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## Does Food Safety Training for Non-Profit Food Service Volunteers Improve Food Safety Knowledge and Behavior?

### ABSTRACT

**T**his pilot study demonstrates the effectiveness of food safety training in improving volunteers' knowledge and behavior at the Ronald McDonald House in Houston, Texas. Thirty-four volunteers participated in a pre-training evaluation, followed by a food safety training course and a post-test evaluation two months after the course. The three main areas of knowledge and behavior that were evaluated were cross contamination (proper food handling); time and temperature (proper heating and cooling times and thermometer use); and personal hygiene (hand washing). Overall, scores improved in the volunteer's food handling behaviors at both home and at the Ronald McDonald House. In addition, the volunteers reported that their behaviors at the Ronald McDonald House were significantly ( $P < 0.05$ ) better than their food handling behaviors at home. To the authors' knowledge, this is the first food safety-related research performed at the Ronald McDonald House. The overall goal is to use the results of this study to enhance food

safety practices among the volunteers throughout this international organization.

### INTRODUCTION

**F**oodborne illness is a substantial health concern in the United States and throughout the world. According to the Centers for Disease Control and Prevention (CDC), one-sixth of U.S. citizens contract a foodborne illness each year (2); over 128,000 are hospitalized and approximately 3,000 die (15). Typical foodborne illness outbreaks may result in mild symptoms such as vomiting, fever, or diarrhea. However, the effects can be fatal for the approximately 20% of the U.S. population that falls into the high-risk category (7). These high-risk members of the population include pregnant women, the elderly, young children, and immunocompromised individuals. Foodborne illness can be contracted in restaurants, the work place, and religious and nonprofit organizations, as well as home. Because improper food handling practices can lead to foodborne illness outbreaks, food safety education has become vital to all establishments that handle food products. These

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include emergency food relief, faith based, and other volunteer organizations. The FDA Food Code sets the standard for food safety compliance in food service establishments (6). However, despite existence of such regulations, a 2008 study by the Food and Drug Administration discovered that only 64% of full service restaurants, 81% of hospitals and 83% of nursing homes were in compliance with the set standards (6). In restaurants, many resources have been invested in food safety courses for managers in attempts to improve overall food handling practices (13). In other sites, however, food safety education and certification may be overlooked, especially in places where food service is not the establishment's primary goal. In general, the public has relatively little food safety knowledge (1), because of the belief that many people have cooked for multiple years without encountering the risks of foodborne illness and do not need the additional hassle of taking food safety precautions (5). Food service workers in for-profit institutions have a significantly better understanding of safe food handling than volunteers who work in temporary, non-profit organizations (10). This study also showed that institutional workers are more likely to have received formal food safety training than are workers who may be serving as volunteers for an organization.

A unique example of a nonprofit organization is The Ronald McDonald House, which serves approximately seven million families each year (14). Established in 1974, the Ronald McDonald House program provides playrooms, private bedrooms, and daily meals for families with children who are being treated at local hospitals and medical centers. All of the meals provided for the families at each Ronald McDonald House are made or donated by volunteers. Currently, there are no standard food safety protocols for preparation of the meals; many are prepared onsite, but volunteers also have the option of serving food that was prepared by a caterer, or restaurant, or within the volunteer's home. With no guidelines for preparing meals, the families eating them may be eating food that has not been prepared or cooled properly, increasing the risk for foodborne illnesses. While the majority of children receiving treatments actually stay in the hospital, some may stay at The Ronald McDonald House with their families for follow-up treatments. This may cause a potentially fatal problem, because some of the children receiving follow-up procedures post-surgery or treatment may still be considered immuno-compromised. Their weakened immune system makes these high-risk individuals especially susceptible to foodborne illness.

