", used generically, always was mentioned first, then hamburger, brisket, roast beef, ribs, and sirloin tips.

Participants indicated that they liked the flavor of these meats and the versatility and economy of hamburger. Further, they pointed out the ease of preparation, especially during summertime for grilling outdoors.

Participants in all four groups mentioned problems of cleanliness in the processing and packaging of beef, bacterial contamination of meat during the slaughter process, exposure of meat to fecal material, and concerns related to grinding and packaging. Participants expressed concerns about "*E. coli*" and other organisms that cause

foodborne illnesses and also about quality factors such as freshness of meat. Other important issues associated with meat consumption were the fat and cholesterol contents, chemicals, steroids, and veterinary supplements that might have been added to the meat during production. Participants believed that cattle feed often contains pesticides, hormones, and vitamin supplements; this worried participants, because they did not know the side effects of these inputs.

Many focus-group members expressed mistrust about the level of cleanliness and sanitation in restaurants. Worries were also expressed about the cooking and handling of hamburgers. Most participants said they felt more secure when they cooked for themselves at home. Nearly every participant discussed means other than temperature measurement for determining the doneness of the meat they cook, such as a visual check or a check by time. All focus-group members associated *E. coli* O157:H7 with ground beef and hamburgers. They knew that it causes foodborne illness and even death. Most participants were aware that although such sources of concern are present in many food items, proper care and handling could prevent foodborne illnesses from these sources. They also stated that *E. coli* O157:H7 arises because of lack of cleanliness of processing plants and that cross-contamination as well as the spread of the organisms occur when the meat is processed or handled more.

### **Innovations: Public interventions**

Participants reviewed a brief paragraph about three innovations used in meat processing, (A) HACCP programs, (B) carcass pasteurization, and (C) irradiation. After reading the information, they were asked to indicate their perceptions of the risk of illness from a hamburger that is processed in a plant that has the specific technology in use. All plants now operate with HACCP programs. Carcass pasteurization may be a part of that system in some plants, but irradiation of meat is uncommon.

*HACCP programs:* Most participants saw only a slight risk in the basic hamburger; this is assumed, since the descriptions referred to it as a "standard hamburger." All consumers had positive experiences with hamburger. Concerning risk to a 5-year-old child, many participants pointed out that the hamburger might be more dangerous for young children or older people. Several women indicated that if the hamburger contained *E. coli* O157:H7, very young children could develop severe disease because of their weaker immune system. One participant said she would eat a hamburger that was a little pink in the middle, but she would never give it to her daughter, because she did not want to take the risk with her.

Participants in each focus group discussed trusting one's senses regarding the safety of the food they eat. In general, participants agreed that they could identify something as unsafe by its odor or appearance. Most participants were not familiar with the safe food handling labeling that is present on all fresh cuts of meat.

Whereas some participants indicated that a HACCP program makes the hamburger safer, others doubted that it affected the ultimate safety of a standard hamburger. The pro-HACCP program participants argued that because of the increased safety precautions and awareness in the meat plants, employees might work in a more sanitary manner and would be willing to cooperate more with the requirements of the HACCP program. The skeptics argued that the meat department in the supermarkets might grind the old and the fresh meats together and present it again as fresh, so every standard meat still had the chance to be contaminated, and the HACCP program at the processing plant did not affect the safety of the hamburger at all.

Most participants understood the basics of sanitation and kitchen cleanliness and the importance of being especially careful with raw meat products. However, misper-

ceptions and misinformation existed. For example, one participant said that she made the meat "germ free" by microwaving for 20 s before she refrigerates it: she had learned this bit of misinformation from a television program.

Participants in all groups agreed that there are many ways to check if food is properly cooked. Each group stressed the importance of cutting into meat to visually check doneness. According to participants, if the juice ran clear out of the patties, then they were well-done and, therefore, safe. Other participants check by time or by the external appearance of the hamburger to determine if it was done.

