

DEVELOPMENT AND EVALUATION OF FOOD SAFETY SIGNS

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Thesis submitted to the Faculty of the Virginia Polytechnic Institute and State
University in partial fulfillment of the requirements for the degree of

Master of Science
in
Food Science and Technology

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August 12, 2009

Blacksburg, Virginia

Keywords: food safety, signs, education, food handlers, Spanish

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(ABSTRACT)

Food borne disease continues to be a significant public health concern. The increasing awareness of food borne illness intensifies the need for proper food safety education among food handlers. The objectives of this study were to develop bilingual (English/Spanish) food safety signs, to determine their comprehensibility and most effective delivery mechanism for presentation to food handlers. The food safety concepts developed into images were: cross-contamination, proper use of thermometer to check temperatures of foods, proper cooling of foods, and do not work with food if ill. The four food safety concepts were designed into three different formats: pictures and words (English/Spanish), pictures only, and lenticular (images that shift when viewed from different angles). The food safety signs were evaluated using forty-five individuals working in the food retail industry. The participants were divided into two groups according to native language (English/Spanish). For comprehensibility of the food safety signs, 69% responses were noted as correct. The ranking of comprehensibility of the signs was: cross-contamination (93%), thermometer (84%), cooling (64%) and not working if ill (33%). A gap in the understanding of the two lowest scoring food safety concepts (cooling and ill) calls for food safety educational programs and materials that emphasize these concepts. Correct responses for sign presentation were as follows: pictures and words with (80%), pictures only (65%) and lenticular (62%). Comparison of three different formats indicated pictures with words as the most effective presentation. The results obtained can be used as the basics for designing effective food signage for food handlers.

ACKNOWLEDGEMENTS

I would like to thank the faculty and staff of the Department of Food Science and Technology for all their help and support. I would also like to thank the following individuals for their help and cooperation completing this study:

Dr. Joe Eifert, major professor, for all his guidance and support;

Dr. Renee Boyer, committee member, for her help with my research;

Dr. Heather Boyd, committee member, for her suggestions for my program plan evaluation;

Dr. Hengjian Wang, for his help and guidance with the statistical analysis of the data;

My family and friends for their love and encouragement during my studies.

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CHAPTER 1

INTRODUCTION

1.1: INTRODUCTION

According to the World Health Organization, mishandling of foods is one of the major causes of food borne disease. This food safety problem is the result of unintentional errors of food handlers produced by their lack of food safety knowledge. The lack of understanding food safety and good sanitation practices among food handlers is exasperated by their socio-demographic characteristics. To improve food safety knowledge among food handlers, effective food safety education must take into account the social, cultural and economic background of the target audience.

An educational tool that has been studied is the use of pictures or symbols to improve communication to people with low literacy skills. Research has shown that pictures and symbols are powerful tools to draw attention, to get people to pay attention to the message, to help people comprehend the message, to increase recall of the message and to increase the likelihood that people will act in accordance to the message (Houts et al., 2005). The purpose of this study is to develop food safety icons/pictures/symbols that represent important food safety tasks that could be recognized universally. These food safety icons may be then used as educational materials to improve food safety knowledge among food handlers in restaurants and the retail industry. Educational materials such as standardized drawings about food safety can be used as an effective and powerful approach to communicate across languages and cultures. Food safety signage has been used as an educational tool to increase food safety knowledge yet literature is lacking in the effectiveness of the food safety signage designed. In addition to that, socio-

demographic factors that may influence the understanding of the signs have not been taken into account either.

1.2: HISTORY OF THE PROBLEM:

Food borne disease may result from ingestion of contaminated foods and food products. Globally, increases in the incidence of food borne disease continue to be reported. Food borne disease is a major concern in public health because not only affects people's health but also inflicts economic burdens. The Center for Disease Control (CDC) estimates that food borne diseases cause 76 million illnesses, 325,000 hospitalizations and 5,000 deaths in United States each year. It is estimated that up to 30% of people in industrialized countries may suffer from food borne illness each year (WHO, 2000). According to the U.S Food and Drug Administration (FDA), infected restaurant employees were identified as a contributing factor in more than 65% of the U.S food borne illness outbreaks linked to restaurants in a 2002-2003 study.

In 2004, the FDA published a report citing the top four common food safety problems in all food sectors of the industry. The top four food safety problems reported were: deficient employee training, contamination of raw materials, poor plant and equipment sanitation and poor plant design and construction (FDA, 2004). The main risk factors of mishandling food include: improper cooking temperatures, improper cooling, poor personal hygiene, cross-contamination, cooking area not clean, cooking utensils not clean, poor chemical storage and inadequate labeling of chemicals (FDA, 2006). These risk factors depend heavily on the food safety knowledge and practices of the employees handling foods. To increase the safety of food, there is a need to implement preventive controls to lower the incidence of food borne disease. Preventive controls should target food workers since their mishandling of food is one of the

major causes of food borne disease. Food safety training programs should be made available to employees addressing good sanitation practices and food safety knowledge. To have an effective employee-training program, the program should take into account the target audience. Training should be tailored to the job of the employee as well as the cultural background of the employee to be effective.

1.3: JUSTIFICATION:

Food can be easily contaminated from an infected food handler via oral-fecal route or cross-contamination thus it is imperative that food workers are properly educated regarding food safety and good sanitation practices. The leading cause of food borne disease is mishandling of food by food workers (WHO, 2004). In a report published by the FDA, (1988-1992), the five main contributing factors associated with food borne illness outbreaks within food service and retail food store facility types are: food from unsafe sources, inadequate cooking, improper holding temperatures, contaminated equipment and poor personal hygiene. These risk factors may be alleviated by providing and enhancing food safety education among food workers. Proper education and changing behavior of food workers can prevent some of the food safety problems in the food service industries.

Food borne illnesses are common. This is an area of tremendous public health concern not only because of the human health implications but also the annual cost of food borne disease. According to a Virginia Cooperative Extension survey “Industry Educational Needs Survey”, the most pressing issues in the food industry for processors, distributors and retailers were 1) turn over of employees, 2) training needs related to Good Manufacturing Practices (GMP), sanitation and employee hygiene practices, 3) language and cultural barriers. Spanish is spoken by

approximately 62% of the employees working in the food processing industry. Food handlers play a key role in ensuring food safety at all levels of food production thus it is important to know the socio-economic characteristics of the food handlers to provide adequate food safety education. Some of the challenges that food handlers working in the food industry face are: language barriers, cultural barriers, low literacy levels, lack of food safety knowledge, practices and behavior. An increasing number of food workers are foreign born and English is not their primary language. Consequently, the need to develop educational tools that take into account the characteristics of food workers is imperative to provide effective food safety education.

Symbols, signs, and icons are educational tools that communicate effectively a message. The role of visual communication in learning has been studied as a way to transfer information successfully. The field of Semiotics emphasizes the function of signs, which we use to communicate verbally, non-verbally and visually (Senel, 2007). In general, semiotics deals with signs and their functions in everyday life (Senel, 2007). According to David Sless (1981), “visual communication is a major transmitter of our cultural heritage, second only to spoken word.” The printed word, painting, drawings, sculpture, photography, cartography, charts, diagrams, graphs, films and television are all visual forms of communication. For example, languages, numbers, traffic signs, national flags are all made symbols used as means of communication. These symbols are used to represent something meaningful. Research has shown that pictures and symbols are powerful tools for effective teaching/learning and communicating. In this research the use of symbols and bilingual materials as effective ways to convey food safety messages for food handlers in the retail industry will be explored.

A. Demographics of Food Workers:

According to a report published by the National Restaurant Association (NRA), the southern states are projected to lead the way in terms of proportional restaurant industry growth during the next decade (National Restaurant Association, 2006). In the meantime, the southern states are also the areas that have the most rapidly growing Hispanic population in the nation (National Restaurant Association, 2006). Hispanic growth in the south is due to industries like manufacturing, processing plants, construction and forestry that tend to attract Hispanic immigrants. According to the U.S department of labor (2004), Hispanics comprised 18% of all food service occupations in the U.S. Foreign born workers continue to increase their presence in the labor force during the past decades (Albrecht, 1995). Roughly 1 out of 5 individuals working in the food service occupations is foreign born (21%) above the proportion for the overall workforce and 26% of restaurant industry employees speaks a foreign language at home (Albrecht, 1995). According to the Virginia Economic Development Partnership Virginia (2007), Virginia has more than 500 food processors employing more than 34,500 people and the Hispanic population is the largest group employed in the food industry in Virginia. Issues confronting food processors and distributors are high turnover of employees, training needs and language and cultural barriers. To overcome these issues, it is important to provide food safety information in a way that is easily understood by the audience. To inform, increase awareness, and improve communication, food safety materials should be made available in Spanish and should also be made available in graphical pictorials to overcome the cultural, educational and language barriers of the target population.

B. Profile of Food Workers:

According to the NRA, a typical person working in the food service occupation is: female (56%), under 30 years of age (52%), and high school graduate or less (65%) (National Restaurant Association, 2006). The educational level of a typical food worker in the food industry is low. In the restaurant industry, food workers with a high school education comprised 35% of individuals while 30% of food workers have less than a high school education (National Restaurant Association, 2006). The social characteristics of food workers may be: low educational level; lack of knowledge about food safety information, language and cultural barriers among immigrants whose language is other than English. The food industry is challenged by the characteristics of its work force and often the training provided is not tailored to overcome these barriers. According to a report published by the FDA in 2004, one of the top food safety problems in the industry is deficient employee training (FDA, 2004). The food safety training provided often focuses in scientific food safety terminology that often may not be understood by the target audience. The training programs are often too long and science-based, expecting the audience to understand and digest everything without taking into account their educational level and social characteristics. Food safety training must be tailored to the audience according to its social characteristics. The training should be delivered in a way that is easily understood by the employees. Food safety training can only be effective if it delivers the necessary knowledge and this knowledge can be learned and applied to the work environment. Training is an essential part of an effective food safety program to provide safe, wholesome and high quality products.

C. The Economic Cost of Food borne Illness:

According to one USDA Economic Research Service (ERS) report, “Food borne illnesses account for about 1 of every 100 U.S. hospitalizations and 1 of every 500 U.S. deaths.” The ERS also estimates that, each year in the United States, just five food borne illnesses – Campylobacter, Salmonella, E. coli O157:H7, Listeria monocytogenes and Toxoplasma gondii - cause \$6.9 billion in medical costs, lost productivity and premature deaths (Buzby et al., 2001). That figure does not reflect any of the hidden costs that victims and their families suffer: the cost of traveling to receive medical care, time lost from work caring for sick family members, lost leisure time, or the intense pain and suffering that accompanies serious food borne illness (Buzby et al., 2001). On top of that, the Food and Drug Administration (FDA) estimates 2 to 3 percent of food borne illness victims develop secondary long-term medical complications resulting in over 1.5 million lingering health problems per year (CFI, 2008). The cost of food borne disease could be reduced by promoting food safety education and good sanitation practices among food handlers. Proper education and changing behavior of food workers can prevent some food safety problems in the food service industries.

D. Effective Food Safety Education:

To have an effective food safety education program for food workers, one must take into account the social, cultural and economic background of the target audience; otherwise, food safety education will not be effective. Proper training in food safety principles may alleviate some of the food safety problems in the industry. At the worker’s level, the lack of food safety knowledge may lead to some contamination of food. For example, the lack of good sanitation practices among food workers is one of the leading causes of contamination (Higgins, 2002).

Language barriers between employees and supervisors is also a major issue since a large percentage of the food workers do not speak English. Food workers cannot learn proper food handling if they cannot understand or read instructional manuals in English. When developing training, the language barrier must be taken into account by providing training so that materials can be easily understood by the employees (FDA, 2004). Thus, proper training may significantly and positively impact food safety by providing a general understanding of good sanitation practices, allergen control, equipment sanitation, temperature control, and cross-contamination of foods. It is a challenge to provide effective educational programs in food safety for such a wide range of food workers with the socio-demographic characteristics illustrated before. One way to improve training is by developing standardized drawings about food safety that can be easily understood by food workers regardless of their cultural background and to made available food safety messages in the language spoken by a high percentage of food handlers. The use of symbols and bilingual materials to convey food safety messages could be an effective and powerful approach to communicate across languages and cultures.

1.4: RESEARCH GOALS:

- 1) To design bilingual (English/Spanish) food safety signs for the labor force in the food retail service industry
- 2) To test food handlers' comprehensibility of each food safety sign.
- 3) To determine most effective delivery mechanism for the signs to be presented to food handlers in the food retail service industry.

CHAPTER 2
LITERATURE REVIEW

2.1: RISK FACTORS ASSOCIATED WITH FOODBORNE DISEASE

2.1.1. Food Safety Problems in U.S:

In the past two to three decades, the awareness of food safety problems is increasing in industrialized countries (Kaferstein et al., 1997). The globalization of food production, manufacturing, marketing, increasing in transnational trade, traveling and migration are some of the factors that increase the risk of infectious diseases (Kaferstein et al., 1997). The WHO and the FAO concluded that illness due to contaminated food was perhaps the most widespread health problem in the contemporary world and an important cause of reduced economic productivity (FAO/WHO, 1984).

The leading cause of food borne illness is mishandling of foods by food workers (WHO, 2004). According to the Department of Health and Human Services, a large proportion of food borne illness is caused by an ill food handler preparing food for other to eat, allowing food to be held for an extended period of time in the temperature danger zone (41°F-135°F), cross-contamination in the kitchen, eating improperly cooked food and a food handler preparing food without washing his/her hands properly (Department of Human Services, 2008). Food borne illness of microbial origin may be the most serious food safety problem in the United States. The CDC reports that 79% of outbreaks between 1987 and 1992 were bacterial; improper holding temperature and poor personal hygiene of food handlers contributed most to disease incidence (FDA, 1999).

Food borne illness is a major concern in public health in the U.S. In 2005, 59% of food-borne outbreaks were traced back to restaurants (Roberts et al., 2008). The top food safety problems in food service operations are: improper cooking, improper cooling, food from unsafe sources, contamination of equipment, improper holding temperatures and poor personal hygiene (Roberts et al., 2008). All of these food safety issues are related back to food handler error (Roberts et al., 2008). For example, an examination of food borne illness risk factors among randomly selected food service establishments in the US highlighted problems in food handling behaviors (Food and Drug Administration [FDA] 2004). Over 53% of fast food restaurants and 72% of full service restaurants were out of compliance regarding adequate hand washing by workers. Over 41% of fast food restaurants and 63% of full service restaurants were out of compliance regarding holding time and/or temperature (FDA, 2004).

In 1998, the FDA conducted a study to identify the rate at which food handlers were in compliance with the Food Code standards (Roberts et al., 2008). The findings were as follows: the compliance with the Food Code in full service restaurants was 74% and quick service was 60%. The compliance rate was lower in restaurants compared to hospitals (80%), nursing homes (82%), and elementary schools (80%) (Roberts et al., 2008). In restaurants, the 3 main problems identified were improper holding temperatures, cross contamination and poor personal hygiene (Roberts et al., 2008). All of these problems have been identified as the most frequently implicated factors in food borne illness outbreaks (Roberts et al., 2008). All of these food safety problems are associated with employees mishandling of foods. Consequently, an effective educational training program about good food safety practices and sanitation can help alleviate this issue. Furthermore, in 2003, the FDA collected data during visits to over 900 facilities representing 9 different types of food service establishments (FDA, 2004). The data collected

was based on whether 42 individual data items from the 1997 Food Code were observed to be out of compliance, in compliance, not observed or not applicable (FDA, 2004). “Out of compliance” means that behavior or practice did not follow the Food code’s provisions (FDA, 2004) “In compliance” means that the behavior or practice did follow the Food code’s provisions (FDA, 2004). “Not observed” means that the behavior or practice was not observed during the visit and “Not applicable” means that the behavior or practice did not apply to that type of facility (FDA, 2004). The data collected for the out-compliance items with the highest incidence was: improper holding/time temperature, improper cold holding of potentially hazardous food (PHF), and inadequate date marking of refrigerated ready to eat foods (FDA, 2004). For all of the different types of facilities investigated, the highest out of compliance items included: improper hand washing, and improper cleaning and sanitizing of food contact surfaces.