The overall goal of this study was to provide food safety education and improve food handling behaviors at the Ronald McDonald House in Houston, Texas. The objectives were to: (1) determine whether or not food safety training increased knowledge and safe food handling behaviors among volunteers at the Ronald McDonald House (since volunteers do the majority of the food preparation, this study evaluated the volunteers' current food handling

practices and current food safety knowledge), and (2) determine if food safety training increased knowledge and improved safe food handling practices at home and at the Ronald McDonald House.

## MATERIALS AND METHODS

### Population

Prior to conducting this study, approval was obtained from the Human Subjects Committee of the Institutional Review Board at the University of Houston. The Ronald McDonald House has meals donated for lunch and dinner seven days per week from various organizations, each of which has its own set of volunteers that prepare, cook, and serve the meals. The population for this study consisted of volunteers and staff that played any role in food production or donation at the Ronald McDonald House. Each volunteer group signs up in advance for the date on which they will be responsible for preparing the meals. This study utilized a convenience sample of volunteers scheduled to serve food during the three months of the study. Although participation in the study was voluntary, volunteers were encouraged to participate by the directors of the Ronald McDonald House. The eligibility criteria for participants were that participants were current volunteers at the Ronald McDonald House in Houston and were able to attend one of the three food safety training sessions.

A total of 52 volunteers attended one of the three training sessions, but only 34 completed the full three-step process of completing a pre-test, attending the food safety training program and then completing a post-training test. Of the 34 participants, 38.2% were male and 61.8% were female. Only 31% of the participants had prior food safety education or training. The ages of the participants ranged from 25 to 69 years, with the average being 49. The length of time volunteering at the Ronald McDonald House varied greatly. New volunteers had been volunteering for only approximately 2 months, while others had volunteered for 29 years. The average length of time the participants had volunteered was 6.5 years.

There are currently no internal standards for the food service volunteers at the Ronald McDonald House with regard to food preparation. Volunteer groups varied in the ways they chose to prepare and serve food. Some volunteer groups prepared food on-site or in their homes while others hired professional food service establishments to cater, with the volunteers serving the food. Administering the questionnaire to different types of volunteer groups during one month allowed a diverse group of volunteers to participate in the study.

### Research Design

This research used a one-group pre-test/post-test design, which included a pre-test, a two-hour food safety training class, and a post-test to determine the effect of the training (Appendix). Participants indicated willingness to participate

by completing the pre-test, which measured their current knowledge of food safety facts and behaviors related to foodborne illness.

After their level of knowledge had been assessed through the questionnaire, the volunteers were required to attend one of three training sessions, each 2 hours long, given by a ServSafe® Certified instructor. The training session provided information regarding proper food handling, time and temperature, personal hygiene practices, and foodborne illness prevention strategies. All volunteers received the same food safety training taught by the same instructor. Frequent information sharing and regular communication with volunteers can be a good tool used over time to ensure that food safety is a priority in the organization (3). For this reason, food safety information sheets ([www.foodsafetyinfosheets.com](http://www.foodsafetyinfosheets.com)) containing food safety material in a storytelling format were provided as references to be used when preparing food at the Ronald McDonald House kitchen.

Two months after attending the training session, a post-test was distributed to the volunteers (Appendix). Both the pre-test and post-test questionnaire were divided into three main sections that measured the volunteers' perception of food safety, knowledge about food safety, and current food safety practices both at home and at the Ronald McDonald House. The perception section consisted of 16 questions using a five-point Likert scale as follows: 1 = Never, 2 = Sometimes, 3 = Often, 4 = Always and 5 = Not Applicable. In the knowledge section, volunteers answered 13 true-false questions regarding foodborne illness. This section of the questionnaire included questions from three main areas of concern: cross contamination (proper handling of food and work surfaces), time and temperature (proper heating and cooling times and thermometer use), and personal hygiene (hand washing). These questions were based on a survey developed by Cho et al., 2012 (4).

In the food safety practices section, the volunteers were given two sets of 15 questions regarding their current food safety practices. The first set evaluated their current food safety practices at home while the second set evaluated their practices at the Ronald McDonald House. This section used a five-point Likert scale, as already described. In the final section of the questionnaire, demographic information was sought regarding the volunteers' gender, age, and level of food safety education, as well as information on organization they volunteer for and the length of time they had been volunteering at the Ronald McDonald House.