One participant said that when the seal of the package was broken, the meat inside was unsafe. Many focus-group members added that meat was also risky when it started to smell or showed a slimy surface and a color change.

*Carcass pasteurization:* After the moderator read the description of carcass steam pasteurization on the handout, participants described their perceptions of risk of foodborne illness from a steam-pasteurized hamburger. The perceptions of hamburger B (HACCP+ steam pasteurization) varied greatly among the focus-group members. Some participants considered this hamburger to be safer, because the meat is more processed. But the fact that more processing was done to the beef products scared some of the other participants. They thought that steam pasteurization was a process of "over kill," and that this step in addition to HACCP was too much; they therefore did not want steam-pasteurized meat. The fact that just the surface of the carcass was pasteurized with steam at 195°F led some participants to think that the bacteria stayed inside the meat, so that contamination might still occur during grinding of the meat. Others expressed concerns about heating the outside of the carcass, uncertainty of destruction of bacteria other than *E. coli* O157:H7, higher costs, and losses of vitamins

and flavor. In general, many participants said that they would not necessarily look for steam-pasteurized beef in a grocery store, because they feel comfortable with the way it has been processed until now.

Participants were asked if they thought carcass pasteurization made hamburger B safer than the HACCP-only product A. Again, opinions were split. Some participants were positive that the meat might be safer, especially for a 5-year-old child. Other participants had more doubts about it. The descriptions of HACCP and carcass pasteurization ended with the same words "However, recontamination of the meat may occur later in processing or prior to reaching consumers." This led some participants to conclude that the process was not necessarily needed; they said that they had never been sick from eating ground meat.

Regarding handling or cooking of steam-pasteurized meat, all participants answered that they would not do anything different than they usually do.

**Irradiation:** After reading the provided information on irradiation, participants were asked to indicate their perception of risks of foodborne illness for hamburger C (HACCP + steam pasteurization + irradiation). The answers of the four focus groups were very different, and the discussion about meat irradiation revealed a lack of information concerning this process. However, most of the participants in two of the groups had no concerns about meat irradiation; they thought this process should be used for all kinds of meat, especially chicken, because then they would feel safer about buying generic branded chicken. However, participants in the other two focus groups were scared by the irradiation procedure. Their concerns started with the word "Irradiation;" one participant said that he had heard the procedure causes cancer, because it changes the molecules of the food. Many of the skeptics said that they

liked the benefit of killing *E. coli* O157:H7 and others organisms in meat, but because they did not know enough about the side effects of irradiation, they had concerns about buying irradiated meat. They wanted to see more studies and information about irradiation's side effects.

Some participants thought product C might be the safest of the three hamburgers, whereas others emphasized their need for more information about the irradiation procedure in order to judge the safety of the meat; they also were worried about any additional costs.

Nearly 50 percent of all focus-group participants would pay more for hamburger C than for hamburger A, but the rest would not because of their concerns about irradiation and because they had never had any problems with foodborne illnesses. Fewer participants would pay more for hamburger C than for B, and again they expressed the need for information about the side effects of irradiation. Positive opinions stressed the fact that the shelf life was increased and that the process had great value for special uses where temperature and cooking cannot be controlled, as during camping. One participant preferred hamburger C for her children, and she would buy it at the same price as non-irradiated meat. Some participants said that they would not pay more because they believed in the safety of standard meat. No participants in the focus-group sessions indicated that they would handle or cook irradiated meat differently than non-irradiated meat. Some participants wondered whether the meat gets drier after the irradiation procedure.

#### **Degree of doneness of hamburgers**

The majority of the participants (58.1 percent) indicated a preference for a well-done hamburger. The next largest category identified was medium-rare (28.4 percent)

and only 13.5 percent of participants preferred a medium-cooked hamburger.