The results indicated that three main risk factors in the industry are: improper holding/time temperature, poor personal hygiene and contaminated equipment/cross-contamination. The data collected support the recommendations of the FDA to food service facilities to implement preventive controls over these risk factors. Preventive controls that help alleviate these risk factors must emphasize food handler food safety knowledge and behavior since all risk factors can be traced back to handler’s mishandling of foods.

2.1.2. Outbreaks Associated with Mishandling of Foods:

To illustrate how the mishandling of food is a leading cause of food borne illness several outbreaks have been traced back to an ill food worker. For example, in Michigan, on January 30 2006, there was an outbreak of Norovirus in a restaurant (CDC, 2006). Results of the outbreak investigation revealed that at least 364 restaurants patrons became ill with gastroenteritis (CDC,

2006). The results from the investigation identified the source and agent of infection: Norovirus genogroup I (CDC, 2006). The findings also revealed that several food workers have been ill during January 19- February 3, 2006, and that a line cook had vomited in the restaurant on January 28 (CDC, 2006). An environmental assessment was performed, which identified the restaurant deficiencies in employee hand washing practices, cleaning and sanitizing of food and nonfood contact surfaces, temperature control and maintenance of potentially hazardous foods (CDC, 2006). As we see with this outbreak, the results of the investigation support the need for food safety education for food service workers regarding prevention of food borne illness through food safety knowledge and good sanitation practices.

A study from the Netherlands about the risk factors for Norovirus confirmed that food handling practices play an important role in the spread of Noroviruses, this virus has been blamed for many outbreaks of intestinal illness on cruise ships and institutions (Matty et al., 2003). The study, which focused on the spread of Noroviruses in the general population rather than on specific outbreaks, indicates that the main risk factor for contracting a Norovirus infection is contact with someone with gastroenteritis. But the investigators also found that in households, poor food-handling hygiene was an important factor in transmission (Matty et al., 2003). Norovirus infections are the most common food borne illness in the United States and possibly worldwide. Food workers should be made aware of the risk of transmission in households. "What the study says is that if you're a food worker and you live in a house where people are sick with vomiting and diarrhea, you need to understand that you may be at greater risk of spreading that yourself. So you have to be extra careful with how fastidious you are with hand washing." (Matty et al., 2003). These illustrations demonstrate the role a food handler plays in food borne illness if his/her food safety knowledge is lacking or deficient.

2.1.3. Food Safety Education Impact:

Most of the research and studies on food safety education has focused on evaluating food safety knowledge and practices immediately after training. In studies about food safety training, results indicate that proper training could have a significant impact in improving knowledge and behaviors of food handlers (Anding et al., 2008). The downfall of these studies is that knowledge and behaviors have not been evaluated over a longer period of time but only in a short-term manner.

A study about change in knowledge and behavior of food handlers after training indicated that knowledge improved (Roberts et al., 2008). The study's intent was to see if a 4-hour food safety-training course could help improve food safety knowledge and behavior among 160 employees in the restaurant industry (Roberts et al., 2008). Initially, the employees were given a knowledge assessment about food safety (Roberts et al., 2008). Then, trained researchers observed each employee in a 3-hour period to record behaviors for handling food, such as hand washing and thermometer use. After that, the employees attended a 4-hour food service class and were given the same prior knowledge assessment at the end of the class (Roberts et al., 2008). Afterwards, trained researchers observed employees again to record data about food handling behavior. The results of this study indicated that there was an improvement in employees' knowledge about cleaning and sanitizing surfaces, minimizing raw food contact with bare hands, proper cold and hot holding temperatures and proper hand washing. On the other hand, the results also indicated that there was little impact on overall cross-contamination and thermometer use (Roberts et al., 2008). This study demonstrates that food safety education does have a great impact in knowledge and behavior of employees. On the other hand, it also demonstrates that a

food safety education program must be devised in a manner that has a positive impact in all aspects of food safety practices. To design an educational program that it is effective, the program must take into account the socio-demographic background of food handlers and then tailored the program to the audience.

Currently, food safety training programs are innovative and use all kinds of tools to get the message across the audience. There are ServSafe classes available in a lecture type of setting, there is also online training, computer based training, videos, case-solving studies, and practice exercises.

2. 2 SOCIO-DEMOGRAPHIC CHARACTERISTICS OF FOOD HANDLERS

2.2.1. Demographics in USA:

Proper food safety training plays a major role in improving food safety practices and sanitation. To design food safety educational materials that are effective the socio-demographic characteristics of the target audience must be taken into account. The U.S is a diverse country in which a high percentage of food service workers are foreign born (21%) (Albrecht, 1995). This fact represents a challenge for an effective educational food safety program since language, cultural background, behavior and educational level may be different from one employee to another one. Consequently, the characteristics of the population must be studied to design appropriate food safety educational materials. National statistics show that 61% or 29 million of older adults have limited reading and comprehension skills, and millions prefer more easy-to-read materials (Barents Group LLC, 1999).

- Population Trends: The total population in the U.S., according to the 2006 census estimate is 299,384.484 (U.S. Census Bureau, 2006). 14.8% of those are of Hispanic origin,

which is becoming now the largest minority group in the country (U.S. Census Bureau, 2006). A new report from the Pew research Center projects that by 2050, non-Hispanic whites will account for 47% of the population, down from the 2005 figure of 67%; and it projects that Hispanic population rising from 14% in 2005 to 29% by 2050 (Pew Research Center, 2008). The Asian population is expected to more than triple and the African American population will grow by more than 50 % by 2050. It is estimated that the population of the United States may rise from 296 million in 2005 to 438 million, with 82% of the increase coming from immigrants

-Educational Attainment: As indicated by the Census Bureau estimates from 2006, the population 25 years and over with a high school education or less are about 90 million of the total population. Food service workers with a high school education or less comprised about 64% working in the food industry. For a large portion of the food workers' educational level is relatively low in this country. The percentage of foreign born high school graduates from Latin America was relatively low 49.1% compared to foreign born from Asia 87.4% and Europe 84.9% (Larsen, 2004).

-Languages: The diversity in U.S continues to increase dramatically and this is reflected in languages spoken at home other than English. The Latino population has had a great impact in all aspects of U. S society. Spanish is the second most spoken language in the country after English. This is of extremely relevance because food safety educational materials must be made available in different languages in order to educate this population. Today, a large area of the media, advertisement and signage is made in Spanish to target the large Spanish speaking population in the country. Graphical messages can also help overcome the language barrier by using pictures that provide a message across regardless of the spoken language. According to the National Restaurant Association, one of four restaurant industry employees (26%) speaks a

foreign language at home and two thirds of employees who speak a language other than English at home- use Spanish at home (NRA, 2006).

-Place of Birth: Foreign Born Population: Foreign-born individuals are those who were not U.S citizens at birth (Larsen, 2004). In a report by the Census Bureau 2003, the foreign born population from Latin America was 53.3%, Asia 25%, Europe 13.7%, and the remainder 8% from other regions of the world (U.S. Census Bureau, 2003). These statistics demonstrate how diverse the U.S is in regard to cultural background of citizens.

- Economic Characteristics: According to the foreign U.S Census Bureau report, 2003, foreign workers are more likely than native workers to be in service occupations (23.3% and 14.9% respectively) (U.S. Census Bureau, 2003). Native workers are more likely to be in management or professional occupations (36.2% vs. 26.9%) (U.S. Census Bureau, 2003). The proportion of foreign workers in management and professional occupations is the lowest among those from Latin America. The Central American foreign born, the proportion of workers were highest in service occupations (production, transportation, material moving) (Larsen, 2004).

2.2.2. Demographics in Virginia:

- Population: According to the U.S. Census Bureau, the estimate of total population of Virginia was 7,642,884 in 2006 compared to 7,078,515 in 2000 (U.S. Census Bureau, 2006).

The total number of the Hispanic/Latino population increased from 4.7% in 2000 to 6% in 2005 data shown by the U.S. Census Bureau. During the last 10 years, Virginia experienced a 14% increase in total population but a 106% increase in the Hispanic/Latino population (U.S. Census Bureau, 2006).

-Education: In Virginia, the educational level of Hispanics over 25 years old was much

lower than that of other races according to the U.S. Census Bureau report in 2006. In general, only 30 % of Hispanics had some level of college education compared to 54% for Whites, 43% for African-Americans, 41% for American-Indians and 64% for Asians (U.S. Census Bureau, 2006). From the 2000 census data, the educational level of Hispanics was considered lower than the one attained by the African Americans with a similar number of people in the country (U.S. Census Bureau, 2000). This shows that large difference among races exists at all levels of education. Additionally, the 2000 census data implies that the rural population in Virginia has a lower level of education compared to the urban population (U.S. Census Bureau, 2000). This information is important because most of the agricultural industry is found in rural areas where the educational level of the workers is less.

-Economics: According to the U.S Census Bureau, the average income in Virginia is much higher than the national average (U.S. Census Bureau, 2006). This difference may be associated with the large metropolitan areas in the northern areas of the state, which are more heavily populated than some other states in the country. Within the state of Virginia, the rural area of the state has a higher poverty rate than the urban region of the state. There is a significantly difference in the earnings per job in dollars from the rural area of Virginia vs. the urban area of Virginia (U.S. Census Bureau, 2006). Between 2004 and 2005, the average earning per job in rural Virginia was \$31,034 compared to \$50,266 in urban Virginia (U.S. Census Bureau, 2006). These differences can be accounted by observing that a higher number of people living in urban areas have a college degree compared to those living in rural areas. From this trend, it can be deducted that people living in rural areas of Virginia need more education to obtain better paying jobs. The Hispanic population is more likely to live in rural areas of Virginia because that is where the agricultural and food industries are located.

-General agriculture: Virginia is an agricultural state. The top 5 commodities in Virginia in 2006 were broilers, cattle, dairy products, turkeys and greenhouse/nursery (U.S. Census Bureau, 2006). Soybeans are now the number one cash crop in the state (U.S. Census Bureau, 2006). This confirms the need for trained work force in food safety since Hispanics are mainly working in the agriculture and food industries. Proper education and training must be available for that part of the population of Virginia. Agriculture industry is the number one industry in the state (U.S. Census Bureau, 2006). Virginia products such as ham, peanuts are famous nationally and internationally.

-Food Industry in Virginia: According to the Virginia Economic Development Partnership Virginia (2007), Virginia has more than 500 food processors employing more than 34,500 Virginians. The food and beverage industry is Virginia's largest manufacturing employment sector (U.S. Census Bureau, 2006). Virginia's workforce is comprised of a large number of Hispanics working in the food and beverage industry. Food borne illness is an overwhelming public health concern in the state of Virginia. Food borne illness outbreaks involve a large degree of monetary losses to the food industry. Preventing outbreaks and protecting consumer's health is a priority for the food industry in Virginia. By targeting the Hispanic community with food safety educational materials and training, food borne illness outbreaks could be better controlled and prevented. Most Hispanic workers in the food industry have low educational level, low income, are not well informed about food safety in a plant/manufacturer/restaurant setting. Proper food safety education including materials in Spanish and the use of symbols may help alleviate some of the problems the industry is experiencing with all of the recent food borne illness outbreaks.

-Population trends in Virginia: The population of Virginia keeps growing. In the last 5 years, the total population of Virginia increased by 500,000 bringing the population to about 7.5 million people (U.S. Census Bureau, 2006). Hispanics comprised 6% of the total population in Virginia (U.S. Census Bureau, 2006). The reason of the steady increase of people moving to Virginia is economic. Virginia has a low unemployment rate (U.S. Census Bureau, 2006). A high proportion of these people moving to Virginia are of Hispanic origin. These people don't have a high school degree and are poorly educated. The income distributions show that immigrants are typically in lower income brackets. Therefore, immigrants of Hispanic origin take lower level jobs working in the agriculture and food industry because these jobs are easier to obtain.

-Virginia's Foreign Population: Virginia's foreign population reached 570,000 in 2000 (U.S. Census Bureau, 2006). 29% of the state's total foreign-born population is recent immigrants (U.S. Census Bureau, 2006). The top two countries sending immigrants to Virginia are Mexico and El Salvador (U.S. Census Bureau, 2006). These immigrants are of Hispanic origin and Spanish speaking. These recent immigrants are of prime working age and tend to get jobs in the food and agriculture industry because their educational level is low compared to the rest of the population in Virginia.

-Conclusion: Virginia's total population is well above 7,500,000 people. 6% are of Hispanic origin. The population in Virginia keeps growing due to a healthy economic in the service sector. The concentration of highly educated people remains in the urban areas of the state while the rural area has a higher number of people with low educational levels. Virginia attracts immigrants of Hispanic origin due to large manufacturing, food and agriculture industry in the state. Immigrants of Hispanic origin tend to obtain jobs in these industries.

2.3. WORLD AND USA ILLITERACY RATES

The United Nations, which defines illiteracy as the inability to read and write a simple message in any language, has conducted a number of surveys on world illiteracy. In the first survey (1950, pub. 1957) at least 44% of the world's population was found to be illiterate. A 1978 study showed the rate to have dropped to 32.5%; by 1990 illiteracy worldwide had dropped to about 27%, and by 1998 to 16%. However, a study by the United Nations Children's Fund (UNICEF) published in 1998 predicted that the world illiteracy rate would increase in the 21st century because only a quarter of the world's children were in school by the end of the 20th century (UNICEF, 1998). The highest illiteracy rates were found in the less developed nations of Africa, Asia, and South America; the lowest in Australia, Japan, North Korea, and the more technologically advanced nations of Europe and North America. Using the UN definition of illiteracy, the United States and Canada have an overall illiteracy rate of about 1%. In certain disadvantaged areas, however, such as the rural South in the United States, the illiteracy rate is much higher.

Illiteracy in America is still growing at an alarming rate. According to the National Adult Literacy Survey, 42 million adult Americans can't read; 50 million can recognize so few printed words they are limited to a 4th or 5th grade reading level; one out of every four teenagers drops out of high school, and of those who graduate, one out of every four has the equivalent or less of an eighth grade education (Sweet, 1996). In Virginia, the illiteracy rate is 7% of the population. According to current estimates, the number of functionally illiterate adults is increasing by approximately two and one quarter million persons each year (Sweet, 1996). This number includes nearly 1 million young people who drop out of school before graduation, 400,000 legal

immigrants, 100,000 refugees, and 800,000 illegal immigrants, and 20 % of all high school graduates drop outs (Sweet, 1996).

Then, the question is how can effective educational programs in food safety be made available to a large portion of food workers with low educational levels and foreign born? The answer is to develop standardized drawings about food safety that can be easily understood by the food workers regardless of their cultural background and to create bilingual food safety messages to target the foreign-born food handlers.

2.4. REVIEW OF VISUAL COMMUNICATION AND LEARNING

Many studies have shown that consumer food safety behavior and knowledge differ according to demographic and socio-economic factors such as gender, age, educational level and economic status (Altekruse et al., 1999; Fein et al., 1995; Johnson et al., 1998; Klontz et al., 1991; Schlech et al., 1983). Food handlers play a key role in ensuring food safety at all levels of food production. Thus, it is important to know the socio-demographic characteristics of the handlers to provide the adequate food safety education. Many people regardless of their educational background lack a basic understanding of food safety. This lack of knowledge is exacerbated for the low literate population by the less effective ways in which they process information, and their greater likelihood of having a low income, of being of minority status and of being from another nationality (Barents Group LLC, 1999). The typical profile of a food worker is: low literacy skills, limited educational attainment, and a high percentage being foreign born. Thus, studies have shown that individuals with low literacy rely heavily on oral explanations, visual cues (graphical icons), and demonstration of task to learn rather than on written materials (Barents Group LLC, 1999). Effective communication is the key ingredient to

deliver educational messages properly, whether communication is oral, written or graphical depends on the target population.