#### Data collection and analysis

Data was collected through a foodborne illness knowledge and food safety practices questionnaire. Before the questionnaire was administered to volunteers at the Ronald McDonald House, researchers at the University of Houston performed a pilot survey with ten graduate stu-

dent volunteers at the University of Houston. The goal of the pilot survey was to obtain feedback from the respondents regarding the questionnaire's level of difficulty and overall content.

SPSS 20 for Windows was used for all data analysis. Descriptive statistics, including frequencies, means, and standard deviations, were calculated for all variables. In the knowledge section of both the pre-and post-test, a value of one was assigned to each correct true/false answer, while a value of zero was assigned to each incorrect answer. For each of the 13 questions, a mean score was computed across the 34 respondents' answers to obtain the average percent of correct responses for each of the 13 questions. Paired-sample t-tests were then conducted to determine the effect of food safety training on knowledge. The mean score for the three categories of knowledge (cross contamination, time and temperature regulation, and personal hygiene) were compared between the pre-and post-test to determine which had the highest increase. Using a paired-sample t-test allowed for detection of a difference between the pre- and post-test means. For data analysis, a probability equal to or less than 0.05 was considered significant.

Paired-sample *t*-tests were also used to evaluate whether food safety training had an effect on the volunteers' food preparation behaviors at home and at the Ronald McDonald House. For each of the 15 behavioral questions, a mean score of the respondents' answers was computed. Scores ranged from 0 (indicating that the respondent never engaged in that behavior) to 4 (indicating that the respondent always engaged in that behavior). The composite mean score for behaviors in the areas of cross contamination, time and temperature abuse and personal hygiene were then computed. Again, paired-sample *t*-tests were used to determine whether there was a significant difference between the mean scores on the pre-test and the post-test.

## RESULTS AND DISCUSSION

This study found significant increases in safe food handling behaviors both at home and at the Ronald McDonald House following the food safety-training course. In addition, following the training, there was a significant increase in understanding of food safety among the volunteers. These results are shown in *Tables 1, 2, and 3*. Understanding the serious consequences of foodborne illness could possibly explain the increase in safe food handling behavior following the training sessions. Similar results were observed in an independent study performed by Finch and Daniel (5), who assessed food safety knowledge and food-handling behaviors of 267 volunteers and staff in emergency food relief organizations in New York State before and after training and reported that knowledge and reported behaviors of volunteers improved significantly following food safety training.

**TABLE 1. Knowledge Survey — pre- and post-test percent correct**

Question	Pre-Test % Correct	Post-Test % Correct	P-values
1. Chicken must be cooked to 150°F to be served safely.	59%	79%	0.05
2. Ready-to-eat food such as frozen vegetables and appetizers must be cooked to 135°F.	64%	74%	0.33
3. It is ok to mix batches of food that have been cooked at different times.	68%	85%	0.21
4. Leftover foods are safe to eat if they are reheated to 145°F.	85%	91%	0.7
5. It is safe to heat food by placing it directly into a chafing dish or steam table.	88%	71%	0.26
6. After meat or poultry has been cooked, it is safe to leave it at room temperature.	79%	88%	0.08
7. Hot foods should be held at a temperature of 135°F or above until they are served.	55%	59%	0.5
8. Refrigeration of foods completely stops the growth of microorganisms.	91%	94%	0.5
9. Cutting boards and knives do not have to be sanitized in between cutting different food products, such as vegetables and chicken.	97%	100%	0.32
10. It is ok to serve cooked chicken on the same plate that held the raw chicken without washing the plate.	100%	97%	0.32
11. You should wash your hands with hot, soapy water for at least 20 seconds before preparing food.	88%	97%	0.08
12. Wearing clean gloves is a substitute for hand washing.	94%	85%	1
13. It is important to wear proper hair restraints when preparing food.	94%	97%	0.5