Most participants identified taste as the primary reason for their preference. Reasons given for picking a medium-rare or medium hamburger were juiciness and the original flavor of the meat. They noted that a well-done hamburger could be a bit dry and that a medium hamburger was not as chewy as a medium-rare one and should be just a little pink in the middle. Some focus-group members indicated that well-done is the way you cook hamburgers and also kill the bacteria in the beef. One participant said that she always liked her hamburger medium, but after the "*E. coli* scare," she preferred it strictly well-done. Other participants who preferred a well-done hamburger explained that a hamburger should not be raw or bloody because the hamburger bun gets soggy. Fans of the well-done style pointed out that they would rather prepare a steak medium-rare but would not have a pink hamburger. For them, pinkness in the middle of a medium-rare meat patty did not look appetizing; it looked like it was still alive and uncooked.

For a 5-year-old child, 89 percent of participants would cook a hamburger to the well-done stage; 19 percent of this group also had chosen a well-done hamburger for themselves. They mentioned that a pink steak could be served to a child but not a pink hamburger. Thirteen and a half percent or five individuals would cook the hamburger medium done for the child, because a well-done hamburger is dry and spongy. Only one participant did not really understand why she might cook the hamburger any differently for a 5-year-old child and decided on the medium degree-of-doneness that she chose for herself, which is safe if measured by temperature, but not if measured by appearance.

**TABLE 2. Respondents' preference for hamburger doneness when new safety-enhancing technologies are available**

Degree of doneness	Hamburger A (Standard hamburger from HACCP program)	Hamburger B (HACCP process with carcass pasteurization)	Hamburger C (HACCP with carcass pasteurization and irradiation)	Percentage
Medium/Rare	2 (1) <sup>1</sup>	0 (0)	2 (0)	10.8 (2.7)
Medium	3 (1.5) <sup>2</sup>	2 (0)	10 (3)	40.4 (12.2)
Well done	4 (4.5)	11 (15)	3 (12)	48.8 (85.1)
Percentage	24.3 (19)	35.2 (40.5)	40.5 (40.5)	100

n= 37

<sup>1</sup> Numbers in parentheses are the results for the respondents' preference for hamburger doneness for a 5-year-old child when new safety-enhancing technologies are available

<sup>2</sup> If a participant made a cross exactly between two categories, his/her vote was split in half between the two choices; hence, unequal numbers appear in some of the fields.

### Innovations and degree of doneness: Private interventions

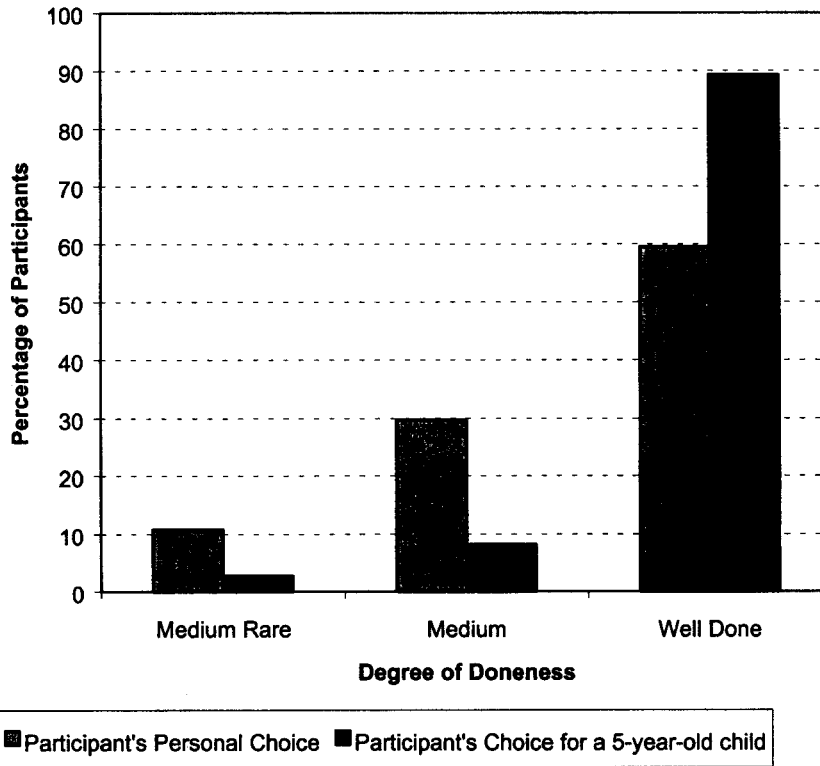
Concerning the degree-of-doneness, which represented the level of private protection, the largest number of participants (48.8 percent) preferred their hamburger well-done (Table 2). Only 10.8 percent chose a medium-rare hamburger. For a 5-year-old child, a large majority of the participants, 85.1 percent, preferred well-done meat. This means that most participants would like to provide the 5-year-old child the highest level of private protection. Of the three choices for public risk reduction, 40.5 percent of the participants preferred hamburger C, which underwent application of all three innovations. Most of the participants preferred either a well-done, steam-pasteurized hamburger (29.7 percent) or a medium, irradiated hamburger (27 percent). Concerning the public risk reduction for a 5-year-old child, both carcass pasteurization and irradiation were chosen by 40.5 percent of the