Symbols and pictures have helped people communicate even before the invention of language (Berger et al). Symbols have appeared in signs for thousands of years. Jim Boleck, a designer and researcher describes universal symbols as a language that is ‘read’ when a picture or symbol is connected with the viewer’s concept of its meaning. Some symbols are universally understood while others symbols are subject to the individual’s own interpretation, which is influenced by the culture of the particular individual. However, either type of symbol can become universally understood after being widely used over time (Berger et al). Traffic signs are a great example of pictorial communication now used universally based on symbols and signs. These symbols have been adapted and recognized throughout different parts of the world. In the 20th century, there were concerted attempts to create uniformity of symbols so that their meaning will be clear to all regardless of spoken native languages (Cowgill et al., 2003). Nations with high illiteracy rates like India and Egypt use symbols as a means of communication. For example, in Egypt, political candidates are assigned symbols, such as, a car or boat, to make it easier for illiterates voters to identify their political choices on the ballot (Cowgill et al., 2003).

Pictorial communication has tremendously helped illiterate people in learning to read and to write (Grant, 1997). A lot of work has been done on pictorial communication, which enables interpersonal communication between people speaking different languages. A few systems have been developed in this field of research, most of them searching for a universal language. In 1949, Charles Bliss developed Blissymbolics for the purpose of international communication (Blissymbolic Communication International, 2000). His semantography is a communication system based on a set of symbols, which can be used to break down language barriers. Every

symbol is abstract meaningful; they can be placed together to form sentences (Blissymbolic Communication International., 2000). The use of Charles' symbols to facilitate communication with non-verbal children was successful in Canada and in a number of other countries (Blissymbolic Communication International., 2000). Charles' system, of course, is not the only one to have been used successfully in this area of education (Grant, 1997).

To illustrate the use of symbols to improve communication in health care systems, Lois Lanier created pictures of health flash card out of personal need (Lannier, 1995). His son had Down's syndrome and had major surgery and was in a respirator for two days afterwards and could not speak. His doctor and nurses could not communicate with him because of his medical impediments. Lois Lanier then said: "I began to think of all the patients who could not communicate due to medical reasons or language barriers. How isolated and afraid that must make them feel. I immediately thought of pictures as a way for the medical staff to learn what patients want and to give information to non-English speaking patients."(Lannier, 1995). Pictures of Health consisted of twenty-eight cards, and all were bilingual (English and Spanish), but the desire was that language wouldn't be necessary; the pictures would work well by themselves and cover many aspects that a patient may encounter in a medical facility (Lannier, 1995). Currently the system is in use in seventy-nine hospitals and medical facilities throughout the United States (Cowgill et al., 2003). As ethnic populations grow in the U.S., health care facilities are discovering the fact that English is not the primary language spoken by many of their clientele. To address this, in many medical facilities, and other public buildings, bilingual (primarily English/Spanish) signs are used (Grant, 1997).

In a review paper published by patient education and consulting, the paper discussed how combining pictures with spoken or written text affects health communication (Houts et al.,

2005). The research cited in the paper demonstrated that adding pictures to written and spoken language could increase patient attention, comprehension, recall and adherence (Houts et al., 2005). The results of the review also showed that pictures could be especially helpful to patients with low literacy skills. The research also suggests that spoken information can, with the help of pictures be recalled to a high degree by people with low literacy level (Houts et al., 2005). Furthermore, one study suggested that people with less education are especially likely to adhere to medical instructions accompanied by pictures (Houts et al., 2005). As a result, graphical information plays a key role in helping people with low literacy level to understand and use health information (Houts et al., 2005).

In another study, Delp and Jones (1996) demonstrated that pictures are a powerful tool in improving health communication. In this study, patients who were given treatment for lacerations were at the point of discharge, given written instructions for what they should do to care for their wounds after returning home. Half of the patients were randomly given text, and the other half received the same text plus pictures that illustrated the information written in the text (Houts, 2005). The patients were then interviewed by phone 3 days later and asked if they had read the instructions. The patients who received the handouts with pictures were significantly more likely to read the handouts 98% compared to 79% (Houts, 2005).

A new and revolutionary way of educating a wide range of individuals is photo novels or photonovelas. This is a new innovative teaching tool for Spanish-speaking individuals. Photonovels are like comic books, but they are compiled using photographs and captions and are highly visual (Anonymous, 2008). Based on the revolutionary Brazilian educator Paulo Friere's concepts of participatory education, the process of creating the photonovel allows learners to define the content and outcome of their learning by creating a story line about an important topic

or theme and then acting it out; using photography as a means to express a story and message (Anonymous, 2008). Auger Communications developed a bilingual (English/Spanish) photo novel series for the National Good Agricultural Practices (GAPs) program out of Cornell University. They focused on food safety, a particularly relevant topic given the recent outbreaks of *Salmonella* and *E.coli*. One story was targeted to farm workers about: hygiene in the fields. The second was a story of a family who gets sick from Salmonella. It contains practical steps for all stages of food preparation (shopping, cooking, storing, cleaning) to prevent food contamination and to kill harmful bacteria in home kitchens (Wikipedia, 2007).

These studies demonstrate the use of graphical messages in education has great impact in learning. The literature suggests that using visual elements help greatly to communicate messages. Pictures can help simplify complex subjects and they can also overcome the low literacy level of individuals, their language and cultural background. The role of graphical materials plays an important role in improving communication with individuals of low literacy levels. Graphical food safety messages had been developed and used by various agencies, such as, the FDA, USDA and the Virginia Department of Health. The International Association for Food Protection (IAFP) developed international food safety icons in 2003 with the help of food industry, academia and representatives of regulatory agencies. The goal of developing these food safety icons was to represent important food safety tasks that could be recognized and understood regardless of a person's native language (International Association for Food Protection, 2003). Eleven food safety icons were developed including: hand washing, cross-contamination, hot and cold holding, sanitizing of utensils steps, temperature danger zone, do not handle cooked foods with bare hands and do not handle food if sick. In addition, IAFP also

developed international food allergen icons for use in the manufacturing and warehousing environment.

2.4.1 Visual Communication through Signage:

Using symbols as tools to effectively convey a message has been used by educators, photographers, historians and many other professionals. These days, advertising is used through signs to attract attention in a quick manner. Signs are placed everywhere on highways, hospitals, schools, railways, streets and restaurants. There are national standards that have been put in place to guide signage size, shape, color and placement in highways. The design of signage must take into consideration some important aspects such as legibility and readability of letters, size of the letters, size of the image and colors (Claus et al., 1976). There are some basic design considerations when developing signs. The first consideration is the purpose of the sign. According to James Claus and Karen Claus, the sign is meant to send a specific message to the viewer. The sign is composed of elements but it must communicate a whole (Claus et al., 1976). Also a principle of sign design is simplicity. A sign is usually designed to communicate a message in a short amount of time by the viewer. Thus, the simpler the sign, the more direct the perception by the viewer (Claus et al., 1976).

Another important aspect of designing signs is using letters in communicating the message. The letters must be legible, easy to read, well situated of sufficient size (Claus et al., 1976). The use of colors is also critical in sign design. Colors must be selected carefully to project and convey certain messages. The choice of color can influence the entire idea about the sign. For example, black and yellow have been found to be very legible and striking combination. Direct associations of modern American colors are: yellow (caution), red (danger,

hot), green (nature, water), and blue (cold, sky, water) according to Birren color psychology and color therapy. Thus, the use of colors in signage must be taken in to account when trying to communicate message effectively. According to Claus, colors can produce physiological and psychological effects, they also have symbolic meanings acquired over the course of human development, and they attract attention catching the eye more quickly than black and white (Claus et al., 1976).

2.5: SUMMARY

One of the main causes of food borne disease is mishandling of foods by food workers. This may include: improper cold/hot holding, cooling, cross-contamination, lack of hygiene, improper cooking temperatures and cleaning and sanitizing. These food safety problems are usually the result of an unintentional error of food handlers produced by the lack of food safety knowledge. The lack of understanding food safety and good sanitation practices among food handlers is exacerbated by their socio-demographics characteristics.

Food workers often are people with low literacy levels and a large percentage are foreign born, and speak another language other than English. These characteristics make food safety training a challenge for the food industry and contributive to the risk factors associated with food borne disease. Thus, an effective educational program for food handlers must aim to improve communication. A strategy to improve communication for populations with low literacy levels, low reading skills is the use of illustrations or symbols. Studies have demonstrated that the use of symbols to convey messages is an effective way to communicate across languages and cultures. Bilingual materials about food safety practices must also be made available for food handlers whose native language is other than English. To reduce food borne disease and food safety

problems, food handlers must be properly educated about food safety in ways that they can easily understand. Developing bilingual (English/Spanish) food safety educational materials can help improve communication tremendously. Written materials for Spanish-speakers food handlers can be used as tools to educate and change the behavior of the target audience.

CHAPTER 3

MATERIALS AND METHODS

3.1: MATERIALS

The materials used for this research included:

1. Examples of food safety brochures, symbols and signs, including international food safety icons.
2. Examples of road symbols and shape.
3. Computer software for graphical design of symbols and pictorials.
4. Virginia Tech facilities:

The food science and technology building will be used for meetings, focus group evaluations, and equipment (computers, printers, photocopy machine).

5. Evaluation tools: Demographic Survey and Evaluation of Symbols Survey in English and Spanish.
6. Voluntary participation of food handlers working in the retail industry.

3.2: METHODS

3.2.1 Target Population:

The target individuals for this research were food handlers working in the food retail industry. One of the selection criteria to participate in this study was that all participants worked handling foods in food retail establishments. Another important selection criteria was that the participants' native language was either English or Spanish. This criterion was put in place to determine the possible influence of language on results.

3.2.2 Research Design and Objectives

Four-food safety concepts were selected to develop into food safety icons. The food safety concepts were selected based on main risk factors associated with food borne illness. Once the selections were made, the food safety concepts were designed into pictorials using computer software. The food safety signs were designed in three different formats: pictures with bilingual text (English/Spanish), pictures only, and lenticular. Lenticular printing consists of images that have the ability to change or move as the image is viewed from different angles. Signs were designed in both color and black and white.

English and Spanish speaking food handlers were recruited using a demographic survey to assess the signs. The demographic survey was used to obtain specific data that could influence the results of this study. This study was conducted by means of personal interviews in the language spoken by the participant using an evaluation survey. All participants were classified into three groups. First, each group was presented one of the three different versions of all four food safety messages (pictures and words, pictures only and lenticular). The food safety signs were randomly shown to participants. The participants were allowed to view each sign for as long as they needed before asking questions about them and were permitted to retain signs while answering questions or survey. The purpose of this was to determine the comprehensibility of the signs and to test for the most effective delivery mechanism.

After this, a post-test interview survey was given to all participants. During this phase, the meaning behind each food safety concept was explained to all individuals. The aim of this phase was to determine which format participants think communicates the message most effectively and to determine preferences of the food signs' design.

The main objectives of this research were to determine how well the newly developed food safety signs are understood by food handlers and to determine the most effective delivery method in which these food safety concepts should be delivered to people working in the food industry.

The objectives were addressed as follows:

- a) The signs were ranked in order of comprehensibility from easiest to understand to the most difficult to understand.
- b) Three different formats were compared to determine the most effective delivery mechanism.
- c) The participants' preference of format and design of the signs that could improve the comprehensibility of the concepts was noted.

3.2.3 Selection Criteria of Food Safety Concepts

One of the objectives of this research was to develop food safety icons for food handlers in the retail industry. The food safety messages designed were selected based on research published by the Center for Disease Control which identifies the main contributing factors associated with food borne illness outbreaks in retail food service facility types. According to the CDC, the risk factors associated with retail food establishment were: unsafe sources, inadequate cooking, improper holding temperatures, contaminated equipment and poor personal hygiene.

The selection of the food safety concepts designed also included improvement of some of the concepts developed for the "International Food Safety Icons" under the sponsorship of the International Association for Food Protection. The 11 "International Food Safety Icons" are pictorial representations of important retail food safety tasks that can be recognized regardless of a person's native language. Icons were developed for the following food safety concepts: hot

holding; cooking; refrigeration/cold holding; wash, rinse and sanitize; temperature danger zone; hand washing; cross-contamination; cooling; do not handle if ill; no bare hand contact; and potentially hazardous food (International Association for Food Protection). In addition to that, the project steering committee including Virginia Tech professors: Dr. Joe Eifert, Dr. Rene Boyer and Dr. Heather Boyd guided the choice of food safety concepts to be graphically presented. The selection of the graphical messages considered messages that communicate warning, reminder, instructions or directions.

As a result, four food safety concepts were selected to develop graphically. The four food safety concepts chosen were: 1) avoid cross-contamination of raw and ready to eat foods, 2) how to cool foods properly, 3) how to check the internal temperature of food products properly and 4) do not handle/prepare food if you are ill. Three of the four food safety concepts chosen “ cross-contamination, cooling, and do not handle if ill” were selected from the International Food Safety Icons as graphical concepts that needed revising to improve the food safety message. One of the four food safety concepts: “use of thermometer to check internal temperature of food product,” was selected based on the risk factors for food borne illness outbreaks. This food safety concept was developed graphically without taking into account any pre-existing pictorials of this concept, but was styled in a manner similar to the modeled food safety icons.

3.2.4 Description of Selected Food Safety Concepts

The four food safety concepts selected to design graphically are among the main contributing factors for food borne illness outbreaks in the retail industry. The four food safety concepts selected were: avoid cross-contamination of raw meats and cooked foods, cooling foods properly, correct use of thermometer to check internal temperatures, and do not handle food if ill.

Each food safety message was developed into a pictorial that emphasized pictures as a visual tool for portraying food safety knowledge. The intention of developing the food safety messages into pictorials was to use pictures as educational tools that aid in communicating a message regardless of the person's social and cultural background. The four food safety concepts chosen are among tasks or behaviors that are of main concern in the food industry because they rank as main risk factors that can potentially contribute to food borne illness.

A. Food safety message #1: Cross-Contamination:

Cross-contamination is an important risk factor in food borne illness. The improper handling of raw meat, seafood and poultry in particular can set the stage for cross-contamination. As a result, bacteria can spread to food and throughout the kitchen. Cross-contamination occurs when we carry bacteria from an object to another object, from an object to a person, or from person to person. In foods, this occurs when microorganisms are transferred from raw food to processed food. Cross-contamination may result in food borne illness. Cross-contamination can be avoided by:

- a) Washing hands thoroughly before food handlers preparing and cooking food.
- b) Keeping raw foods/meats separated from cooked foods.
- c) Placing raw meats on the bottom shelf of the refrigerator to avoid any leaking of fluids into ready to eat foods.
- d) While cooking, use separate cooking utensils. Never use the same cooking utensil you used on raw food to serve cooked food.
- e) Using separate dishtowels or sponges for each stage of preparation of food process.