### Knowledge

Significant improvement in knowledge was observed after training in the areas of cross contamination, temperature control and hygiene (Table 1). However, overall the levels of food safety knowledge were similar before and after the training session. Paired *t*-tests were conducted to determine the effectiveness of the food safety training on knowledge. In some areas, the pre-test scores indicate that the respondents already had adequate knowledge in those areas before training. There was no significant improvement in overall knowledge scores before ( $M = 0.861$ ,  $SD = 0.152$ ) and after training ( $M = 0.859$ ,  $SD = 0.123$ ). Improvements in knowledge in the areas of cross contamination, temperature control and hygiene were also analyzed individually. For temperature-related questions, a significant improvement ( $P < 0.05$ ) was seen between pre- ( $M = 0.642$ ,  $SD = 0.105$ )

and post-training scores ( $M = 0.75$ ,  $SD = 0.124$ ) at  $P = 0.05$ . The mean scores of cross contamination pre-training ( $M = 0.88$ ,  $SD = 0.1767$ ) and post-training ( $M = 0.94$ ,  $SD = 0.0794$ ) and hygiene pre-training ( $M = 0.92$ ,  $SD = 0.0346$ ) and post-training ( $M = 0.93$ ,  $SD = 0.0693$ ) both increased slightly, but neither were statistically significant ( $P = 0.2$ ). Proper time and temperature monitoring is one of the three main areas evaluated in this study. Using thermometers to check internal food temperature is an integral part of minimizing the risk of foodborne illness. The use of a thermometer to cook foods adequately has been ranked as the number one intervention to prevent illnesses caused by *Campylobacter jejuni*, *Salmonella* spp., *E. coli* O157:H7, *Toxoplasma gondii*, and *Yersinia enterocolitica* (8). Our results show that, overall, the pre-test indicates that the area most lacking with regard to knowledge and proper behavior was

**TABLE 2. Food safety training effect on food preparation behaviors at home**

Question	Pre-test Mean	Post-test Mean	P-values
1. I wash my hands with soap and warm water before handling food.	3.91	3.76	0.16
2. I wash my hands with soap and warm water immediately after handling raw meat, raw poultry, or raw fish.	3.94	3.97	1
3. I wear an apron when handling food.	2.56	2.91	0.18
4. I wash and sanitize cutting boards and knives in between cutting different food products such as vegetables and chicken.	3.91	3.88	0.3
5. I clean fruits and vegetables by rinsing tender skinned items (e.g., grapes, strawberries, green peppers, tomatoes, spinach, etc.)	3.85	3.82	0.7
6. I wear gloves when I have cuts or burns on my hands.	3.27	3.38	0.4
7. I make sure food is cooked properly by using a food thermometer to measure the internal temperature.	2.65	2.82	0.4
8. I cook chicken, turkey, or duck until it reaches and internal temperature of 165°F.	3.70	3.62	0.6
9. I defrost foods using the refrigerator, microwave and/or running water.	3.42	3.53	0.3
10. I label and date all food items before storing them.	2.76	2.85	0.5
11. I let all dishes, glassware, and silverware air dry after they are washed.	2.79	2.82	0.5
12. I store all raw meat, poultry, and seafood away from ready-to-eat foods in the refrigerator.	3.58	3.82	0.9
13. I skip hand washing when it is not convenient.	1.12	1.39	0.2
14. I wear a hair net when handling food.	1.70	2.06	0.3
15. I thoroughly rinse fresh vegetables under running water before eating them.	3.65	3.71	0.3

use of a thermometer when cooking. Following the training course, however, knowledge had increased significantly. This indicates that prior to training, the volunteers did not know proper temperatures or the importance of using a thermometer. However, despite the significant increase in knowledge following the food safety training course, post-test results indicate that the volunteers' self-reported behaviors regarding thermometer use had not significantly increased. One possible explanation for this could be the lack of resources needed for proper use of a thermometer while preparing food. Because the Ronald McDonald House is not a full service