participants. Relative to the previous question, which asked them to pick a hamburger for themselves, some women switched to a higher degree of doneness, but with the same innovation. One participant picked a well-done hamburger B because to her it seemed to be a safe method no matter who is going to eat it. Some women emphasized that they would never serve irradiated meat to their children. Most of the participants chose a combination of a well-done, steam-pasteurized hamburger or a well-done, irradiated hamburger. This demonstrates that who is at risk (children vs. adults) influences preferences. Participants who chose the highest level of risk reduction represented by a well-done, irradiated hamburger for themselves chose the same for the 5-year-old child. In general, participants who decided on hamburger C for themselves also chose the same hamburger for the 5-year-old child (Fig. 3).

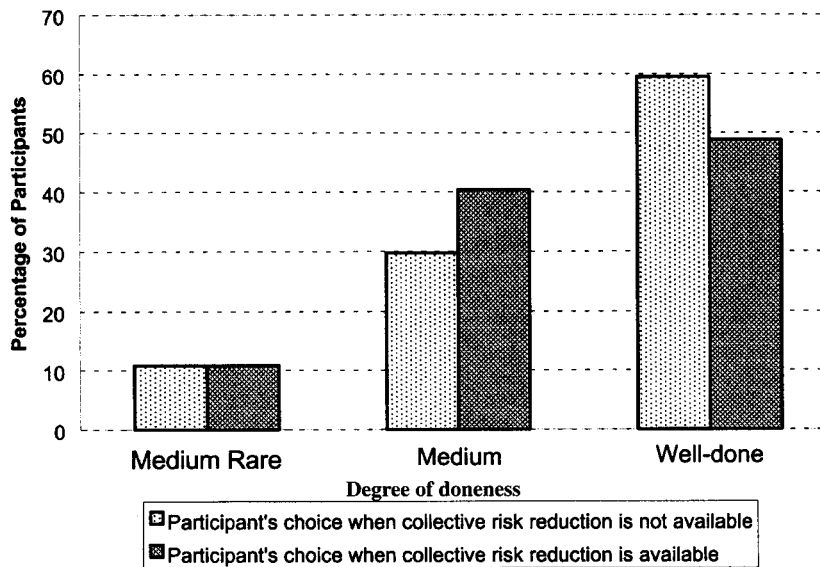
Figure 4 shows how the participants' choice for degree of doneness was influenced by the availability of new collective risk-reduction strategies. When public risk reduction was available, more people chose a medium hamburger, but well-done still remained the most preferred degree of doneness. This means that the safety aspect of a hamburger seemed to be more important than its flavor to the participants who originally preferred a well-done hamburger and then switched to a medium hamburger. Some participants indicated that they moved from a higher to a lesser degree-of-doneness along with a higher degree of technology that had been added to the hamburger. These participants traded private protection for public risk reduction; the availability of the new safety-enhancing innovation provided a marginal value to them.