B. Food safety message #2: Use of Thermometer to Check Internal Temperature of Foods:

Another important food safety concept is how to correctly use the thermometer to check internal temperatures of food products. Different foods have to reach different temperatures to be considered “done” or safe. All foods need to be cooked for a minimum of 15 seconds at the required temperatures. Color is not a sure indicator of whether food is safe to eat. The only way to know that meat, poultry, casseroles, and other foods are properly cooked all the way through is to use a clean food thermometer. A food handler may use a metal stem or digital thermometer to check temperatures while cooking food to make sure that it gets sufficiently cooked all the way inside (USDA/FDA, 1999). The metal stem thermometer measures the inside, or internal, temperature of the food. A thermometer that works best shows a range of 0° F to 220° F. The only way you can be sure that the food is cooked enough is to use a metal stem thermometer placed in the center of the thickest portion of the food without touching fat or bone (USDA/FDA 1999).

Recommended steps for checking food temperatures using a food thermometer:

- a) Use a metal stem thermometer to check food temperatures
- b) Sanitize thermometer before using it
- c) Insert thermometer in the thickest part or in the center of the food.
- d) Wait 15 seconds to get an accurate measurement.
- e) Sanitize thermometer between uses.

C. Food safety message #3: Proper Cooling of Foods Message:

Cooling cooked foods properly is a critical defense in preventing food borne illness. Foods should be refrigerated quickly because cold temperatures keep most harmful bacteria from

multiplying rapidly. The goal of proper cooling is to avoid the growth of bacteria during the temperature danger zone (135°F to 41°F). Foods must be cooled properly, using a thermometer to record temperatures when cooling to make sure the internal food temperature is cooled from:

- a) 140 °F to 70 °F within two hours;
- b) and then 70 °F to 41 °F or below, within four hours.

The use of stainless steel containers instead of plastic containers to store divided portions of food helps cool food faster than plastic. Food containers should also be labeled with important information such as the time and date of preparation. If foods are not cooled properly, the potential for bacteria to growth is high and thus the stage for food borne illness to occur.

D. Food safety message #4: Do not Handle or Work with Food if Ill Message:

The FDA Food code says we must restrict or exclude ill food workers from a food preparation area. This is because an ill food handler can easily contaminate foods thru his/her hands and cause many food borne diseases. Sick workers can spread illness through the food they prepare, so managers may have to exclude or restrict their access to food, depending on how serious their illness is. Sending sick workers home is not easy for a busy kitchen and many food establishments do not pay sick employees for staying home, so this can be hard for the workers. According to the FDA's 2005 model Food Code, if a worker calls in sick, the manager should find out if the worker has been vomiting or has diarrhea or jaundice. For the first two symptoms, the worker needs to stay away until well after the symptoms have passed. If the worker has jaundice, he or she may have to stay away even longer.

3.2.5 Final Design of Food Safety Signs:

The exploration of a variety of formats of the selected messages helped determine which may be most effective to portray the message. The formats or styles evaluated included:

- 1- Emphasis on “warnings” versus “instructions”
- 2- Graphics or icon only, lenticular graphics only or graphics with limited English and/or Spanish text
- 3- Colorful or black/white

A) Color

The four food safety concepts selected were developed in both color and black and white. The messages were developed in black and white because international signs are often in black and white with a minimum of color. The color version of the signs was also designed so that the visual identification of the objects in the pictorials was easier. The main colors used for the design were: yellow (caution), red (danger), green (clean, sanitation) and blue (cool) to help symbolize the concept (Claus et al., 1976).

B) Category

1) Warning/ Caution:

For the selected 4 food safety messages, the formats selected emphasized “warnings” or “instructions.” Two of the four messages cross-contamination and do not handle food if ill were developed using the “warning” message. The goal of the warning message is to notify in advance of an imminent or possible danger. The two messages developed using this format convey an action or state that if taken or acquired could potentially create a biological hazard through

contamination of foods by an ill person or by microorganisms transferred from a raw meat product to a cooked food product. In this sense, the most logical format for these two messages was the “Do Not” pictorial. The pictorial “Do Not” was developed in a set of 2 steps for each message. By default, the colors selected for the design were yellow and red emphasizing, “Do not” and “Caution.”

2) Instructional:

For the other two messages, the format selected was instructional. The messages: how to check internal temperature of food products properly and how to cool foods properly seemed to fit the format instructions better because of the nature of the messages. The messages “how to” refers to a set of instructions to follow in accordance to a set number of steps. In this case, instructions tell food handlers how to perform an action in a set of particular steps. The messages “Cooling and Use of Thermometer” are actions that can be outlined in a particular procedure or set of steps. Thus, the instructional format for the actions (cooling and use of thermometer) was selected in a set of 2 steps for each food safety concept. The colors selected for these concepts were green (use of thermometer) and blue (cooling).

C) Format:

The final four food safety concepts were designed in 3 different formats: pictures only, pictures plus bilingual text (English/ Spanish) and lenticular version to test for which format communicates the messages the best.

1) Pictures Only:

This format was designed with pictorials/graphics only. The goal of this format was to test if pictures alone could be used as tools to communicate a concept without the need for any written text or words.

2) Pictures with Text:

This format was designed including pictures/graphics and text. The text was made bilingual both English and Spanish. In this format, the text written was kept to a minimum, explaining the food safety concept in the picture. The text was placed at the bottom of the picture with the English version first and then the Spanish version below.

3) Lenticular Version:

The lenticular version was used to produce images that have the ability to change or move as the image is viewed from different angles. The lenticular version was printed as up/down and side/side movement. Combining two images per sign developed this format. The goal of this format was to test if a lenticular version of the signs communicated the concepts better than the other versions since this version allowed the subjects to play with the signs. This version of the signs required the subjects to tilt the sign up/down physically so more participation of the subject was required. This version required both a visual and a physical participation from the subjects in contrast to the other two versions of the signs, which only required a visual engagement from the participants.

3.2.6 Pre-testing of Symbols

Once the symbols were developed, the symbols were tested with food safety specialists and food science graduate students for understanding of the message and suggestions to make the

message clearer in the picture. A total of 32 people were used to test the signs for understanding of the message.

The evaluation process consisted of:

- a) First, asking participants what the pictorial means.
- b) Second, explaining to participants what the concept was.
- c) Third, once participants understood the concept, they were asked to make suggestions to make the symbol clearer or the image easier to understand.
- d) Fourth, participants were asked which version they preferred: black and white or color.
- e) Lastly, participants were asked: how many years they were employed in the food industry, if any.

The suggestions and comments were taken into account and revisions to the pictures were made in an attempt to make the symbols clearer for the target audience. The format: “pictures only” was used during pre-testing of symbols. After the pre-testing of symbols, text was also added to the final draft of the icons. The aim of adding text to the pictures was to check whether the icons with words would convey the food safety message better than the picture alone for food handlers. The text added was in English and Spanish aiming for better understanding among Hispanic workers.

3.2.7 Evaluation of Food Signs

First, a demographic survey instrument was developed in the form of a questionnaire to recruit voluntary participants. Recruitment of food handlers occurred in restaurants. There were two main criteria to select the restaurants for this research: amount of food handling and native language spoken by employees. The restaurants selected were full service restaurants where a lot

of food handling, preparing and cooking occurs. The other criterion was native language spoken by employees. Restaurants selected had native English speakers as well as native Spanish speakers employees. A total of six full service restaurants participated in this research. Three of the full service restaurants were Mexican restaurants where all surveyed employees' native language was Spanish. The other three restaurants were major chain restaurants in the U.S. and were full service chain restaurants where the majority of the surveyed employees' native language was English. All restaurants were located in Southwestern Virginia. The questions were presented in English or Spanish depending on the individual's native language. The aim of the recruitment survey was to collect specific data concerning demographics including: educational level, work experience, language, food safety training and work experience that may influence interpretation of comprehensibility results. The initial questions asked were:

- a) Years employed in the food industry.
- b) Language spoken at home or native language.
- c) Educational level (primary school, high school, college)
- d) Any form of formal food safety training.
- e) Gender (male/female).
- f) Position title.

Then, a food safety sign evaluation survey was developed in both English and Spanish. The evaluation program plan was as follows: A total of 45 food handlers, including those whose native language was English (29) and those whose native language was Spanish (16), were given a written survey in their native language to test for understanding of food safety concepts and format. In some cases, the survey was given orally for better comprehension of survey for individuals with low reading skills.

The evaluation of the food safety signs consisted of 2 phases:

Phase 1: All participants were classified into 3 groups. First, each group was presented one of the three different versions of all food safety signs (pictures and words, pictures only and lenticular). The food safety signs were randomly ordered and presented to the participants. The aims were testing for understanding of the food safety concept and to identify most effective delivery mechanism without prior explanation of concepts. The goals here were: to test comprehensibility of each sign, to determine how difficult each sign is to understand and to determine most effective delivery mechanism. The questions in the evaluation survey included:

- Tell me what this series of icons is trying to tell you?
- What do you need to do to comply with it?

Phase 2: In this phase, all participants were given all three different versions of the symbols and an explanation of all food safety concepts was provided. Once an explanation was provided, participants were asked to choose the format or the version of the sign they thought conveyed the concept the best. The aim here was to test for format preference once the concepts were explained to participants. Format preference also included asking for which version they liked the best: color vs. black and white. A last question included asking to see if the participants had any suggestions for improving the symbol in the format they liked the best. The aims of this phase were to determine which format participants think communicates the concept best and to determine suggestions how this information should be presented to improve the message.

3.2.8 ANALYSIS OF DATA

The data was analyzed to provide answers to the main research questions: to determine comprehensibility of each sign developed and to determine the most effective delivery

mechanism of the signs. Demographic data was also taken into account that may influence interpretation of the results. The data was analyzed using the statistical analysis tool: Chi-square to determine any statistical differences in the results obtained. The statistical tool: Chi-square was used because it examines differences with categorical variables. This statistical tool test for independence and evaluates significantly differences between proportions for two or more groups in a data set.

CHAPTER 4

RESULTS AND DISCUSSION

4.1: DEMOGRAPHIC OUTCOME

The main criterion for participant selection was that all participants were working in full service food establishments handling foods. There were a total of 45 voluntary participants. The overall demographic survey results were as follows: Spanish was the native language of 16 (36%) of the participants and English was the native language for 29 (64%) participants (Table 1). The number of Spanish-speaking participants with some level of high school education was 4 (25%) and with some primary education were 12 (75%). The number of English-speaking food handlers with some college education was 22 (76%) and with some high school education were 7 (24%). The average years of work in the food industry for the Spanish-speaking participants was 6.6 years while the average years of work in the food industry for the English-speaking participants was 6.7 years. 76% of the English-speaking participants had some kind of food safety training while only 13% of the Spanish-speaking had some kind of food safety training (Table 1). To be more specific, participants were asked whether or not they have some kind of food safety training from the company or the manager. Food safety training was referred to the kind of training that included food safety concepts, such as, personal hygiene, cooking temperatures, cross-contamination, hand washing and sanitation.

Understanding the socio-demographic characteristics of food workers is a key element in providing an adequate and tailored food safety education. To design food safety educational materials that are effective, one must take into account the socio-demographics of the target population. The results of the demographic survey illustrate the educational gap among the

Spanish-speaking food handlers vs. the English-speaking food handlers. While most English-speaking food handlers had at least some high school education, most of the Spanish-speaking food handlers had only a few years of primary school education. This result demonstrates the need for tailored food educational materials that address a way to transfer information in a simple and easy to understand manner to the target population. An effective mechanism that has been studied to relay information to food workers with low literacy levels is the use of graphical icons (Cowgill et al., 2005). Graphical icons provide visual cues that can be understood regardless of the individual's socio-demographic characteristics. Presenting information in a graphical manner aids in overcoming the low literacy levels of the Spanish-speaking food handlers. The ethnic population working in the food industry in the U.S continues to grow. As a result, the use of graphical icons to present food safety concepts also addresses this issue.

The difference in food safety training between the two groups was also another major finding that provided clues to understand the results of this research. Only 13% of the Spanish-speaking group had some kind of food safety training compared to 76% of the English-speaking group. These results imply that the need for more food safety training among Spanish-speaking food handlers is critical. The lack of food safety training for the Spanish-speaking group could be rooted in the language as a barrier to provide an effective food safety education. This implies that food safety educational materials must be designed to address this hurdle.

The results of the survey also indicate that the average of years employed in the food industry for the two groups was similar. The Spanish-speaking group had an average of 6.6 years working in the industry while the English-speaking group had an average of 6.7 years (Table 1).

4.2: COMPREHENSIBILITY OF SIGNS RATINGS

4.2.1 General Results for Comprehensibility of Signs

One of the aims of this study was to test for food handlers understanding of each sign designed. This will determine how difficult each sign is to understand and how difficult each food safety concept is. The responses disclosed a reasonable understanding of the four food safety signs used. For both groups (English and Spanish speaking participants), the ranking of comprehensibility of the signs was similar. In general, the ranking of responses from easiest to understand to most difficult to understand was as follows: “Cross-contamination > Use of thermometer > Cooling of foods > Do not work with food if ill”

In general for all participants, the responses recorded as correct were 69% (Table 2). There was a large difference amongst the top two signs (Cross-contamination and Thermometer) vs. the bottom two signs (Cooling and Ill). The top two signs had 89% of correct responses while the bottom two signs had only a 49 % of correct responses (Table 2). These results show a great difference amongst the top two signs and the bottom two signs for understanding the food safety concept.

The statistical analysis of the general ranking of the signs for understanding was done using the statistical analysis tool called Chi-square. There was a statistically significant difference among the top two signs and the bottom two signs evaluated for comprehension ($p < 0.05$). There was no difference in comprehensibility between the cross-contamination and use of thermometer signs, but there was a difference of comprehensibility between these top two signs and the bottom two signs.

The familiarity of the participants with the food safety concept behind the sign may have played a role in the understanding of the signs. Ninety-three percent of all participants responded

correctly to the cross-contamination sign indicating that they were familiar with the food safety concept of cross-contamination. During the interviews, participants seemed to have a general sense over the rationale of the cross-contamination sign. They knew that raw meats should be not mixed or prepared with ready to eat foods. To expand even more, some participants went on to explain the required usage of different cutting boards and knives for raw meats and ready to eat foods in their place of work. The second top ranking sign (Use of Thermometer) for understanding had 84% correct responses (Table 2). Again, participants seemed to have some familiarity with the concept behind the sign. In interviews and recorded responses, most participants knew that a thermometer is used to check the internal temperature of foods. When they saw the sign, some participants explained that they knew that the picture was telling them to check the temperature of the product in the picture to a certain required cooking temperature. So, there was a sense of familiarity with the procedure for checking internal temperature of food.

The two lowest scoring signs (Cooling and Ill) were less familiar with the participants. The third lowest scoring sign: Cooling had 64% of correct responses (Table 2). The rationale behind this result is that participants were not overly familiar with the cooling concept. When asked orally to explain what the sign was trying to tell, a moderate number of participants could not explain the concept or explained incorrectly. Many participants responded that the picture was trying to tell them the temperature of cold foods vs. the temperature of hot foods. During the second phase of the evaluation process, after the concepts of each sign were explained to all participants, more than 35% of all participants did not know how to cool foods properly at all and were not familiar with the concept. The lowest scoring sign: Do not handle food if ill had only 33% of correct responses (Table 2). During the interviews, people with prior food safety training knew what the message was trying to tell them while people without food safety training

responded incorrectly to the survey. During the interviews, a large number of food workers commented that they did not know or were never told to avoid going to work if they had any gastrointestinal illness. This may explain the low score for this particular sign.

The results for comprehension of the signs by all populations also imply that there may be a difference in the difficulty of understanding each food safety concept. The food safety concepts of cross-contamination and use of thermometer were easier to understand and thus simpler to depict visually using graphical icons. Cooling and do no work with food if ill seemed to be concepts that require more attention to detail and more explanations. The graphical representation of these concepts by default is also more complicated and harder to depict visually. One can said that the more complicated the concept is, the harder and more confusing the sign was. Since these two low scoring concepts had more material to explain to be understood, the graphical representation of these two signs also had more information in the icons. This may have confused the participants.