restaurant, tools, including food thermometers, are not always readily available to the volunteers. Currently, the only way for volunteers to use a thermometer when cooking at the Ronald McDonald House is to bring their own with them. Similar observations were made by Kwon et al. who studied food-handling practices in faith-based Louisiana operations (9). The investigators noted that several facilities lacked refrigerators, freezers, and hot holding equipment. In the absence of proper tools, behavior is unlikely to change, regardless of the fact that food safety training has provided adequate knowledge. As part of enhancing food safety behavior, it will be recommended

that Ronald McDonald House ensure that volunteers are properly equipped with the resources and tools needed to perform food safety practices correctly.

### Behavior

Paired *t*-tests were conducted to determine the effect of food safety training on the volunteers' food handling behavior both at home (Table 2) and at the Ronald McDonald House (Table 3). The results indicate that there was a significant

difference between pre-test ( $M = 3.12$ ,  $SD = 0.852$ ) behavior and post-test ( $M = 3.22$ ,  $SD = 0.745$ ) behavior at home ( $P = 0.02$ ) and between pre-test ( $M = 3.27$ ,  $SD = 0.907$ ) behavior and post-test ( $M = 3.43$ ,  $SD = 0.8173$ ) behavior at the Ronald McDonald House ( $P = 0.02$ ). With regard to mean scores of hygiene behavior, temperature behavior and cross contamination behavior individually, no significant differences were found.

**TABLE 3. Food safety training effect on food preparation behaviors at Ronald McDonald House**

Question	Pre-test Mean	Post-test Mean	P-values
1. I wash my hands with soap and warm water before handling food.	3.93	4.00	0.3
2. I wash my hands with soap and warm water immediately after handling raw meat, raw poultry, or raw fish.	4.00	4.00	0.5
3. I wear an apron when handling food.	3.10	3.22	0.3
4. I wash and sanitize cutting boards and knives in between cutting different food products such as vegetables and chicken.	3.93	3.90	0.6
5. I clean fruits and vegetables by rinsing tender skinned items (e.g., grapes, strawberries, green peppers, tomatoes, spinach, etc.)	4.00	3.97	0.4
6. I wear gloves when I have cuts or burns on my hands.	3.86	3.94	0.3
7. I make sure food is cooked properly by using a food thermometer to measure the internal temperature.	2.88	3.50	0.05
8. I cook chicken, turkey, or duck until it reaches and internal temperature of 165°F.	3.55	3.81	0.1
9. I defrost foods using the refrigerator, microwave and/or running water.	3.50	3.76	0.7
10. I label and date all food items before storing them.	3.36	3.61	0.3
11. I let all dishes, glassware, and silverware air dry after they are washed.	2.40	2.59	0.2
12. I store all raw meat, poultry, and seafood away from ready-to-eat foods in the refrigerator.	3.90	3.91	1
13. I skip hand washing when it is not convenient.	1.13	1.10	1
14. I wear a hair net when handling food.	1.59	2.37	0.02
15. I thoroughly rinse fresh vegetables under running water before eating them.	3.87	3.84	0.5

In addition, a significant difference was found between the post-test behavioral scores ( $M = 3.22$ ,  $SD = 0.747$ ) at home and the post-test behavioral scores ( $M = 3.43$ ,  $SD = 0.8173$ ) at the Ronald McDonald House ( $P = 0.00001$ ). This indicates that the participants reported that they practiced safer food safety behaviors at the Ronald McDonald House than they do in their own homes.

The following three statements were used to determine the importance of understanding food safety to respondents: (1) Foodborne illness can be life threatening; (2) I think unsafe food can make people really sick; and (3) Foodborne illness can result in serious consequences. Comparison of the results from pre-training ( $M = 4.63$ ,  $SD = 0.017$ ) and post-training ( $M = 4.79$ ,  $SD = 0.00$ ) indicates a significant improvement ( $P = 0.05$ ). This is a possible explanation for why the volunteers' behaviors both at home and at the Ronald McDonald House changed following the food safety training course.