Nearly all participants indicated that they had been cooking a certain way for many years and had never gotten sick in the past. They

**Figure 3.** Focus group participant's preference for the degree-of-doneness of hamburgers



**Figure 4.** Participant's preference for the degree of doneness of hamburgers with/without public food safety interventions



doubted the importance of changing their behavior at this time. Another participant said that she chose hamburger B because she liked the fact that the surface of the carcass was cleaned. One partici-

pant explained that if they did everything to hamburger C, it would be a lot safer, so she could cook it a little juicier. A similar reason was given by another participant to change from a well-

done HACCP-hamburger to a medium steam-pasteurized hamburger B. She said if the meat had been treated an extra time, eating it the way she had always liked it might be safer. She had been scared by the *E. coli* O157:H7 outbreaks and had started to cook hamburgers well-done. The skeptics about irradiation chose a type A or type B burger, because they claimed to have insufficient knowledge about the irradiation process.

### Willingness to pay

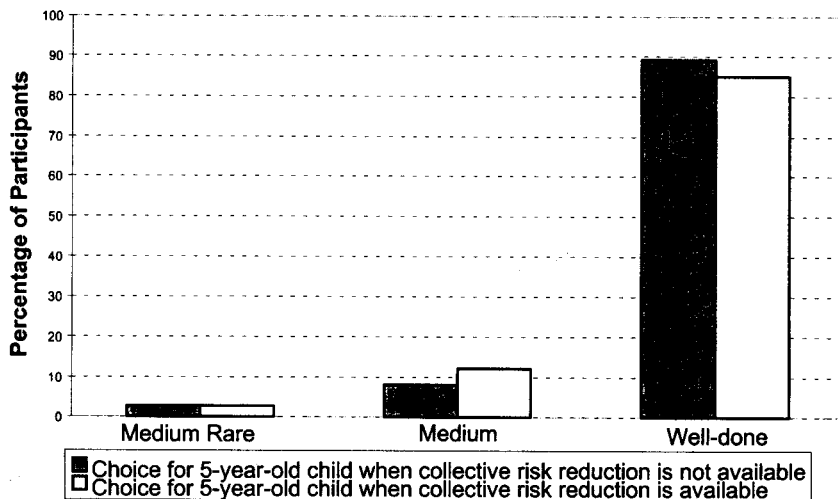
At the retail meat market, a minority of focus-group participants would pay between 3 and 10 cents per pound more for hamburger B (steam-pasteurized). Some would pay the same as for hamburger A. The skeptics would not pay more because they had never had any problems with foodborne illnesses.

Most of the participants who chose either hamburger B or hamburger C indicated that they would pay more for these than for a standard hamburger, A (HACCP). When asked to indicate how much more they would pay, assuming the type A standard hamburger costs \$1.60 per pound, the answers varied from 2 cents per pound to 40 cents per pound, with a mean of 8.19 added cents per pound. Ten of those participants who preferred B or C hamburger would not pay anything more; one participant would pay only 2 to 3 cents more. One participant indicated that she would only pay 40 to 50 cents more per pound for ground beef when she would use it for cooking out. One participant chose a medium-rare standard hamburger, but indicated that she would pay more only in a restaurant for a higher degree of safety, because she mistrusted the hygiene of the restaurant kitchen.

Few participants switched their choice from a well-done to a medium hamburger for a 5-year-old child when new safety-enhancing technologies were available; 85 percent still chose a well-done ham-



**Figure 5.** Preference for the degree of doneness for a 5-year-old child with/without collective risk reduction



burger (Fig. 5). Most of the participants decided on the same hamburger regardless of whether collective risk reduction was available. This means that fewer participants traded private risk reduction for public risk reduction and that the availability of new safety-enhancing technologies did not provide a marginal value for those participants.

The moderator asked participants who chose type B or type C hamburgers about their willingness to pay for them and to specify the number of cents per pound, assuming that the standard hamburger, type A, costs \$1.60 per pound. The answers ranged from 5 to 35 cents more, with a mean of 7.67 added cents per pound.