4.2.2 Comprehensibility of Signs Ratings for Spanish-speaking Food Handlers

The ranking for understanding of the signs in the Spanish-speaking group was as follows: Cross-contamination > Use of Thermometer > Cooling > Do not handler food if Ill. For this group, the results for understanding were ranked similarly to the general results for understanding of the signs. The comprehension of the signs for the Spanish-speaking group was also in the same order of the English-speaking group. The scores of correct responses per sign were as follows: Cross-contamination (94%), thermometer (75%), cooling (31%) and ill (25%) (Table 2). The percentage for correct responses for the lowest scoring three signs was greatly lower than the average results. Thus, it may be implied that the lack of familiarity with the

concepts and food safety training may have influenced this. For the Spanish-speaking group, the two lowest scoring signs: Cooling and Ill scored a lower percentage of correct responses compared to the general results for understanding the message (Table 2). This implies that these food safety concepts need to be focused on when providing food safety training to this group.

4.2.3 Comprehensibility of Signs Ratings for English-speaking Food Handlers

For the English-speaking group, the ranking of best understood to least understood sign was as follows: Cross-contamination > Use of thermometer > Cooling > Do not handle food if sick. In this group, there was only a minimal difference between the 3 top signs: cross-contamination, thermometer and cooling. The sign cross-contamination had 93% correct responses, the sign “use of thermometer” had a 90% of correct responses and the sign “cooling” had an 83% of correct responses (Table 2). This result indicates that English-speaking food handlers were familiar or knowledgeable about these three food safety concepts. These results implied that since the English-speaking group had more food safety training, they were more familiar with more food safety concepts. Contrarily, the sign: “Do not work with food if ill” had only a 38% of correct responses (Table 2). For the English-speaking group, the results indicate that reinforcement or focus in this concept should be addressed when providing food safety training to this group.

4.3: COMPARISON OF SIGNS FORMAT

4.3.1 General Results for Comparison of Signs Format:

The food safety signs were designed in three different formats to test for effectiveness of the delivery mechanism. The three formats were: pictures only, pictures with text and lenticular.

The goal of this evaluation was to determine the most effective delivery mechanism of the messages. The order in ranking of correct responses among the three different formats was as follows (Table 3): Pictures and words (80%), pictures only (65%) and lenticular (62%). Since all participants were literate to some degree, it was expected that the pictures with bilingual written words better communicated the message. It was important that the text was printed in the native language of the participants for better comprehension.

This result reinforces studies that state that combining pictures with written text improves communication. In a study investigating the role of pictures in improving health communication, the results indicated that adding pictures to written language increase patient attention, comprehension, recall and adherence to the message (Delp, 1996). In another study by Delp and Jones about the role of pictures in health communication, the results also indicated that patients that were given pictures and written instructions were more likely to read the instructions than those patients that were given text instructions only (Delp, 1996).

There was no statistical difference among the three formats, using the statistical analysis Chi-square ($P > 0.05$). Yet, looking at the percentage results, the format pictures and words did have the highest percentage of comprehension. The other two formats: pictures and lenticular had a similar percentage of correct responses (65% and 61% respectively) indicating that both presentations of the signs did not have a great influence in the number of correct responses between both of them. This also indicates that a sign presented alone as a picture is insufficient when trying to communicate a message or concept among the population evaluated. The lenticular version of the sign was greatly accepted by all individuals. Participants showed a lot of enthusiasm and interest in this version. Yet, the results of the correct number of responses

were the lowest of the three formats. This implies that this version produced the most confusion for all the signs presented.

4.3.2 Format Comparison for the Spanish-speaking Food Handlers

For the Spanish-speaking group, when comparing the three formats evaluated, there was not statistical difference among the three methods ($P > 0.05$). The results of the number of correct responses per format were as follows: Pictures only (65%), pictures and text (63%) and lenticular (40%) (Table 3). However, these results differ from the general population results where pictures and words did the best. This indicates an influence of the literacy level among the Spanish-speaking group. The pictures only presentation had the highest percentage of correct responses for the Spanish-speaking group indicating that words added to a picture did not make a difference in the format presentation. Since the Spanish-speaking group had the lowest literacy level of the participants, the need for words added to pictures may be over-estimated.

4.3.3 Format Comparison for the English-speaking Food Handlers

For the English-speaking group, when comparing the three formats tested for message effectiveness, there was a great difference between the format (pictures with words) and the other two formats (pictures only and lenticular). The results for correct responses were ranked as follows: Pictures with words (92%), lenticular (73%) and pictures only (65%). The statistical analysis also indicated a statistical difference between the three presentations of the signs for the English-speaking group. The P value was less than 0.05 ($P < 0.05$).

The format “pictures with words” had the highest number of correct responses indicating a correlation among the educational level of the participants and the presentation of the pictures

with words. The English-speaking group had a higher educational level than the Spanish-speaking group. All English-speaking participants had some level of high school education while the majority of the Spanish-speaking group had only some level of primary school education. This demographic information helps understand why pictures with words worked the best for the English-speaking participants. One can imply from this information that the English-speaking participants rely in both visual and reading comprehension to understand the signs while the Spanish-speaking individual rely more heavily in the visual presentation alone.

4.4: COMPARISON OF LANGUAGE RESULTS

All messages and formats were compared for the number of correct responses between the Spanish-speaking participants and the English-speaking participants. The Spanish-speaking group had 56% of correct responses while the English-speaking group had 76% of correct responses (Table 3). When a statistical analysis was run using Chi-square, there was also a statistical difference amongst the two groups compared ($P < 0.05$).

The demographic information collected indicated that only 13% of the Spanish-speaking group had some kind of food safety training while 76% of the English-speaking group had some kind of food safety training. Comparison of the two groups by their most critical characteristic (native language) results in great differences between the two groups. Overall, the English-speaking group by far had a higher level of education and level of food safety training than the Spanish-speaking group. These socio-demographic characteristics affect greatly the outcome of the evaluation results indicating the need for better suited food safety educational materials that address the issues of: low education and low food safety training among the Spanish-speaking food handlers.

4.5: PARTICIPANTS DESIGN PREFERENCES

The last objective of this study was to determine which format participants think communicates the concept the best and to determine any suggestions about how the signs could be improved. Both groups selected pictures with words as the format they think communicates the message the best (Table 4). When asked for the reason behind their choice, the participants' rationale was that words reinforce and clarify what the pictures are trying to tell them so the sign was easier to understand.

Another main suggestion included in the survey was color choice for the designs. The majority of participants in both groups selected designs with color as they design they liked the best. Most Spanish-speaking participants (88%) and English-speaking participants (90%) selected color versions as the design they liked best primarily because color helps clarify the objects in the pictures (Table 4).

CHAPTER 5

CONCLUSION

5.1: IMPLICATION OF RESULTS

The findings of this study indicate a low understanding of two critical food safety concepts: “how to cool foods properly” and “do not handle food if ill.” These results suggest that the lack of knowledge about the above food safety concepts may play a role in the occurrence of food borne illness since improper cooling and poor personal hygiene are among the top food safety problems in food service operations. The results obtained called for developing food safety educational programs and food safety materials that focus more attention into the understanding of these concepts. These results also suggest that the icons designed for cooling and ill are in need of improvement. The main purpose of signs is to communicate a message. For a sign to be effective, it must be simple and easy to understand. The food safety concepts: cooling and ill are concepts that contain a lot of information. This becomes a challenge when trying to design effective and simple signs.

Another important finding of this study is the need for effective food safety training and educational materials in the language spoken by the food handler addressing the socio-demographic background of the individuals. To improve food safety education, it is necessary to understand the target population by taking into account social and cultural factors that may influence behavior and learning. This was demonstrated by the large gap in educational level, as well as, the differences in food safety training received by the two compared groups. Once the socio-demographic characteristics of the target population are understood, the success of communicating a message in an effective manner will be more likely. For example, identifying

the specific needs of the target population helps determine which media is best for delivering messages effectively (WHO, 2002).

This research greatly contributes to understanding the role of literacy levels that influence sign comprehension. Low literacy levels affect sign comprehension negatively while higher literacy levels increase comprehension of signs. Therefore, signs should be designed in a way that takes into account literacy levels of the target audience. This research also demonstrates the positive impact of food safety education among food handlers. Exposure to food safety training greatly improves understanding of food safety concepts. Adequate food safety training is the key for improving food safety knowledge among food handlers. This research also contributes in determining the comprehensibility of food safety signs and to determine the most effective delivery mechanism for presentation of signs to food handlers.

5.2: FUTURE RESEARCH SUGGESTIONS

A suggestion for future research is to use a larger sample size of individuals to provide more insight about the understanding of food safety signage. Another suggestion is to include individuals from more than two linguistic groups to understand better the role of pictures in increasing food safety knowledge. Last, the food safety signs developed could be tested in place by posting them in the kitchens of food establishments and testing to see if they increase food safety awareness among food handlers.

5.3: FINAL CONCLUSION

This study greatly contributes to understanding the roles of literacy and food safety training in the comprehensibility of the food safety signs designed. Low literacy levels as well as

deficiency in food safety training indicated a low understanding of two of the four food safety signs. The food icons that were more difficult to understand were those food safety concepts that required a more elevated capacity for understanding.

For all populations, the format in which the signs were presented to the participants indicated that the inclusion of text to pictures had the highest level of comprehension. However, for the population with low literacy levels the format “Pictures only” did the best while for the population with higher literacy level, the format “Pictures and words” did the best. This indicates that individuals from different socio-cultural groups require different delivery mechanisms of educational materials that are designed to meet their specific needs and characteristics.

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LIST OF TABLES

Table 1. Demographic Characteristics of Participants by Spoken Native Language.

Native language	Primary school only	Some high school only	Some college	Average work experience in years?	Any food safety training?
English N=29	24%	0	76%	6.7	76%
Spanish N=16	75%	25%	0	6.6	13%
All participants N=45	42%	9%	49%	6.6	53%

N= Number of participants

Table 2. Comprehensibility of Signs by Food safety Concept

Food safety Sign	% Correct Reponses ¹	Number of correct responses (English) ²	Number of correct responses (Spanish) ²
Cross-contamination	93% ^A	93% ^a	94% ^a
Thermometer	84% ^A	90% ^a	75% ^a
Cooling	64% ^B	83% ^a	31% ^b
Do not work if Ill	33% ^B	38% ^a	25% ^a
Average % correct (all signs)	69%	76% ^a	56% ^b

¹ Significant differences ($P < 0.05$) between the comprehensibility of the food safety concepts are designated with upper case superscript letters.

² Significant differences ($P < 0.05$) between the English speakers and Spanish speakers (across columns) for comprehensibility of the food safety concepts are designated with lower case superscript letters..

Table 3. Comprehensibility of Format for all Food Safety Concepts.

Format	% of correct responses all populations ¹	% Correct responses (English) ²	% of correct responses (Spanish) ²
Pictures and words	80%	92%	63%
Pictures only	65%	65%	65%
Lenticular	62%	73%	40%
Average % correct all formats	69%	76% ^A	56% ^B

For each format, N=15 for each of 4 food safety concepts

¹ No significant differences ($P > 0.05$) between the three food safety sign formats using Chi-square for statistical analysis.

² Significant differences ($P < 0.05$) between the English speakers and Spanish speakers (across columns) for comprehensibility of the food safety sign formats are designated with upper case superscript letters..

Table 4. Format and Design Preference for all Food Safety Signs.

Preferred sign format:	English Speakers	Spanish Speakers	Total for both groups
Pictures and words	100%	100%	100%
Pictures only	0%	0%	0%
Lenticular	0%	0%	0%
Preferred sign design:			
Color	90%	88%	89%
Black and White	10%	13%	11%

LIST OF FIGURES

Figure 1. Cross-Contamination (Color Version, Pictures Only)

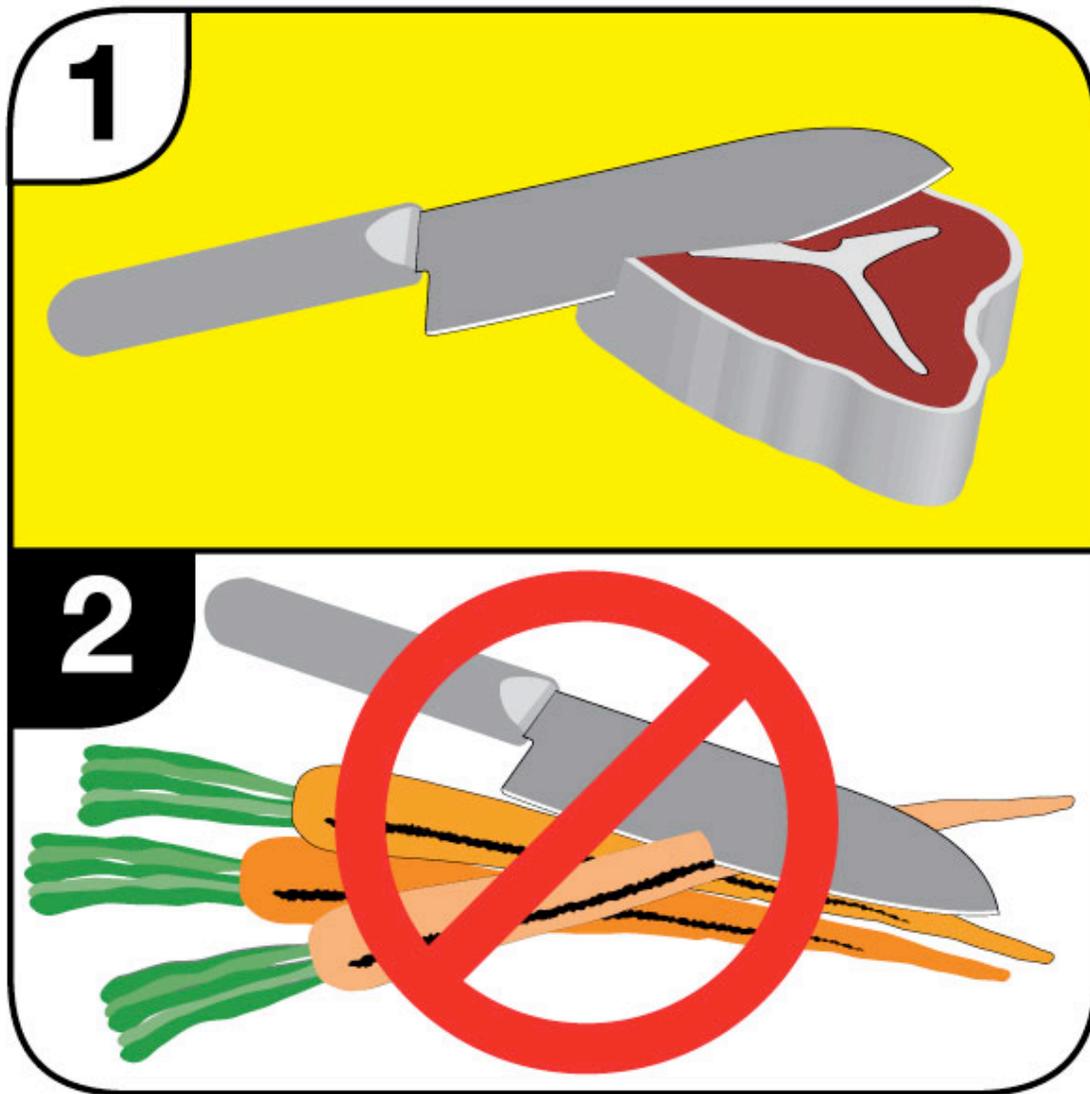


Figure 2. Proper Use of Thermometer to Check Internal Temperatures of Food
(Color Version, Pictures only)