There was no significant change in the respondents' level of confidence in ability to practice safe food safety behaviors before ( $M = 4.12$ ,  $SD = 0.32$ ) and after ( $M = 4.37$ ,  $SD = 0.1456$ ) the training session. This indicates that regardless of the food safety training class, participants felt confident that their current food handling behaviors were safe, which in reality may or may not be so.

In 1996, the Pathogen Reduction/Hazard Analysis Critical Control Point (PR/HACCP) Systems Final Rule initiated consumer awareness and educational campaigns, such as FightBAC!™ (12). After these consumer educational programs were implemented, the Research Triangle Institute conducted a study, in 2001, to analyze consumers' knowledge about food safety (e.g., are chicken and meats high risk foods?; importance of hand washing; use of a food thermometer; etc.). These studies were conducted using the following tools: (a) 3 telephone surveys; (b) 2 series of focus groups; and (c) 2 sets of observational studies. The results showed that 79% of participants reported or were observed cleaning cutting boards after using them in handling raw meats and 68% washed their hands before cooking. However, only 20% safely heated leftover food, and only 46% owned a food thermometer. The reasons given for not following proper food safety practices were as follows: (a) "knowing correct practice but not thinking about it at the time" 40%; (b) "had no knowledge" 40%; or (c) "chose to ignore safe practices" 20% (12).

Similar results were obtained by Patil et al. (11), who performed a meta-analysis of 20 studies since 1992 that contained information on consumption of raw/undercooked meats, good hygiene practices, prevention of cross contamination, proper cooking practices, actual practices in these areas, and basic demographic information. Their results showed an increased gap since 1992 between consumer knowledge and practice.

Our results are consistent with the research just cited. Overall, they indicate that an increase in knowledge does not always translate to an improvement of proper behavior. It should be noted that only self-reported behaviors were evaluated. This study is unique in that it is the first food safety-related study performed at an international charity that relies on local volunteers in each community it serves. Yiannas (2009) notes that the food safety culture for most organizations is a choice (16). An organization such as the Ronald McDonald House may encourage their volunteers to use best food safety practices because they so highly value the safety of their residents.

## CONCLUSIONS AND RECOMMENDATIONS

A limitation of this study was the inability to conduct effective behavioral observations. Unlike a restaurant, where employees are required to work many days of the week, the Ronald McDonald House has a schedule of participants that is very inconsistent. Some individuals volunteer monthly, while others volunteer as little as one time per year. Because of the time frame of the research and the inconsistency of volunteers' schedules, this study was unable to track behavior both before and after training. This study's findings may have positive implications for non-profit organizations such as the Ronald McDonald House. The results may make volunteers and staff aware of the different areas of importance regarding food safety. The main areas of knowledge and behavior in this study were cross contamination, personal hygiene, and time and temperature abuse. It is important that current and future staff members continue to be educated in these areas, as well as in all other areas of food safety. Providing all food handlers with proper training, educational materials and adequate information such as reminder signs or "info-sheets" could be beneficial in helping the organization, as a whole, make food safety a priority. Implementing food safety "info-sheets" as a training guide could also serve as a way to promote a food safety culture by providing a personalized method, emphasizing control, and demonstrating the importance of risk reduction practices (3). Info-sheets that communicate information regarding simple food safety guidelines, proper times and temperatures needed in cooking different items, and the proper way to wash hands could be posted around the Ronald McDonald House to remind volunteers and staff of how to put the guidelines they have learned into practice. Many of the families travel far from home to stay at the Ronald McDonald House while they seek medical care for their children. Many of these children are immunocompromised and therefore even more susceptible than usual to fatal effects of foodborne illness. Creating a food safety culture at the Ronald McDonald House will not only make food safety a top priority among volunteers and staff, but also provide peace of mind to the families staying there.

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