The participants' willingness to pay increased when they considered the hamburger for the 5-year-old child. Only the participant who would have paid 40 to 50 cents more per pound for the ground beef would never feed irradiated ground beef to a 5-year-old child. She decided in this grid on a well-done standard hamburger, because it seemed to be the safest choice for a child. Most of the participants would pay between 5 and 10 cents more per pound, and 11 partici-

pants would not pay anything more. Several participants said their willingness to pay would change if they heard weekly about foodborne illness caused by eating beef. They were not willing to pay extra for something that they did not really think was needed.

#### Other comments on hamburger safety

Many emphasized that processing plants should make the meat safer by using more hygiene and sanitation. One participant indicated that the US Food and Drug Administration should check on the irradiation process and give out some more information about it. Most participants expressed positive feelings about food safety.

Finally, participants described the perfectly safe hamburger. Cleanliness and freshness were important to most of the participants. They said that requiring employees to wear gloves and hairnets and having more inspections would improve the food safety of restaurants. Two women expressed their desire for a hamburger that contains less fat and less cholesterol; they would pay more for that. Other focus-group

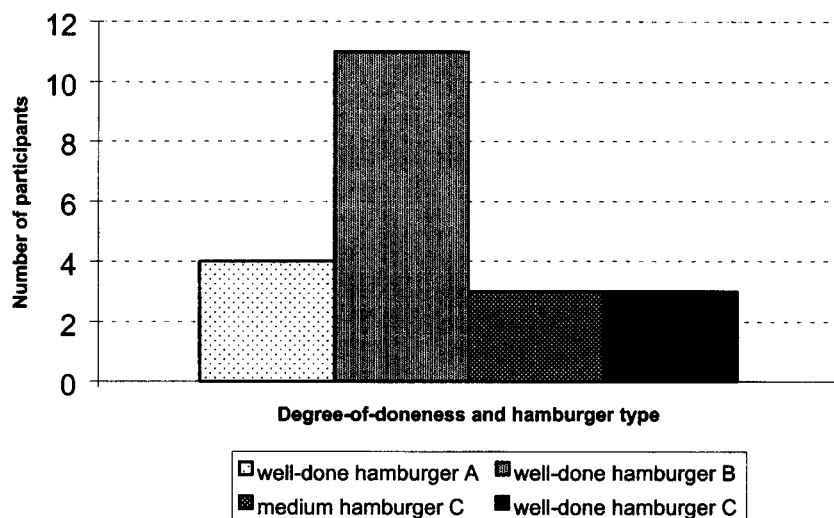
members described the perfect hamburger as drug free, germ free, showing less risk of recontamination, tasty, and already cooked.