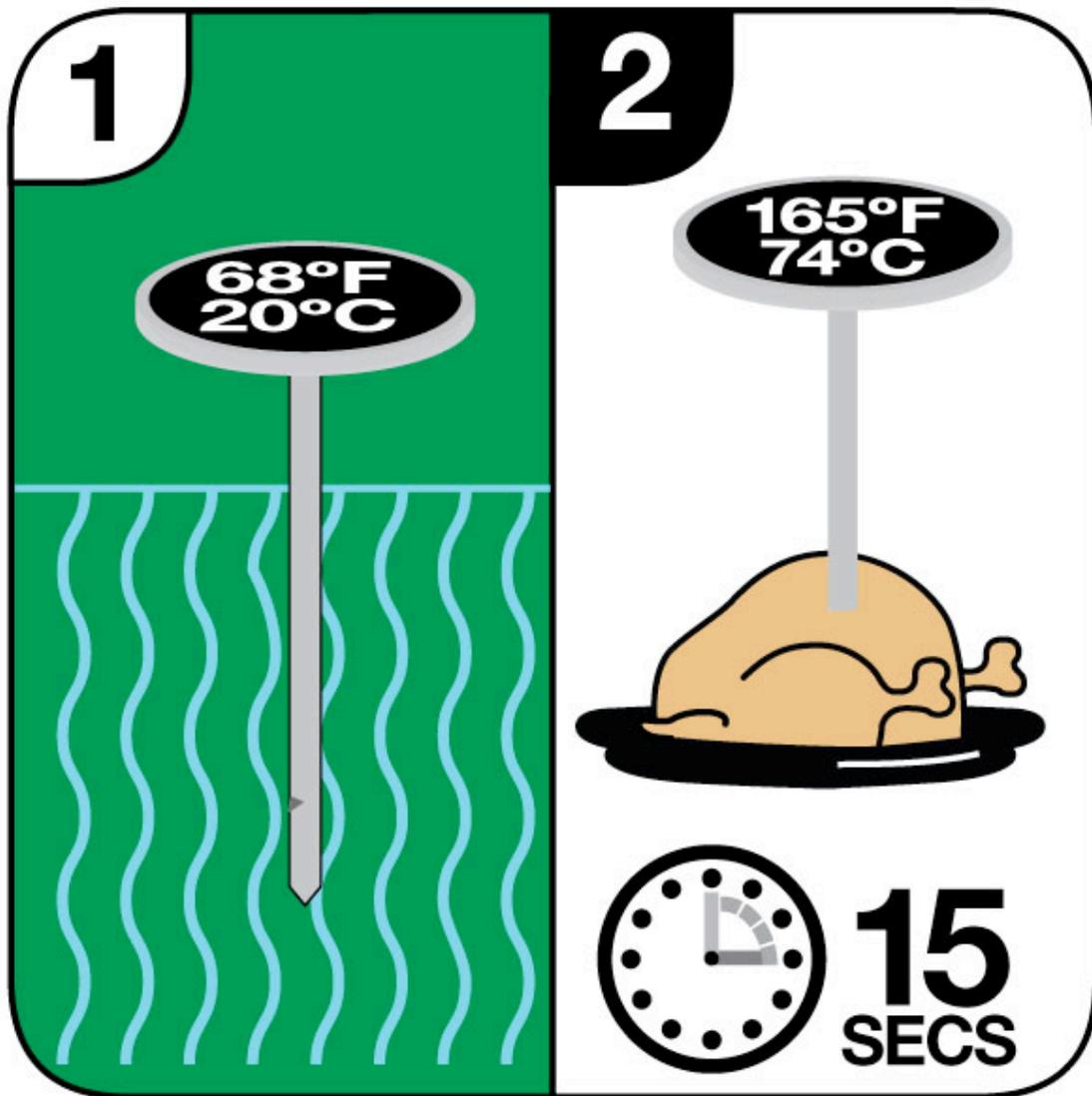


Figure 3. Proper Cooling of Foods (Color Version, Pictures Only)

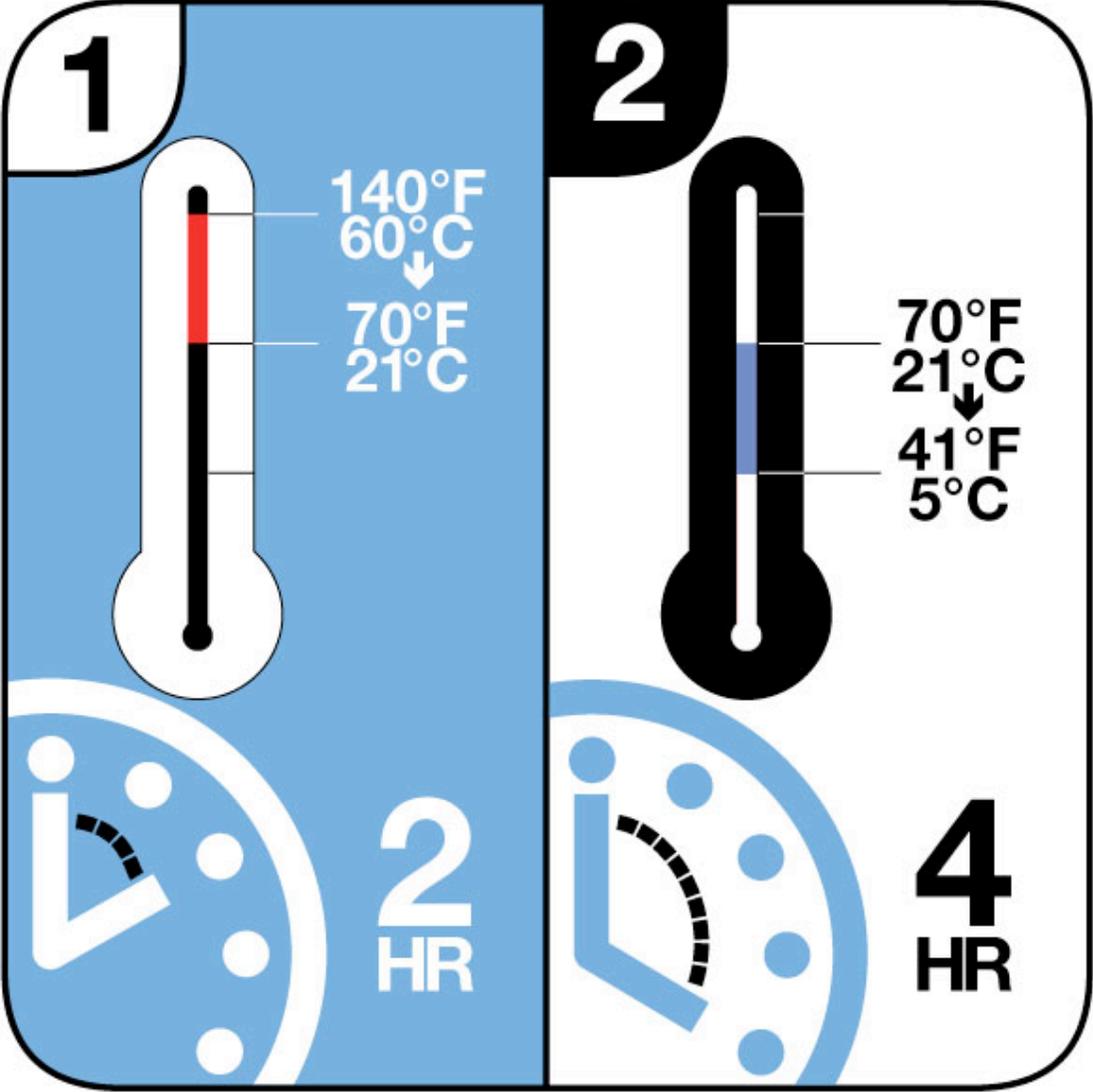
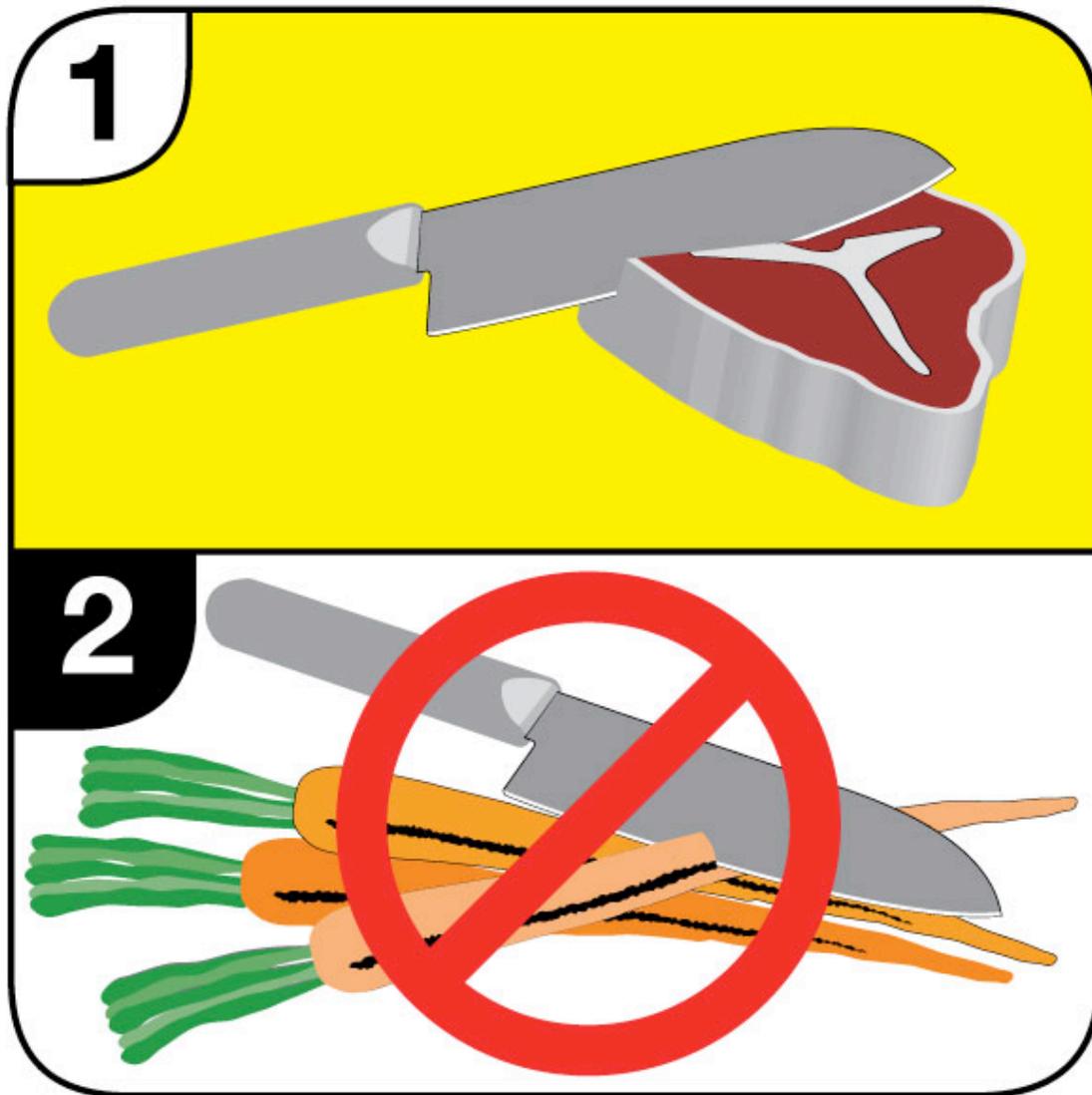


Figure 4. Do Not Work With Food If Ill (Color Version, Pictures Only)



Figure 5. Cross-Contamination (Color Version, Pictures and Words)

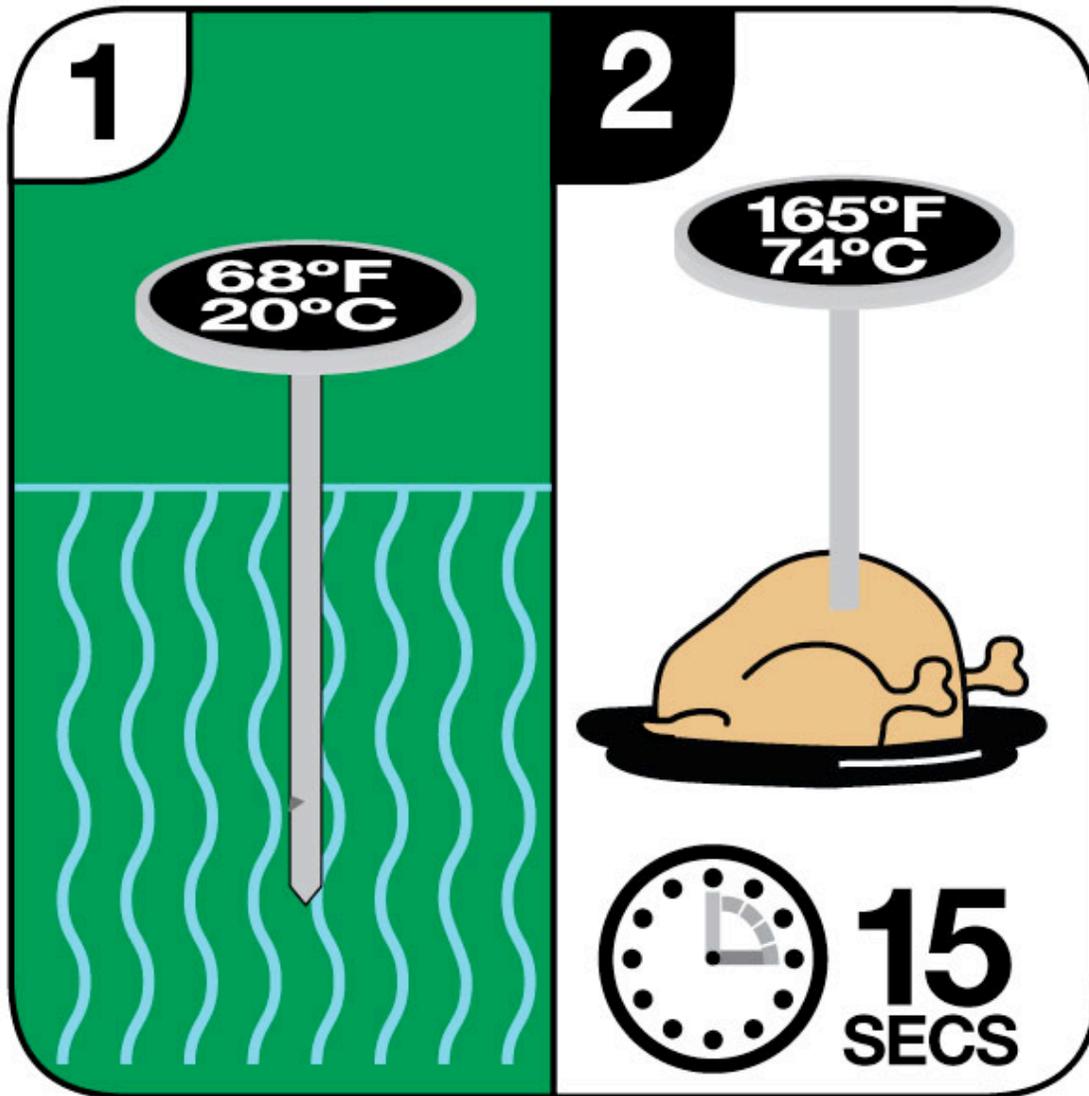


CROSS-CONTAMINATION

Do not cross-contaminate between raw foods and ready to eat foods.

Evite la contaminación cruzada entre los alimentos crudos y los alimentos cocidos.

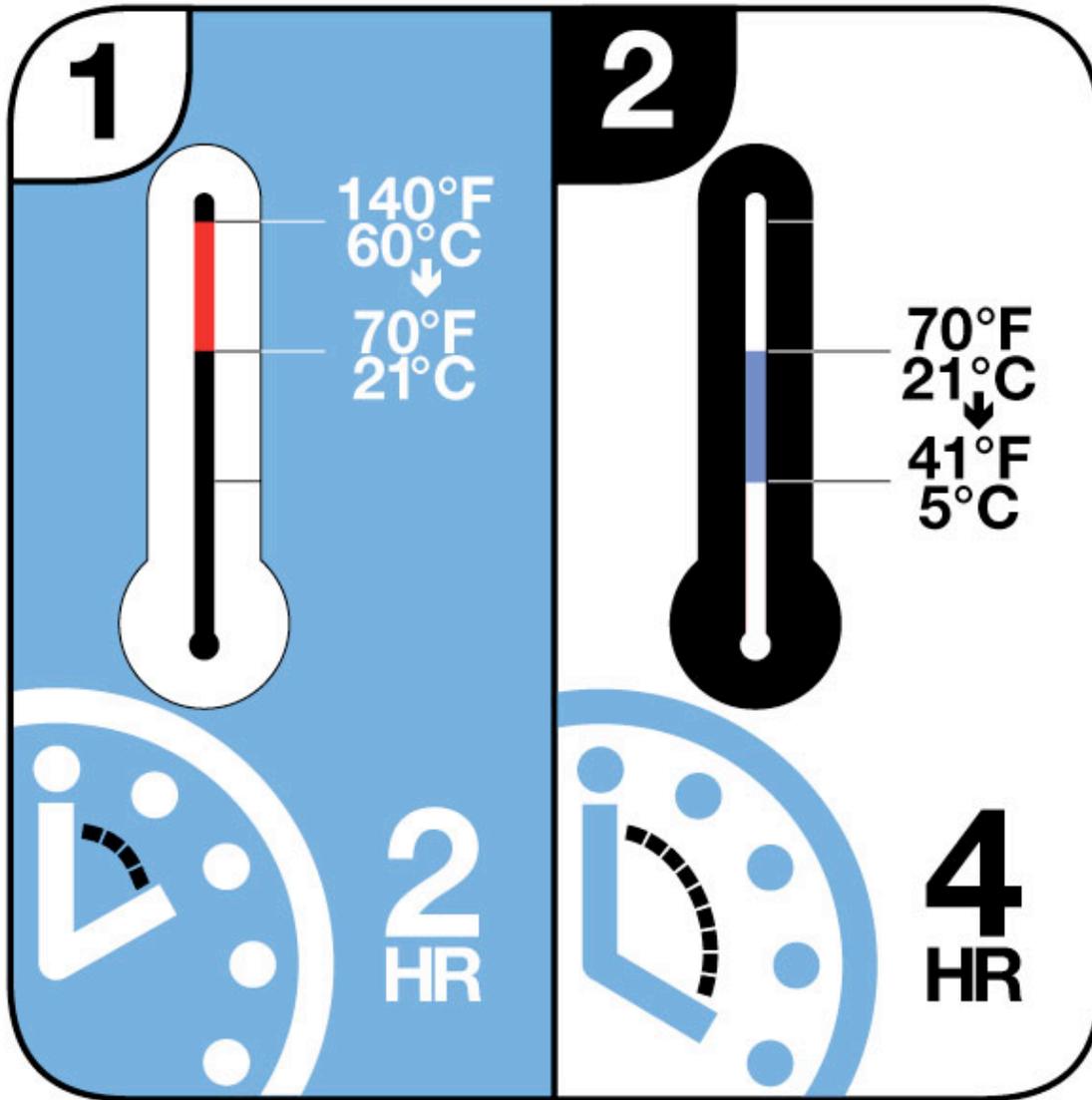
Figure 6. Proper Use of Thermometer to Check Internal Temperatures of Food
(Color Version, Pictures and Words)



THERMOMETER

- Sanitize thermometer.
- Insert thermometer in thickest part of food for 15 seconds.
- Desinfecte el termómetro.
- Inserte el termómetro en la parte mas densa del alimento por 15 segundos.

Figure 7. Proper Cooling of Foods (Color Version, Pictures and Words)



COOLING

Hot foods must be cooled from 140°F to 70°F within 2 hours and from 70°F to 41°F within 4 hours.

Los alimentos calientes deben enfriarse de 140°F a 70°F en 2 horas.y de 70°F a 41°F en 4 horas.

Figure 8. Do Not Work With Food If Ill (Color Version, Pictures and Words)



ILL

If you are ill, do not work with food.
Si esta enfermo, no prepare alimentos.

Figure 9. Cross-Contamination (Black and White Version, Pictures Only)

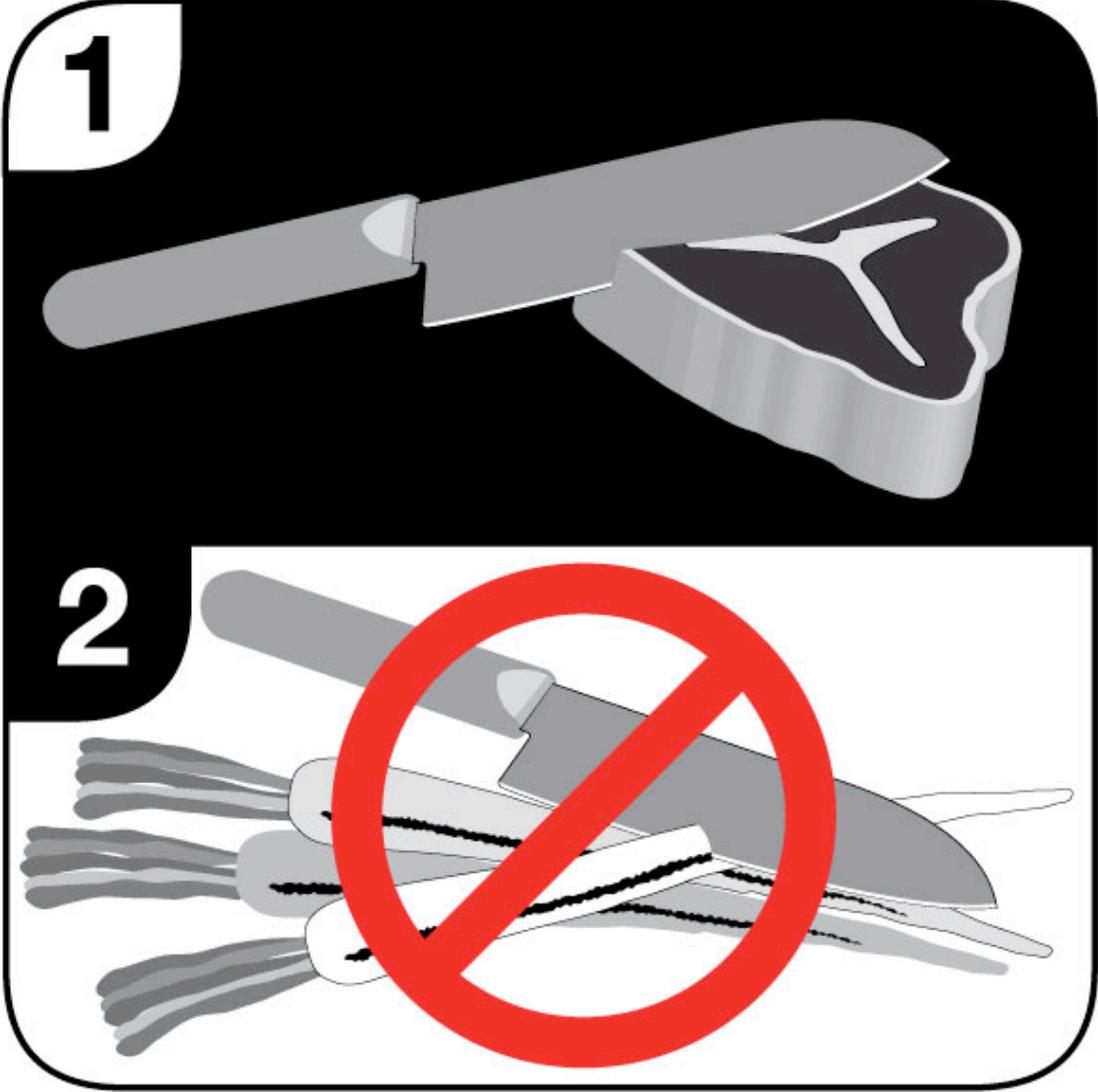


Figure 10. Proper Use of Thermometer to Check Internal Temperatures of Food
(Black and White Version, Pictures only)

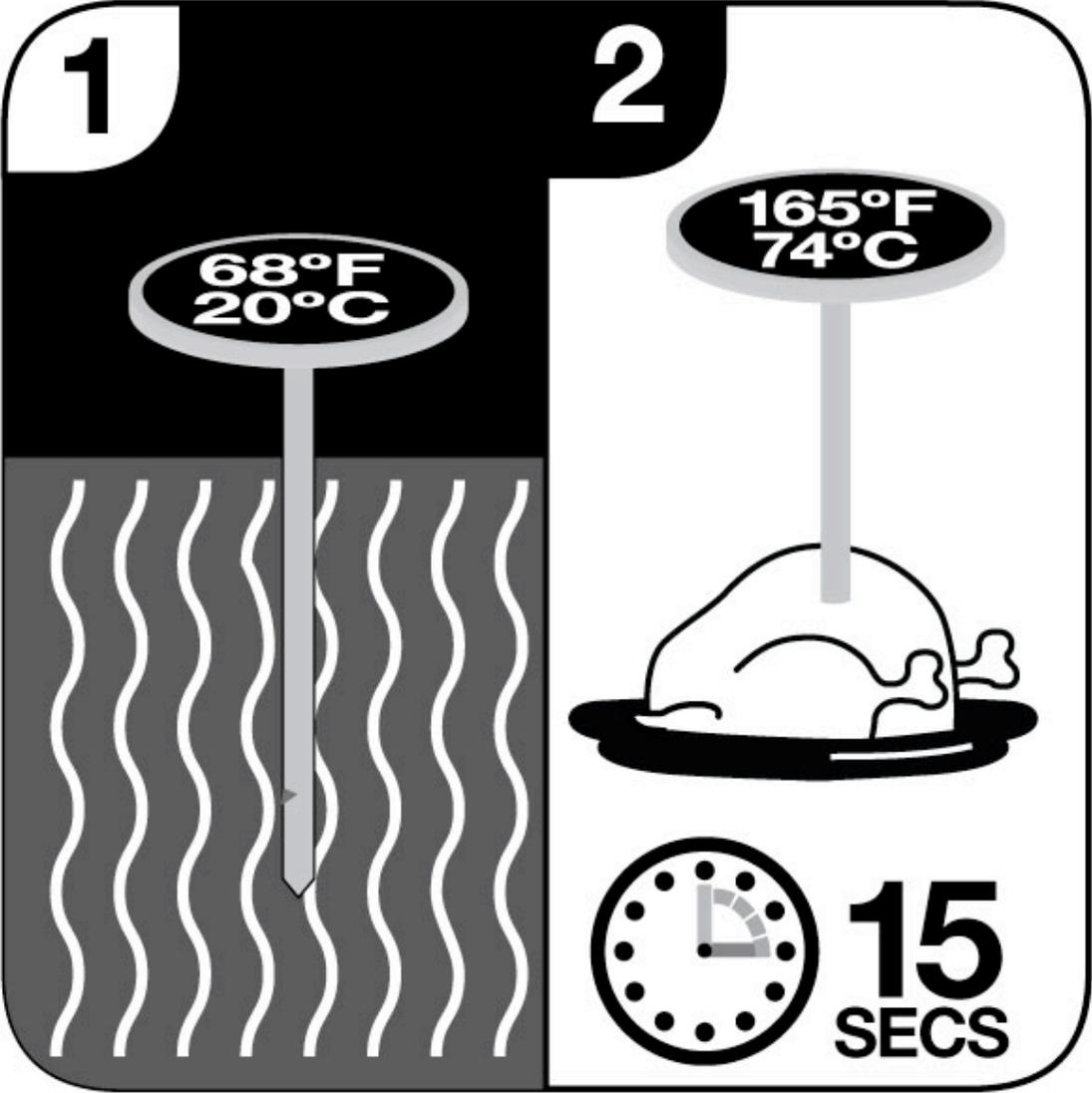


Figure 11. Proper Cooling of Foods (Black and White Version, Pictures Only)