#### Private vs. public risk reduction trade-offs

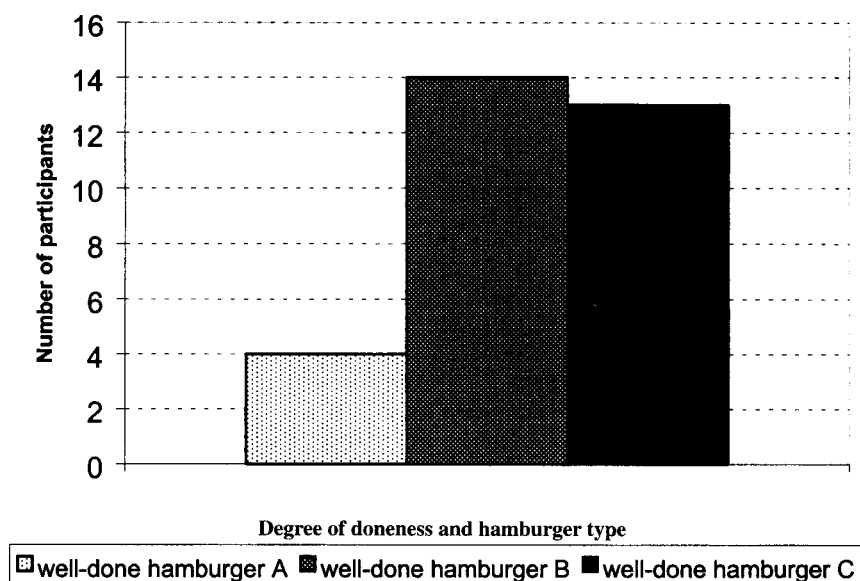
The majority of participants, 22 individuals, indicated a preference for a well-done hamburger, which represented the highest degree of private protection. We label this group "well-done." One objective of the study was to determine relative preferences for alternative combinations of collective action and private protection. Hence, one question of the questionnaire was designed to determine whether the availability of new safety-enhancing technologies would alter their choice of degree of doneness. In the following section, results from the "well-done" group are examined to see if a trade-off exists between reductions of private risk and public risk. Figure 6 shows the results for the "well-done" group. The largest number of participants (11) chose a well-done hamburger from meat that had undergone the carcass pasteurization process (hamburger B). This means that the public risk-reduction strategy represented a marginal value to these participants. Because these individuals did not change their preference concerning the degree of doneness, which represents private risk reduction, no trade-off was seen between public and private risk reductions. Only a small number (3 participants) of the "well-done" group switched to a lesser degree-of-doneness; they chose a medium hamburger from meat that had undergone all three innovations (hamburger C) and hence traded private risk for public risk reduction.

Figure 7 shows that 14 participants of the "well-done" group chose a well-done, carcass-pasteurized hamburger (hamburger B) for the 5-year-old child and 13 individuals decided on a well-done hamburger associated with all three innovations (hamburger C). Hence, these two public risk-reduction strat-

**Figure 6.** Preference for hamburger doneness by participants from the "well-done" group when new safety-enhancing technologies are available



**Figure 7.** Preference for hamburger doneness for a 5-year old child by participants from the "well-done" group when new safety-enhancing technologies are available



egies represented a marginal value to these participants. Only a minority of the participants of the "well-done" group picked the same hamburger (A) that they chose in the situation when new safety-enhancing technologies were not available. None of the participants chose a medium hamburger, which means that nobody traded private for public safety.

### Implications

Food safety as a product attribute has to be based on consumers' trust. This trust can be established only by identifying the knowledge and concerns that consumers have about food safety, and a consumer focus group is one means of identifying these. Once identified, these insights can be used to develop educational

materials, programs, and effective consumer information about innovations related to meat processing. Consumers rely upon food processors and government regulators to provide safe food, because it is almost impossible for the consumer to determine the safety of a particular food product.

Along with demographic distinctions, several interesting themes and issues emerged from the focus groups in this study. Although participants seemed aware of many important food safety practices, misinformation and misconceptions regarding general food safety topics, particularly irradiation, were found. Participants in all focus groups indicated that they were worried about cleanliness in meat-processing plants. This is consistent with a previous study (10) in which participants suggested that meat-processing plants and supermarkets should be cleaner and more sanitary in the processing and handling of meat. In a 1985 study by USDA/FSIS, food-manufacturing facilities were ranked first out of six choices as the place where food safety hazards most likely occur (12). The same result was found in a 1992 FSIS study (5). However, epidemiological data indicate that restaurants, institutions, and other large preparation facilities are far more likely to be the sites of mistakes that can lead to foodborne illness. The focus-group participants were also very concerned about the microbial safety of the food in restaurants.

Participants in all groups seemed aware of many important food safety issues and felt safe about the meat they served in their own kitchens. This conclusion is identical to previous results for focus groups (10) in which participants felt confident that they handled meat products with appropriate caution and safety. However, some misperceptions and misinformation also existed: To the question "under what condition is the meat safe for you," many participants answered that contaminated meat

smells and looks bad. This fact indicates that consumers may not understand that a food may contain pathogenic bacteria even though it does not smell, taste, or look bad.

Internal meat temperature is a food safety factor that consumers can control at the preparation stage. However, none of the focus-group participants indicated that they used a meat thermometer. Many participants mentioned that seeing if the juice ran clear or if the meat still looked pink inside indicated the doneness of the meat. The recommended safe endpoint temperature for ground beef is 160°F. Meat at this temperature may be pink or brown, depending on other factors. The visual check for doneness gives a quality indication of doneness, not one of safety. Some focus-group participants checked the doneness by cooking time. In a previous focus-group study (11) most participants felt that there are several safe alternatives to the use of a thermometer and that using a thermometer was no guarantee of safety in any event. As reasons for not using a thermometer, participants mentioned "inconvenience," "laziness," and "hassle." These results indicate that education is needed on use of thermometers to ensure that food is thoroughly cooked and safe to eat.

Participants in all groups agreed that they felt safe about the meat they served in their own kitchens in the absence of any opportunity to buy steam-pasteurized or irradiated meat products. In the current market, irradiated meat products are labeled, but steam-pasteurized products are not. Therefore, consumers will not necessarily make a choice in the market regarding steam-pasteurized products, and without such labeling, people may feel they have little opportunity for personal control. However, labeling will have little impact without public understanding of what the labels mean, a fact underlined by this study in relation to irradiation of meat. Hence, the fact that concern exists about steam pasteurization is surprising. It suggests that part of the "anti-irradiation" senti-

ment is really an "anti-messing-with-my-food" sentiment, i.e., an aversion to processing in general.

However, many participants indicated a willingness to buy irradiated meat if they were convinced that it would not have any side effects such as producing cancer. After reading a brief description of the process, approximately 70 percent of participants expressed a willingness to purchase irradiated meat. This is consistent with the findings from another study (7), in which respondents who received information about irradiation were less concerned about the effects of the technology than those who did not receive the information. Those authors concluded that even a minimal presentation on food irradiation can lead to a significant decrease in consumers' concerns. Many participants in all groups stated that they would be very unlikely to change any behavior regarding what kind of meat they buy. Parents of young children indicated that they could be persuaded to change their behavior, if they felt that such changes would ensure the safety of their children. However, they also indicated that they would be unlikely to change behavior solely for their own benefit. Hence, a clear need exists for effective communication strategies to facilitate public understanding of this technology and to dispel misconceptions about various aspects of safe meat handling.

Concerning willingness to pay, results indicate that the majority of individuals had a preference for steam-pasteurized ground beef over regular ground beef when both are priced the same. Over 70 percent of participants revealed willingness to pay a premium for the safer ground beef. It remains to be seen whether consumers actually would pay for improved safety, when they have the choice at the time of their actual purchase decision.

The study showed that the prevalence of eating undercooked hamburgers was 10.8%. About one quarter of the participants reported that they usually serve medium-rare hamburgers at home. The majority

of participants (nearly 60%) liked their beef well-done, which result may be attributed to a higher proportion of the population acknowledging the health risks related to the consumption of undercooked beef. Zhang et al. (13) found similar results in their survey about prevalence of selected unsafe food-consumption practices and their associated factors in Kansas. However, results might vary in other geographical locations. Because Kansas is a major beef-production state in the United States, higher media coverage may exist about the incidence of foodborne illness associated with undercooked hamburgers. In addition, there are old rural traditions of cooking all food well. On the other hand, aggressive education efforts on food safety have been made in the past and resulted in better consumer awareness (8).

The focus group's results emphasize the need for continuing research on consumer education related to food safety. Given the limitations of using a convenience sample, this study also suggests guidelines to consider in public risk-communication efforts. The intent of this research was to gather preliminary data that might be used in the design of effective information to educate consumers about innovations related to meat-processing and the role of these innovations in providing safer meat products. The results highlight some special problems for the communicator in the realm of educating people about controversial issues such as risk of foodborne illnesses. Information from this study can be used in designing a nationwide survey, which might provide a more accurate reflection of overall consumer attitudes toward the safety of our nation's meat supply.

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