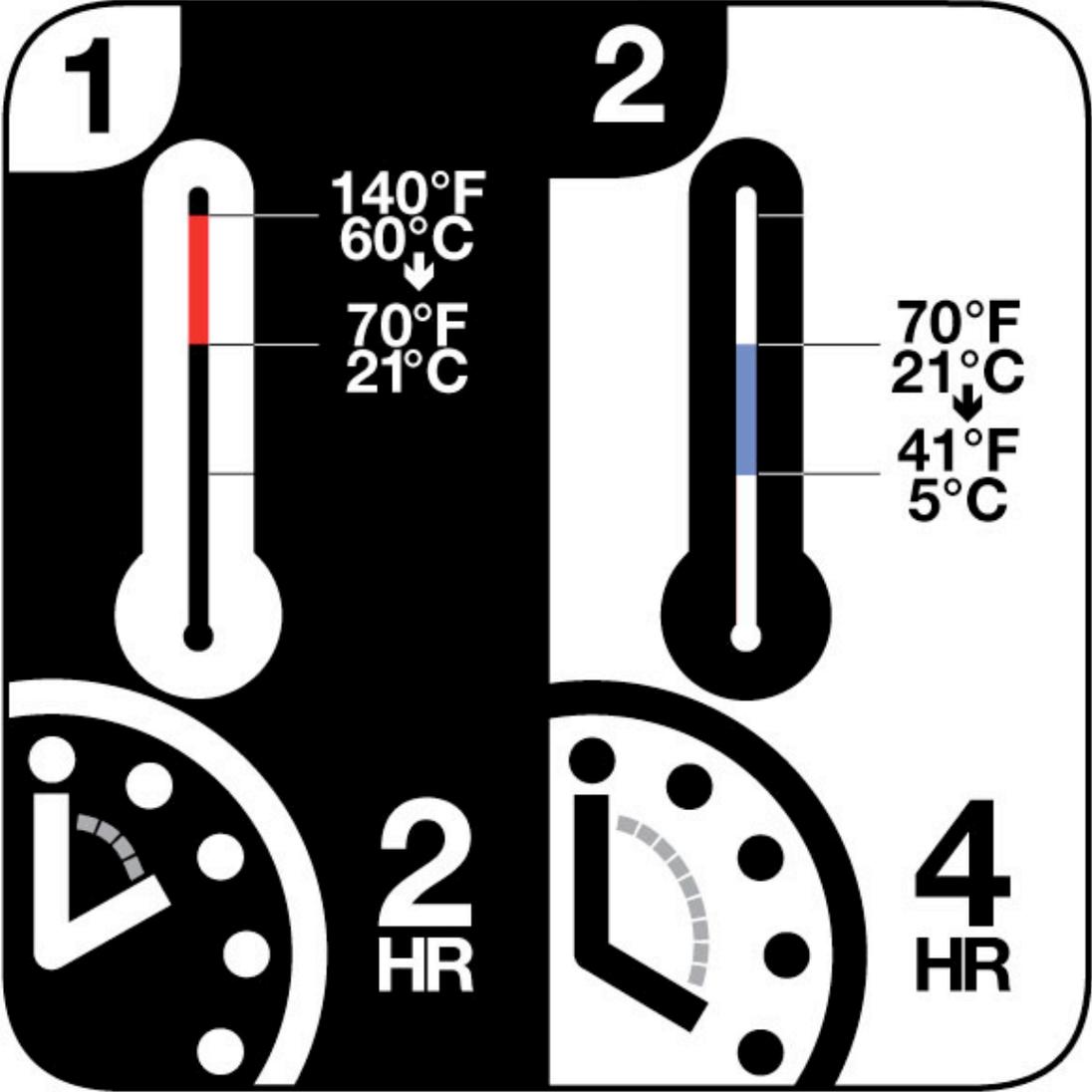
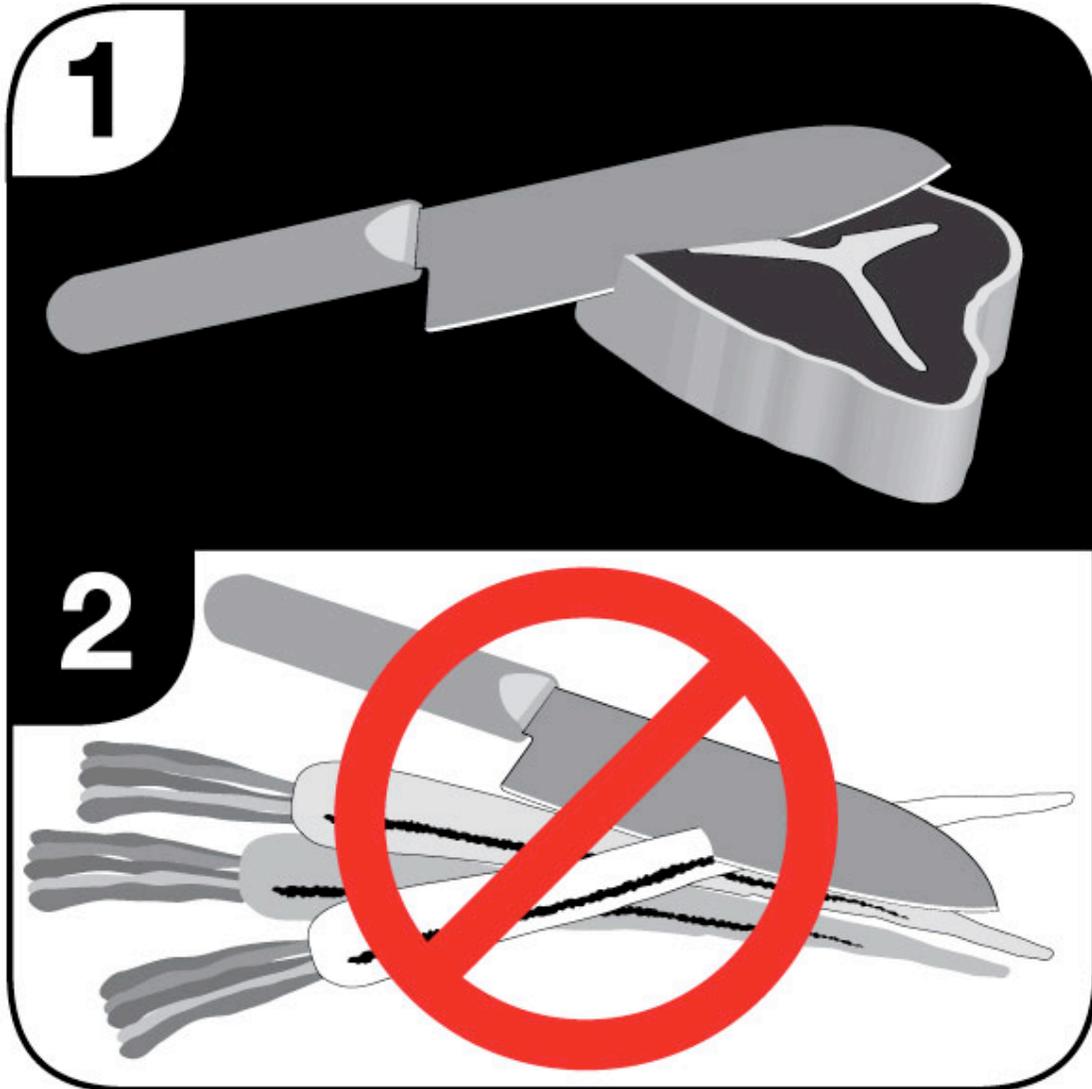


Figure 12. Do Not Work With Food If Ill (Black and White Version, Pictures Only)



Figure 13. Cross-Contamination (Black and White Version, Pictures and Words)

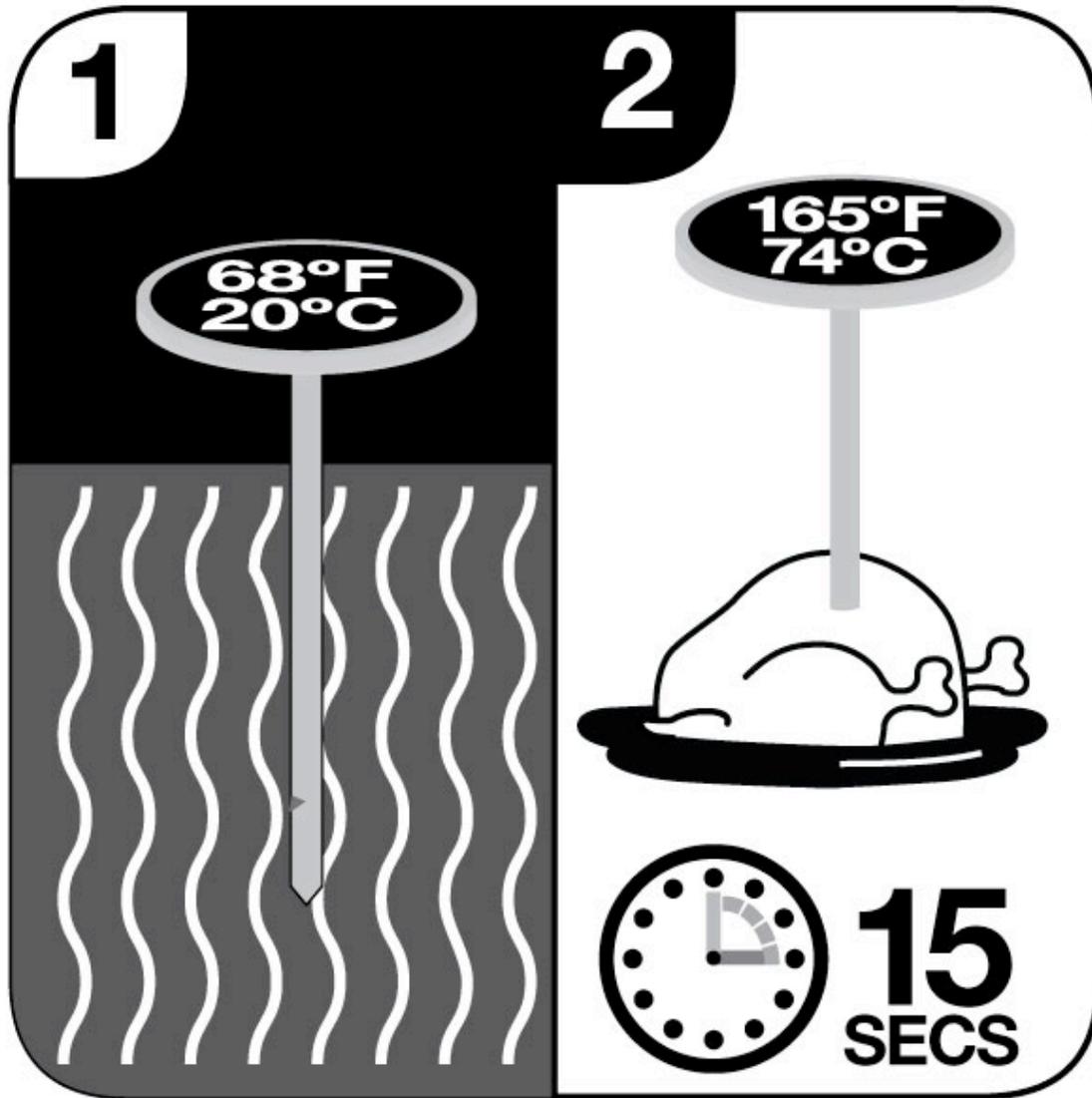


CROSS-CONTAMINATION

Do not cross-contaminate between raw foods and ready to eat foods.

Evite la contaminación cruzada entre los alimentos crudos y los alimentos cocidos.

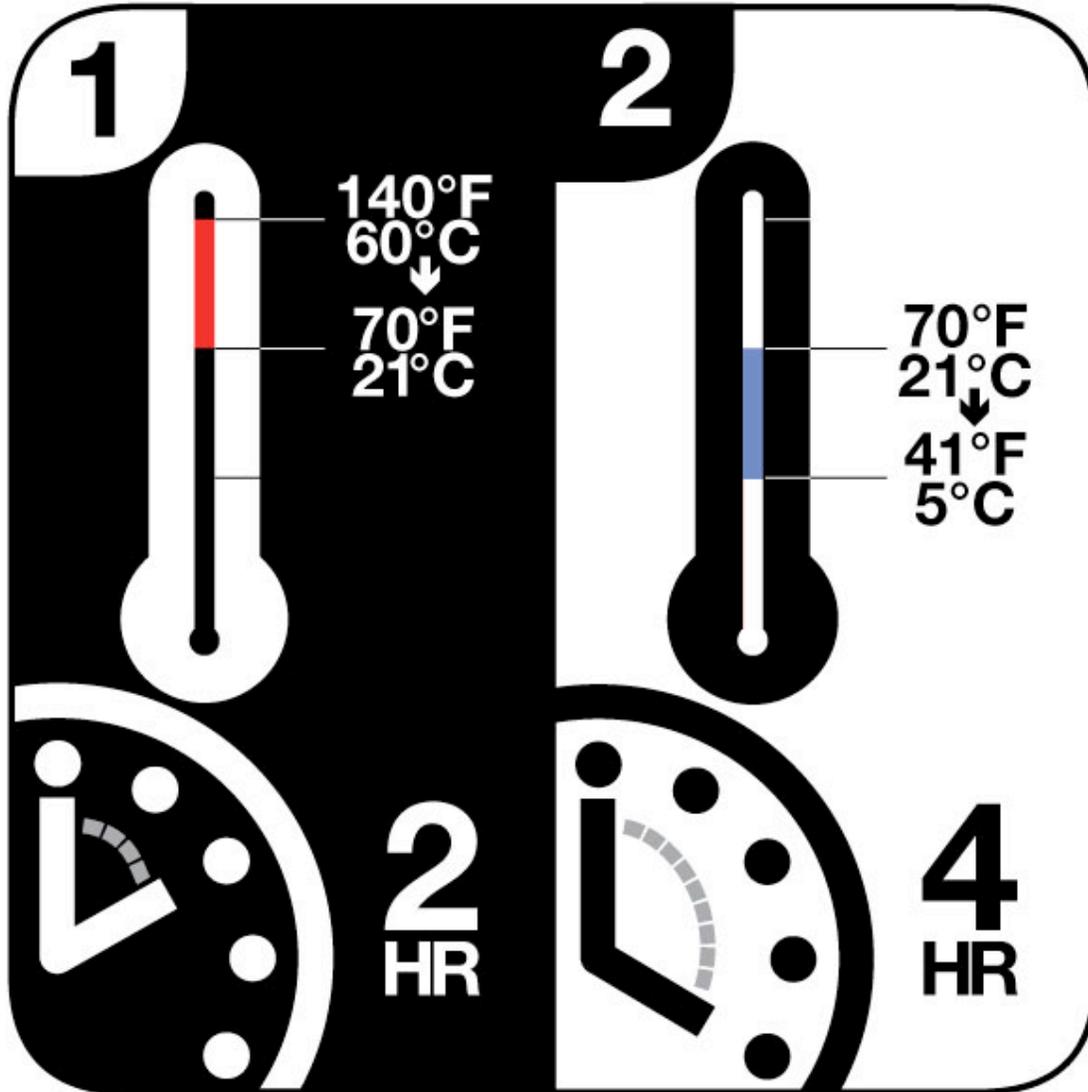
Figure 14. Proper Use of Thermometer to Check Internal Temperatures of Food
(Black and White Version, Pictures and Words)



THERMOMETER

- Sanitize thermometer.
- Insert thermometer in thickest part of food for 15 seconds.
- Desinfecte el termómetro.
- Inserte el termómetro en la parte mas densa del alimento por 15 segundos.

Figure 15. Proper Cooling of Foods (Black and White Version, Pictures and Words)



COOLING

Hot foods must be cooled from 140°F to 70°F within 2 hours and from 70°F to 41°F within 4 hours.

Los alimentos calientes deben enfriarse de 140°F a 70°F en 2 horas. y de 70°F a 41°F en 4 horas.

Figure 16. Do Not Work With Food If Ill (Black and White Version, Pictures and Words)



ILL

If you are ill, do not work with food.

Si esta enfermo, no prepare alimentos.

DEMOGRAPHIC SURVEY

Name:

Gender:

Native Language:

Current Position:

Years employed in food service:

Level of education:

Any formal food safety training:

FOOD SAFETY SIGNS EVALUATION SURVEY (ENGLISH)

Date:

Focus Group Facilitator:

N. in Focus group:

Focus group description: pre-test

Version of sign:

Participant Name:

Phase 1: Test comprehensibility of the sign

Concept # :

1-What do you think this series of icons is trying to tell you?

2-What do you need to do to comply with it?

Concept # :

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1- What do you think this series of icons is trying to tell you?

2- What do you need to do to comply with it?

Post-Test: Phase 2: All versions of signs plus explanation of food safety concepts:

Part 1: Which format communicates the concept the best?

1-Which of the 3 formats do you think communicates the concept _____the best?

- a) Pictures only b) Pictures with words c) Lenticular

Of the format you chose, which version do you like the best: black and white or color?

- a) Black and white b) Color

2-Which of the 3 formats do you think communicates the concept _____the best?

- a) Pictures only b) Pictures with words c) Lenticular

Of the format you chose, which version do you like the best: black and white or color?

- a) Black and white b) Color

3-Which of the 3 formats do you think communicates the concept _____the best?

- a) Pictures only b) Pictures with words 3) Lenticular

Of the format you chose, which version do you like the best: black and white or color?

- a) Black and white b) Color

4-Which of the 3 formats do you think communicates the concept _____the best?

- a) Pictures only b) Pictures with words 3) Lenticular

Of the format you chose, which version do you like the best: black and white or color?

- a) Black and white b) Color

Part 2: Do you have any suggestions that could make the most favored format and the symbol clearer?

1) Concept:
Suggestions:

2) Concept:
Suggestions:

3) Concept:
Suggestions:

4) Concept:
Suggestions:

EVALUACION DE LOS SIMBOLOS DE SEGURIDAD ALIMENTARIA

Fecha:

Facilitador:

N. de personas:

Pre-test: Descripción del grupo:

Versión del signo:

Nombre del participante:

Parte 1: Probando la comprensibilidad del símbolo

Concepto # :

1-Que cree Usted que esta serie de símbolos esta tratando de comunicarle?

2-Usted que necesita hacer para conformarse con el mensaje?

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Concepto # :

1-Que cree Usted que esta serie de símbolos esta tratando de comunicarle?

2-Usted que necesita hacer para conformarse con el mensaje?

Concepto # :

1-Que cree Usted que esta serie de símbolos esta tratando de comunicarle?

Parte 2: Usted tiene alguna (s) cambios sugeridos que podrían hacer el símbolo/símbolos mas claros del formato que usted eligió?

1) Concepto:
Sugerencias:

2) Concepto:
Sugerencias:

3) Concepto:
Sugerencias:

4) Concepto:
Sugerencias: