

# FOOD ALLERGY KNOWLEDGE, ATTITUDES, PRACTICES, AND TRAINING EXPERIENCES OF EMPLOYEES IN CHINESE RESTAURANTS

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## ABSTRACT

This study explored food allergy knowledge, attitudes, practices, and training experiences of Chinese restaurant employees ( $n = 98$ ). Meals consumed at Chinese restaurants can be potentially hazardous for individuals with food allergies due to reactions resulting from hidden allergens, cross-contact, communication issues, and a lack of knowledge among food handlers. Results confirmed food allergy knowledge gaps ( $M = 7.5 \pm 2.8$ ) and most (67%) reported no previous food allergy training. Positive attitudes towards individuals with a food allergy and safe food allergy handling practices were found suggesting opportunities to provide training. Training preferences of these employees are also reported.

**Keywords:** food allergy, foodservice, Chinese restaurants, ethnic food, training needs

## INTRODUCTION

Meals consumed away from home can pose a substantial health risk to individuals with food allergies. For individuals with food allergies, contact or ingestion of even small amounts of an allergen can pose a significant risk of reaction, the result of an overreaction of the body's immune system (American Academy of Allergy, Asthma & Immunology [AAAAI], 2018). Food allergy is distinct from food intolerance which involves the digestive system and not the immune system (AAAAI, 2018). Symptoms of a food allergy reaction can range from mild, such as cramps, vomiting, hives, shortness of breath, or wheezing; to severe, such as difficulty swallowing or breathing; to death (Sicherer & Sampson, 2018). There is currently no cure for food allergies and medical professionals advise careful avoidance of the allergen to prevent serious health complications (Sicherer & Sampson, 2018).

Strict avoidance of an allergen can be problematic. Over one-third of individuals with food allergies have reported multiple (three or more) reactions as a result of food purchased from restaurants (Wanich, Weiss, Furlong, & Sicherer, 2008). Reactions frequently occur after consuming foods that had been considered safe (Ajala et al., 2010; Bailey et al., 2011; Common et al., 2013) and have been attributed to cross-contact during food preparation, communication issues, mislabeling, and a lack of food allergy and allergen knowledge among foodservice professionals (Kwon & Lee, 2012; Wen & Kwon, 2016; Vierk, Koehler, Fein, & Street, 2007).

Asian restaurants have been identified as a frequent site for food allergy reactions. For incidences relating to seafood allergies, Asian restaurants were found to be the second most common restaurant type ( $N = 186$ , 18%) as a result of cross-contact and poor communication between staff and customers (Furlong, Maloney, & Sicherer, 2006). For peanut and tree nut allergy related incidences ( $N = 156$ ), 13% occurred in Asian restaurants (Furlong, DeSimone, & Sicherer, 2001).

In particular, Chinese restaurants have been identified as high risk places for a food allergy reaction. Individuals with food allergies report perceiving Chinese restaurants as particularly risky places for dining out, citing the heavy reliance on peanuts and tree nuts in the cuisine and communication issues with staff (Leftwich et al., 2011). Previous literature also suggests the risks may be related to the cuisine's unfamiliar ingredients and premade sauces (Kwon & Lee, 2012; Leftwich et al., 2011). Given the prevalence and severity of food allergies, the frequency with which food away from home is responsible for an allergic reaction, and the popularity of Chinese restaurants in the United States (National Restaurant Association [NRA], 2015) supporting efforts that help Chinese restaurants provide food allergen safe meals for consumers is not just critical for these businesses but vital for public safety.

Research of food allergy accommodations in foodservice recommends training to address knowledge gaps can enhance safe food allergen handling practices, but acknowledges that current food allergy training options for the foodservice industry are limited and are in need of further development (National Academies of Sciences, Engineering, and Medicine [NASEM] et al., 2016; Sicherer et al., 2012). The paucity of food allergy training options may be limiting the reach of food allergy knowledge given the diverse demographics of the foodservice industry's workforce—as seen in food safety training research where differing attitudes, levels of English literacy, language, and inadequate resources are barriers of food safety training (Mauer et al., 2006; Niode, Bruhn, & Simonne, 2011; Park, Kwak, & Chang, 2010; Roberts, Kwon, Shanklin, Liu, & Yen, 2011; Rudder, 2006).

To better help address the paucity of food allergy training options available and to provide greater insight into the food allergy training needs of foodservice employees in Chinese restaurants, it is important to understand the food allergy knowledge and training levels of these employees. Therefore, the purpose of this study was to assess food allergy knowledge, attitudes, and practices foodservice employees employ in Chinese restaurants as well as to explore their preferred training content and formats.

## METHODS

### Population

The target population for this study was employees of Chinese restaurants in Chicago, Illinois. The state was selected because food allergy-related legislation (State of Illinois HB 2510 Law) required the completion of approved food allergen awareness training by restaurant-employed foodservice sanitation managers by July 1, 2018 (Food Handling Regulation Enforcement Act Amendment of 2017). Therefore, the target population was likely to have either recently completed or was searching for food allergy training programs and could provide timely feedback regarding food allergy training programs.

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Participants were recruited from a list of 428 Chinese restaurants in Chicago, compiled from the Chinatown Chamber of Commerce food directory of Chinatown (Chicago Chinatown Chamber of Commerce, 2017), as well as a search of Chinese restaurants on Yelp.com, and a search of business licenses in the City of Chicago Business Affairs and Consumer Protection database (City of Chicago, 2018).

In addition to full-time employees, part-time employees were included in the study given the foodservice industry's reliance on part-time employees as nearly half of all foodservice employees (in food preparation and serving) are considered part-time employees (U.S. Department of Labor, Bureau of Labor Statistics, 2019).

### Questionnaire

The questionnaire was adapted, with permission, from a previous study by Choi and Rajagopal (2013), which was used to explore food allergy knowledge, attitudes, practices, and training of foodservice employees in college and university foodservice operations. The adapted questionnaire was pilot-tested and reviewed by a panel of how many experts; revisions were made based on the feedback received.

The final questionnaire was comprised of six sections. The first section investigated participant attitudes towards food allergies and customers, training, and practices. The second section evaluated knowledge of food allergies and accommodation practices. Section three recorded the self-reported frequency of performing safe food allergen handling practices. Section four explored past food allergy training, when applicable. Section five examined participants' preferences for future food allergy training content and formats. Section six collected demographic information.

In order to address the possible language needs of the study's target population the questionnaire was translated into Chinese (simplified and traditional characters). Also, as over a quarter of restaurant and foodservice employees identify as Hispanic or Latino (U.S. Bureau of Labor Statistics, 2019) and previous research has found that 17% of Hispanic workers live in limited English-speaking households (Bucknor, 2016), the questionnaire was also translated into Spanish to include the many employees in Chinese restaurants who felt more comfortable communicating in Spanish. The questionnaire was back-translated from both Chinese and Spanish for translation verification.

### Recruitment and data collection

Given the varying legal work status of employees in the leisure and hospitality industry where unauthorized immigrants account for an estimated 18% of the industry's national workforce (Passel & Cohn, 2016), participants were not required to self-identify and sign informed consent forms to avoid any undue legal risks. In lieu of the consent document, participants were given a cover letter containing the elements of a consent document.

Previous research found recruitment and retention of minority participants was improved through face-to-face recruitment by culturally-matched researchers and materials in the appropriate language (George, Duran, & Norris, 2014), therefore recruitment and data collection were conducted in-person by an ethnically Chinese researcher fluent in Mandarin and Cantonese.

Of the 428 restaurants identified, 42 restaurants were closed or incorrectly listed, leaving a total of 386 restaurants that were visited for participant recruitment and data collection. Restaurants were visited between lunch and dinner service hours (2pm-5:30pm) and the first staff member that extended a greeting was approached about the purpose of the visit. Potential participants were informed

of the study's purpose, the time and effort requested, and confidentiality provisions. All staff members present at the time of visit were invited to participate in the study. Participants were invited to choose a questionnaire from the languages offered (English, Traditional or Simplified Chinese, or Spanish). No incentives or compensation was offered to participants in the study. Institutional Review Board approval was obtained for the study prior to data collection.

### Data Analysis

Questionnaire data were analyzed using SPSS 25.0. Descriptive statistics were calculated. Negatively worded items in the attitude and practices section were reverse-coded prior to data analysis. Cronbach's alphas were calculated for attitude and practice factors to assess reliability, resulting in alphas of 0.89 and 0.88, respectively. One-way analysis of variance (ANOVA) and independent t-tests were conducted to compare the differences in means of food allergy knowledge, attitudes, and practices based on the respondents' demographic characteristics. Multiple linear regression analyses were used to determine which variables had the greatest effect on knowledge and practice. Post-hoc tests (Tukey) were conducted to further examine within group differences. The significance level was set at 0.05 for the study.

The written responses to the three open-ended questions were translated into English, as needed, and analyzed following the data procedures detailed by Creswell (2014) for coding data and developing themes from the data. A second researcher coded the responses independently before the two researchers agreed upon final themes.

## RESULTS & DISCUSSION

### Participant and Restaurant Profile

In total, 101 questionnaires were collected from 98 of the 386 restaurants visited. Three questionnaires were deemed unusable for data analysis. Ultimately, 98 questionnaires from 98 restaurants were used for data analysis (25.4% response rate).

Respondents were predominantly female ( $n = 52, 53\%$ ), 34-41 years old ( $n = 25, 26\%$ ), and possessed high school diplomas or GEDs ( $n = 42, 43\%$ ). Most ( $n = 82, 84\%$ ) respondents were born outside the U.S. and most commonly preferred communicating in Mandarin ( $n = 43, 44\%$ ) or Cantonese ( $n = 35, 36\%$ ), describing their English fluency as "average" ( $n = 40, 42\%$ ) (Table 1). No participants requested a questionnaire in Spanish.

Participants frequently worked at casual full-service operations ( $n = 35, 36\%$ ) or takeout and delivery establishments ( $n = 30, 31\%$ ). Respondents were predominately ( $n = 64, 65\%$ ) full-time (40+ hours per week at work) and typically had over eight years of experience in foodservice ( $n = 49, 50\%$ ) and Chinese restaurants ( $n = 45, 46\%$ ). Most participants ( $n = 68, 70\%$ ) reported having received food safety training but only one-third ( $n = 32, 33\%$ ) received food allergy specific training.

### Food Allergy Knowledge

The mean food allergy knowledge score was  $7.5 \pm 2.8$  (out of a possible 12 points) resulting in a score of 62.5% (Table 2). Respondents were able to demonstrate basic food allergy knowledge—correctly identifying fruit as not a major allergen ( $n = 80, 82\%$ ), the symptoms and onset timeline of a food allergy reaction ( $n = 61, 64\%$  and  $n = 79, 81\%$ ; respectively), and the amount of a food allergen safe for consumption by individuals with food allergy ("none",  $n = 66, 69\%$ ).

**Table 1: Participant Demographics (n = 98)**

Category	n	%
Gender		
Female	52	53
Male	42	43
Prefer not to Answer	4	4
Age (n = 97)		
18-25 years old	14	14
26-33 years old	24	25
34-41 years old	25	26
42-49 years old	16	16
Over 50 years old	18	19
Place of Birth		
United States	16	16
International/Outside the United States	82	84
Preferred Language		
Mandarin	43	44
Cantonese	35	36
English	18	18
Arabic	2	2
English Fluency (n = 96)		
I don't know any English	9	9
Poor	10	10
Average	40	42
Good	19	20
Excellent	18	19
Highest Level of Education Completed		
Some high school	13	13
High school/GED	42	43
Associate degree	13	13
Bachelor's degree	26	27
Master's degree	4	4
Years of experience in foodservice		
Less than 1 year	7	7
1-3 years	3	3
4-6 years	28	29
6-8 years	11	11
More than 8 years	49	50
Years of experience in Chinese restaurants (n = 97)		
Less than 1 year	7	7
1-3 years	13	13
4-6 years	20	21
6-8 years	12	12
More than 8 years	45	46
Hours worked per week		
Less than 20 hours	4	4
20-40 hours	30	31
Over 40 hours	64	65
Type of foodservice operation (n = 97)		
Fast food	6	6
Takeout and delivery	30	31
Casual full-service	35	36
Fine dining full-service	26	27
Received food safety certification (n = 97)		
Yes	68	70
No	29	30
Received food allergy training		
Yes	32	33
No	66	67
Type of food allergy training		
ServSafe® Allergen	6	19
Part of food safety training	11	34
On the job	7	22
Previous workplace	3	9
Other	3	9
Not reported	2	6

Note. Categories with fewer than 98 participants due to non-responses are noted.

Areas where knowledge was lacking among participants included cross-contact practices, hidden allergens, food ingredient labels, and appropriate responses to food allergy reactions. While most ( $n = 74$ , 78%) participants were able to identify cross-contact practices that could compromise food allergy safety fewer ( $n = 60$ , 70%) were able to explain how cross-contact occurs. When asked which foods posed the greatest potential hazard for customers with a food allergy, only half ( $n = 47$ , 51%) correctly selected "All of the above" from the multiple-choice responses. Participant responses to where allergen information of an ingredient could be found were divided between the ingredient label ( $n = 44$ , 46%) and relying on the customer to know ingredients hazardous to them ( $n = 43$ , 45%).

Fewer than one-third of participants ( $n = 21$ , 30%) were able to accurately identify the medication used for a severe food allergy reaction ("epinephrine"). Fewer than two-thirds ( $n = 63$ , 66%) correctly identified the best first response to a food allergy reaction in the restaurant. Concerningly, roughly one-third of respondents did not select an answer (only 69 responses were collected) for a question regarding the best treatment for controlling a severe food allergy reaction. Participants remarked during data collection the question was left blank because they did not know the answer; of the participants that responded 57% ( $n = 39$ ) incorrectly selected "Benadryl™".

#### Food Allergy Attitudes

Participants had a mean attitude score of  $3.6 \pm 0.5$  (1 = *strongly disagree*; 5 = *strongly agree*) with a range of 2.7 to 4.0 (Table 3). Attitude scores towards providing customers food allergen information were high ("It is important to me that accurate information about food ingredients is provided to customers",  $4.1 \pm 0.8$ ; "I believe that providing customers with food allergy information will decrease the likelihood of a food allergy reaction",  $4.0 \pm 0.8$ ) as were attitudes towards changing food handling behaviors relating to food allergens ( $4.0 \pm 0.8$ ), and personal responsibilities regarding preventing food allergy reactions on the job ( $4.0 \pm 0.9$ ). Attitude scores towards food allergy training were lower than attitude scores regarding food allergy reaction prevention and customers with food allergies with statements about food allergy training being "not a good use of time" ( $3.8 \pm 0.9$ ), being of personal importance ("learning about food allergy is important to me",  $3.7 \pm 0.9$ ) or usefulness ("food allergy training is not useful to me",  $3.6 \pm 1.0$ ), or about a general willingness to attend training courses or workshops ( $3.7 \pm 0.8$ ) had attitude scores closer to the sample's mean score of  $3.6 \pm 0.5$ .

#### Food Allergy Self-Reported Practices

During data collection, participants noted that their roles frequently crossed multiple areas of the restaurant, from kitchen work to service work and occasionally management, in the absence of a formal manager. Therefore, participants were told to complete the questionnaire for any applicable areas which resulted in varying sample size numbers for the categories of restaurant employees. The mean practice scores for kitchen staff ( $n = 65-72$ ,  $4.3 \pm 0.6$ , mean range = 4.1 to 4.5) and service staff and managers ( $n = 67-79$ ,  $4.3 \pm 0.7$ , mean range = 4.1 to 4.6) were high, with an overall mean practice score of  $4.3 \pm 0.6$  (Table 4).

**Kitchen staff.** Respondents' self-reported practice scores surrounding communication of food allergy needs between staff members ("I communicate with other staff members to ensure an allergy safe meal is prepared",  $n = 68$ ,  $4.5 \pm 0.8$ ) and how to handle customers with food allergies ("When a customer with a food allergy comes in, I know exactly what to do",  $n = 70$ ,  $4.5 \pm 0.8$ ) received the highest practice scores. The lowest self-reported practice scores were associated with reading ingredient labels for allergens ("I read labels of ingredients

**Table 2: Food Allergy Knowledge Results**

<b>Knowledge Items</b>	<b>n</b>	<b>%</b>
<i>Which of the following is not considered a major food allergen? (n = 98)</i>		
<b>Fruit</b>	<b>80</b>	<b>82</b>
Wheat	10	10
Soy	4	4
Shellfish	3	3
<i>Which body system can be affected by a food allergy reaction? (n = 96)</i>		
Gastrointestinal tract	16	17
Respiratory system	12	13
Skin	7	7
<b>All of the above</b>	<b>61</b>	<b>64</b>
<i>How soon does a food allergy reaction occur after the food is consumed? (n = 97)</i>		
<b>Immediately or within a few hours after the food is consumed.</b>	<b>79</b>	<b>81</b>
Twenty-four hours after the food is consumed.	16	16
Thirty-six hours after the food is consumed.	1	1
Forty-eight hours after the food is consumed.	1	1
<i>Which of the following is the best treatment for controlling a severe food allergy reaction? (n = 69)</i>		
Benadryl™	39	57
Pseudoephedrine	2	3
<b>Epinephrine</b>	<b>21</b>	<b>30</b>
Aspirin	7	10
<i>When preparing or serving a meal for a person with a food allergy, it is important to: (n = 97)</i>		
Discuss the meal with the customer with food allergy.	19	20
Check ingredient labels of foods used to make the meal.	9	9
Deliver the food allergens safe meal to the customer separately.	9	9
<b>All of the above.</b>	<b>60</b>	<b>62</b>
<i>Which of the following practices could cause cross-contact? (n = 95)</i>		
Using the same cooking surfaces to prepare allergen-free foods as allergen-containing foods.	6	6
Cooking allergen-free food in the same cooking equipment as allergen-containing foods.	5	5
Not washing hands before handling the allergen-free food.	10	11
<b>All of the above.</b>	<b>74</b>	<b>78</b>
<i>How much of a food allergen is safe for a person with food allergy to eat? (n = 96)</i>		
Small amounts are safe.	7	7
<b>None.</b>	<b>66</b>	<b>69</b>
Varies with the food.	14	15
Depends on how the food was prepared.	9	9
<i>If a customer is experiencing a food allergy reaction, what is the best first response? (n = 96)</i>		
Determine what caused the reaction.	20	21
<b>Call for medical help.</b>	<b>63</b>	<b>66</b>
Find the customer's epinephrine and administer the medication.	13	14
Fire the person responsible for making the food that caused the reaction.	0	0
<i>Why can fried foods be dangerous for individuals with food allergy? (n = 86)</i>		
The high fat content in fried foods makes food allergy reactions worse.	11	13
Frying changes the chemical structure of foods.	13	15
<b>Cross-contact with food allergens can occur if the oil was used to cook allergen containing foods.</b>	<b>60</b>	<b>70</b>
The high starch content makes food allergy reactions worse.	2	2
<i>Which of the following items are risky for customers with food allergy? (n = 92)</i>		
Menu items with many ingredients.	24	26
Desserts.	5	5
Sauce-covered foods.	16	17
<b>All of the above.</b>	<b>47</b>	<b>51</b>
<i>What are some of the symptoms of a food allergy reaction? (n = 93)</i>		
Sneezing, dizziness, muscle pain, headache.	6	6
<b>Wheezing, facial swelling, abdominal cramps, vomiting.</b>	<b>80</b>	<b>86</b>
Constipation, bloating, gas, heartburn.	7	8
Lack of energy, backache, depression, anxiety.	0	0
<i>Where can you find whether an ingredient you are using contains an allergen? (n = 95)</i>		
Looking on the manufacturer's website.	1	1
By asking a manager.	7	7
<b>Reading the ingredient label.</b>	<b>44</b>	<b>46</b>
The customer should know what foods they cannot eat.	43	45

Note. Bolded items are the correct answers.

**Table 3: Participants' Attitude Scores**

Attitude Statement ( $\alpha = 0.89$ )	$M \pm SD^a$	$n(\%)$				
		Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
<b>Individual's Role in Food Allergy Safety</b>						
I cannot guarantee a food allergen safe meal. <sup>b</sup> ( $n = 95$ )	3.3 $\pm$ 0.9	3(3)	11(12)	41(43)	33(35)	7(7)
It is important to me that accurate information about food ingredients is provided to customers. ( $n = 97$ )	4.1 $\pm$ 0.8	1(1)	1(1)	15(15)	47(48)	33(34)
I believe that providing customers with food allergy information will decrease the likelihood of a food allergic reaction. ( $n = 98$ )	4.0 $\pm$ 0.8	1(1)	2(2)	18(18)	51(52)	26(27)
I am willing to change my food handling behaviors related to handling food allergens. ( $n = 98$ )	4.0 $\pm$ 0.8	1(1)	4(4)	15(15)	47(48)	33(34)
I think preventing food allergy reaction is an important part of my job responsibilities. ( $n = 98$ )	4.0 $\pm$ 0.9	1(1)	4(4)	27(28)	32(33)	34(35)
<b>Restaurant's Role in Food Allergy Safety</b>						
I think my workplace is responsible for educating me about food allergy and allergen handling. ( $n = 98$ )	3.6 $\pm$ 0.8	1(1)	4(4)	42(43)	41(42)	10(10)
My workplace should refuse to serve people with food allergy. <sup>b</sup> ( $n = 98$ )	3.9 $\pm$ 0.9	1(1)	7(7)	19(19)	45(46)	26(27)
<b>Individuals with Food Allergies</b>						
I believe it is entirely the customers' responsibility to avoid food allergens. <sup>b</sup> ( $n = 97$ )	2.7 $\pm$ 1.0	13(13)	28(29)	36(37)	15(15)	5(5)
Serving a customer with food allergy is not worth the potential liability. <sup>b</sup> ( $n = 98$ )	3.8 $\pm$ 0.8	1(1)	4(4)	25(25)	49(50)	20(20)
A person with food allergy should not be eating in restaurants. <sup>b</sup> ( $n = 97$ )	3.8 $\pm$ 0.8	0(0)	8(8)	20(21)	50(52)	19(20)
Food allergy customers are just picky eaters. <sup>b</sup> ( $n = 98$ )	3.8 $\pm$ 1.0	4(4)	6(6)	22(22)	41(42)	25(26)
<b>Food Allergy Safety &amp; Training</b>						
Food allergy training is not a good use of my time. <sup>b</sup> ( $n = 98$ )	3.8 $\pm$ 0.9	1(1)	4(4)	30(31)	43(44)	20(20)
Learning about food allergy is important to me. ( $n = 97$ )	3.7 $\pm$ 0.9	1(1)	9(9)	23(24)	47(48)	17(18)
Food allergy is a serious health issue. ( $n = 98$ )	3.7 $\pm$ 0.9	1(1)	5(5)	33(34)	42(43)	17(17)
I am willing to attend training courses/workshops to learn more about food allergy. ( $n = 98$ )	3.7 $\pm$ 0.8	0(0)	4(4)	38(39)	44(45)	12(12)
Food allergy training is not useful to me. <sup>b</sup> ( $n = 98$ )	3.6 $\pm$ 1.0	3(3)	8(8)	29(30)	40(41)	18(18)

<sup>a</sup>5-point Likert scale used (1 = *Strongly disagree*; 5 = *Strongly agree*)

<sup>b</sup>Items were reverse coded

when preparing food for a customer with a food allergy",  $n = 72$ , 4.1  $\pm$  1.2) and workplace policies and training ("My workplace has told me what I should do when someone tells me they have a food allergy",  $n = 65$ , 4.1  $\pm$  1.2).

**Service staff and managers.** Mean self-reported practice scores for service staff and managers were also high. The statement "I wash my hands before serving customers with food allergy their food" had the lowest mean score of 4.1  $\pm$  1.1 ( $n = 77$ ), followed by "my workplace has told me what I should do when someone tells me they have a food allergy" which received a mean score of 4.2  $\pm$  1.2 ( $n = 67$ ), similar to the results found for kitchen staff on the same statement. Statements regarding food allergy communication received the highest self-reported scores ("I communicate with other staff members to ensure an allergy safe meal is prepared",  $n = 67$ , 4.6  $\pm$  0.8; "I provide accurate information to customers regarding a dish's ingredients",  $n = 79$ , 4.5  $\pm$  0.8).

**Food Allergy Training and Perceived Needs**

Of the respondents that had received food allergy training ( $n = 32$ ), over 90% reported having received training regarding identifying major food allergens (94%), reading food labels (91%), avoiding cross-contact (94%), and communicating allergen information to customers (94%). Fewer respondents (72%) recalled receiving training on how to handle food allergy reaction and was the only area that saw a result lower than 90% (Table 5).

Participants' responses to the perceived need of food allergy training were high for most items on a scale ranging from 1 = *very unnecessary* to 5 = *very necessary*. The mean score for perceived need of training was over 4.5 regarding major food allergens, reading food labels, avoiding cross-contact, and communicating food allergy information to customers (Table 6). These results mirrored the responses regarding training received. The lowest mean score for perceived need related to how to handle a food allergy reactions (4.4

**Table 4: Participants' Self-Reported Practice Scores**

Practice Statement ( $\alpha = 0.88$ )	$M \pm SD^a$	n(%)				
		Never	Rarely	Sometimes	Often	Always
<b>Practice Total</b>	4.3 $\pm$ 0.6					
<b>Kitchen Staff (n = 65-72)</b>	<b>4.3 <math>\pm</math> 0.7</b>					
I prepare allergen-containing and allergen-free dishes separately. (n = 70)	4.1 $\pm$ 1.2	3(4)	5(7)	10(14)	13(19)	39(56)
I told staff members a dish did not contain any allergens when I was unsure. <sup>b</sup> (n = 70)	4.3 $\pm$ 1.3	5(7)	4(6)	6(9)	8(11)	47(67)
I use clean and sanitized cooking equipment to prevent cross-contact. (n = 71)	4.4 $\pm$ 1.0	2(3)	3(4)	6(9)	16(23)	44(62)
I read labels of ingredients when preparing food for a customer with a food allergy. (n = 72)	4.1 $\pm$ 1.2	3(4)	6(8)	7(10)	20(28)	36(50)
When a customer with a food allergy comes in, I know exactly what to do. (n = 70)	4.5 $\pm$ 0.8	1(1)	0(0)	7(10)	18(26)	44(63)
My workplace has told me what I should do when someone tells me they have a food allergy. (n = 65)	4.1 $\pm$ 1.2	4(6)	5(8)	5(8)	16(25)	35(54)
I communicate with other staff members to ensure an allergy safe meal is prepared. (n = 68)	4.5 $\pm$ 0.8	1(2)	1(2)	6(9)	15(22)	45(66)
<b>Service Staff and Managers (n = 67-79)</b>	<b>4.3 <math>\pm</math> 0.7</b>					
I serve allergen-containing and allergen-free plates separately. (n = 75)	4.4 $\pm$ 1.0	1(1)	4(5)	8(11)	13(17)	49(65)
I told customers a dish did not contain any allergens when I was unsure. <sup>b</sup> (n = 78)	4.2 $\pm$ 1.3	8(10)	1(1)	11(14)	3(4)	55(71)
I wash my hands before serving customers with food allergy their food. (n = 77)	4.1 $\pm$ 1.1	3(4)	4(5)	12(16)	18(23)	40(52)
I provide accurate information to customers regarding a dish's ingredients. (n = 79)	4.5 $\pm$ 0.8	0(0)	4(5)	5(6)	17(22)	53(67)
When a customer with a food allergy comes in, I know exactly what to do. (n = 76)	4.4 $\pm$ 0.9	2(3)	0(0)	9(12)	22(29)	43(57)
My workplace has told me what I should do when someone tells me they have a food allergy. (n = 67)	4.2 $\pm$ 1.2	4(6)	2(3)	9(13)	12(18)	40(60)
I communicate with other staff members to ensure an allergy safe meal is prepared. (n = 76)	4.6 $\pm$ 0.8	0(0)	3(4)	4(5)	13(17)	56(74)

Note. Participants that identified as kitchen staff and service staff completed both sections, resulting in varying sample size numbers.

<sup>a</sup>5-point Likert scale used (1 = Strongly disagree; 5 = Strongly agree)

<sup>b</sup>Items were reverse coded.

$\pm 1.3$ ). Training on avoiding cross-contact between foods during preparation or service had the highest perceived training need (4.6  $\pm$  1.0).

#### Knowledge, Attitudes & Practices by Food Allergy Training and Food Safety Certification

Independent-samples t-tests were conducted to compare the knowledge, attitude, and practice scores of participants that had and had not received food allergy training. For participants that had completed food allergy training, a significant difference was found in mean scores for food allergy knowledge,  $t(96) = 3.646$ ,  $p < 0.001$ , attitudes,  $t(96) = 2.676$ ,  $p = 0.009$ , and self-reported practices,  $t(81) = 3.904$ ,  $p < 0.001$ . Participants with food safety certification also saw significantly different mean scores than those that did not have food safety certification for food allergy knowledge ( $t(95) = 4.136$ ,  $p < 0.001$ ), attitudes ( $t(95) = 2.316$ ,  $p = 0.023$ ), and practices ( $t(37) = 3.497$ ,  $p < 0.001$ ).

#### Differences in Knowledge, Attitudes, Practices, Based on Demographic Characteristics

The knowledge, attitude and practice score means of participants' with and without food allergy and food safety training was also compared (Table 7). Independent t-tests and ANOVA with Tukey's post hoc analyses were used to compare mean in knowledge, attitude, and practice scores and demographic characteristic. The results showed a significant difference for knowledge scores between age groups ( $F_{(4, 90)} = 2.674$ ,  $p = 0.037$ ) with scores for 18-25-year-olds

(9.2  $\pm$  2.5) found to be significantly different ( $p = 0.016$ ) than those of the 42-49-year-olds (6.0  $\pm$  2.5); no significant difference was found for other age groups. Education levels also resulted in significantly different knowledge scores ( $F_{(4, 91)} = 2.561$ ,  $p = 0.044$ ).

Preferred language of communication ( $F_{(3, 92)} = 5.204$ ,  $p = 0.002$ ) and English fluency ( $F_{(4, 89)} = 4.035$ ,  $p = 0.005$ ) had significant impacts on knowledge scores. Mean knowledge scores for those with preferences for Mandarin (7.4  $\pm$  2.8,  $p = 0.017$ ) and Cantonese (6.7  $\pm$  2.7,  $p = 0.001$ ) had significantly different mean scores than participants with a preference in communicating in English (9.1  $\pm$  2.2). Mean English fluency knowledge scores for those with "Excellent" English fluency (9.1  $\pm$  2.7) was significantly different than those that had "Poor" English fluency (5.2  $\pm$  1.6). Place of birth saw significant differences in knowledge ( $t(96) = 3.025$ ,  $p = 0.003$ ) and practice scores ( $t(94) = 2.286$ ,  $p = 0.025$ ) scores but not attitude scores. Mean knowledge scores for U.S.-born participants (9.4  $\pm$  2.5) were significantly different ( $F_{(1, 96)} = 9.151$ ,  $p = 0.003$ ) from scores for those born outside the U.S. (7.2  $\pm$  2.7).

Correlation and multiple regression analysis were used to test if attitude, knowledge, previous food allergy training, or food safety certification significantly predicted participants' safe food allergy handling practices (Table 8). Each of the predictors were positively and significantly correlated with the self-reported practice scores. Attitude scores and knowledge scores were also positively and significantly correlated ( $r = 0.360$ ,  $p < 0.001$ ) and food allergy attitude

**Table 5: Participants' Reported Food Allergy Training Items Received (n = 32)**

Training Items	n(%)	
	Yes	No
I have received training to identify the major food allergens.	30(94)	2(6)
I have received training on how to read food labels for food allergen identification.	29(91)	3(9)
I have received training on how to avoid cross-contact between foods during food preparation or service.	30(94)	2(6)
I have received training on how to communicate allergen information to customers.	30(94)	2(6)
I have received training on how to handle a food allergy reaction.	23(72)	9(28)

scores also had significant positive correlations with food safety certification ( $r = 0.226, p=0.014$ ) and food allergy training ( $r = 0.254, p=0.007$ ). Food allergy knowledge scores were significantly and positively correlated with food safety certification ( $r = 0.383, p<0.001$ ) and food allergy training ( $r = 0.347, p<0.001$ ).

Multiple regression analyses were conducted to examine the relationship between safe food allergy handling practices and food allergy knowledge, attitude, food allergy training, and food safety certification. There was linearity as assessed by partial regression plots and a plot of studentized residuals against the predicted values. There was independence of residuals, as assessed by a Durbin-Watson statistic of 1.473. There was homoscedasticity, as assessed by visual inspection of a plot of studentized residuals versus unstandardized predicted values. There was no evidence of multicollinearity, as assessed by tolerance values greater than 0.1.

The analysis found a significant result with the food allergy attitude, knowledge, food allergy training and food safety certification predictors and safe food allergy handling practices. The results of the regression indicated that the predictors explained 25% (adjusted  $R^2 = 0.252$ ) of the variance ( $R^2 = 0.284, F(4, 90) = 8.903, p<0.001$ ) with a small effect size. The significant findings were examined further with the coefficients of the regression model computed for further analysis. It was found that food allergy attitudes ( $\beta=0.385, p=0.005$ ) and food safety certification ( $\beta=0.348, p=0.016$ ) significantly predicted safe food allergy handling practice scores. The regression summary can be found in Table 9.

**Food Allergy Training Preferences**

Participants were asked to complete open-ended questions regarding food allergy training preferences, specifically, what should be included in food allergy trainings, what should be excluded in food allergy trainings, and their preferred formats for food allergy training. The first question ("If you were to design a food allergy training program for your workplace, what would you include?") received 17 responses with the most frequent response ( $n = 16$ ) requesting information to help with understanding what food allergens are and knowing how to identify and recognize food allergens. Five respondents commented training should provide information on allergens in sauces, foods, or dishes/meals and help employees identify dishes where food allergens were not present. Four participants requested training on how to read food labels for allergens, mentioning training should "make sure kitchen staff knows the name of [food allergens] in English" as well as in Chinese, and that it was important for employees to know "how [allergens] can hide [in] different dishes."

Respondents ( $n = 8$ ) also wanted food allergy training specific to safely preparing foods for kitchen staff and safely serving foods for service staff, such as how to communicate food allergy information with customers and why relaying accurate information was important for customer safety, saying servers needed to "be honest to customers" by "telling the truth if you do not know for sure you can [provide a safe meal to a customer with a food allergy]." Three respondents deemed information regarding the potential health consequences of ingesting a food allergen for those with food allergy were important to include and two respondents wanted information on how to handle food allergy reactions.

Ten participants responded to the second question, "if you were to design a food allergy training program for your workplace, what would you exclude?" Responses to this question focused primarily on attitudes of potential trainees rather than content, as was the case with the first open-ended question, saying that staff should not be included in the training if "they are not serious about it" or "do not want to learn" about food allergies. Similarly, training should exclude anything that reinforced negative stereotypes about people with food allergies and avoid presenting food allergy customers as "just being difficult" or "picky" eaters.

The third question asked participants to identify their preferred format for future food allergy training (Table 10). Nearly half of respondents ( $n = 24, 41%$ ) indicated a preference for booklets/posters/flyers as the format for a training program, liking that they

**Table 6: Participants' Perceived Need of Food Allergy Training Items (n = 32)**

Training Item	M ± SD <sup>a</sup>	n(%)				
		Very unnecessary	Somewhat unnecessary	Neither necessary or unnecessary	Somewhat necessary	Very Necessary
Training about food allergy.	4.5 ± 1.2	3(9)	3(9)	0(0)	0(0)	26(81)
Training to identify major food allergens.	4.5 ± 1.2	3(9)	0(0)	0(0)	4(13)	25(78)
Training on how to read ingredient labels for food allergen.	4.5 ± 1.2	3(9)	0(0)	0(0)	4(13)	25(78)
Training on how to avoid cross-contact between foods during food preparation/service.	4.6 ± 1.0	0(0)	3(9)	1(3)	3(9)	25(78)
Training on how to communicate with customers about allergens.	4.5 ± 0.9	0(0)	3(9)	0(0)	6(19)	23(72)
Training on how to handle a food allergy reaction.	4.4 ± 1.3	3(9)	1(3)	0(0)	4(13)	24(75)

<sup>a</sup>5-point Likert scale used (1 = very unnecessary; 5 = very necessary)

**Table 7: Participant Mean Knowledge, Attitude, and Practice Scores with and without Food Allergy Training or Food Safety Certification**

Food Allergy Training (n = 98)	Food Safety Certification (n = 95)	M ± SD <sup>a</sup>		
		Knowledge	Attitude	Practices
No (n=x)	No (n=x)	5.8 ± 2.9	3.4 ± 0.5	3.8 ± 0.8
	Yes (n=x)	7.6 ± 2.6	3.6 ± 0.4	4.3 ± 0.5
Yes (n=x)	No (n=x)	7.0 ± 4.2	3.8 ± 1.0	4.7 ± 0.3
	Yes (n=x)	9.0 ± 2.1	3.8 ± 0.5	4.6 ± 0.5

could “go over it on [their] own time” and that they could “always refer back to it” later. Many (n = 16, 29%) also requested a program in a traditional classroom-style setting with a lecture that presented the important material. One respondent liked the classroom-style lecture format “so everyone can take notes” but thought the class should also include a “booklet and posters for extra help” in understanding the information. Eleven participants were interested in an online class format for the training but another respondent made it clear that computer literacy levels varied significantly and that it may not be a good option for everyone. One participant remarked that any printed materials should understand the varying literacy levels within foodservice employees and that the examinations should come in multiple choice and true/false question formats.

Some respondents noted other training program considerations, including a need for programs to be offered in multiple languages (n = 2), to include visuals (n = 1), and to create programs that emphasized a personal perspective to make the experience of having food allergies or a food allergy reaction “more relatable.”

**DISCUSSION**

This study examined the food allergy knowledge, attitudes, practices, training experiences, and future training preferences of employees in Chinese restaurants. The results found that while participants were able to identify major food allergens, food allergy reaction onset and symptoms, as well as some allergen-safe kitchen and service practices, areas of knowledge where improvement was needed were found. Participants’ knowledge scores were high regarding practices to prevent cross-contact, but scores dropped when participants were asked how cross-contact occurs and how it could be hazardous for individuals with food allergies. This gap in scores suggests respondents may be conflating safe food handling practices learned from food safety that prevent foodborne illness and those that prevent food allergy reactions. This finding is consistent with previous

research that found foodservice managers would use the terms “cross-contamination” and “cross-contact” interchangeably and were unaware of the difference between the terms (Wen & Kwon, 2016). Namely, “cross-contact” refers to the transfer of an allergen from an allergen-containing food to an allergen free food, whereas “cross-contamination” refers to the transfer of microorganisms from cross food and/or equipment (Food Allergy Research & Education [FARE], 2018). Following safe food handling practices is important in the reduction of foodborne illness outbreak, however it does not lessen the risk of an food allergy reaction due to cross-contact (FARE, 2018) which customers believe to be one of the major causes of food allergy reactions in restaurants (Kwon & Lee, 2012). Training focusing on the severity of allergy and the importance of cross-contact—and how it differs from cross-contamination—has been suggested by medical professionals in the past (Sicherer & Sampson, 2018). To potentially help address this confusion for foodservice professionals, future training programs may wish to consider providing a glossary of food safety and food allergy terms and offer examples that help illustrate the concepts. Additionally, providing information to help foodservice professionals understand food allergies is an immunological disorder with potentially life-threatening reaction consequences could provide context for safe food allergen handling practices may also be useful for future trainings. Information regarding the difference between a food allergy and a food intolerance may also be helpful for foodservice professionals to understand the differences in reaction and potential for fatalities.

Food allergy reactions in restaurants are frequently attributed to the unknown consumption of an unidentified or hidden allergen (Anibarro, Seoane, & Mugica, 2007; Vierk et al., 2007). Hidden allergens have been identified as particularly problematic in Chinese restaurants due to the use of premade sauces and dishes (Kwon & Lee, 2012). Thus, it is recommended for individuals with food allergies and anyone involved in the purchasing, preparing, or serving of food

**Table 8: Correlations of Food Allergy Knowledge, Attitude, Practice, Certifications, Trainings (n = 95)**

		Practice Score	Knowledge Score	Attitude Score	Food Allergy Training	Food Safety Certification
Practice Score	Correlation	1	0.316*	0.398*	0.344*	0.393*
	Sig.		0.001	<0.001	<0.001	<0.001
Knowledge Score	Correlation	0.316*	1	0.360*	0.347*	0.383*
	Sig.	0.001		<0.001	<0.001	<0.001
Attitude Score	Correlation	0.398*	0.360*	1	0.254*	0.226*
	Sig.	<0.001	<0.001		0.007	0.014
Food Allergy Training	Correlation	0.344*	0.347*	0.254*	1	0.363*
	Sig.	<0.001	<0.001	0.007		<0.001
Food Safety Certification	Correlation	0.393*	0.383*	0.226*	0.363*	1
	Sig.	<0.001	<0.001	0.014	<0.001	

\*p < .05, one-tailed



**Table 9: Regression Analysis Summary (n = 93)**

R	R <sup>2</sup>	Adjusted R <sup>2</sup>	df1	df2	F	Sig.
0.53 <sup>b</sup>	0.28	0.25	4	90	8.90	0.00
Coefficients <sup>a</sup>						
	Beta	t	Sig.	VIF		
Attitude Total	0.324	3.486	0.001	1.056		
FS Certification	0.318	3.416	0.001	1.056		

<sup>a</sup> Dependent Variable: Practice Score Total

<sup>b</sup> Predictors: (Constant), Knowledge Score Total, Attitude Score Total, Food Allergy Training, Food Safety Certification

\*p < .05

to allergic customers to be educated about the careful reading of food labels to reduce accidental exposure to allergens (Sheth et al., 2010). Problematically, as the findings show, participants lack knowledge regarding the use of food labels to reference whether ingredients contained within a sauce or food item contain a food allergen and recorded the lowest self-reported practice score for the reading of food labels for food allergen identification.

To help address the lack of knowledge and practice surrounding allergen identification on food labels, training developers may wish to consider creating programs focused entirely on learning how to use and understand food labels to identify major food allergens on packaged foods. For Chinese restaurants, it may be beneficial for managers to consider providing employees a reference booklet or posters listing allergens in the ingredients frequently used in their operations, as past research suggests visual-based food safety posters have been helpful in food safety training for educating immigrant foodservice workers (Rajagopal, 2013). Managers may also consider providing employees short trainings consistently over time regarding food allergen identification on food labels specific to the ingredients frequently used in their operations. Previous research has found that short, consistent trainings over time have improved food safety behavior among foodservice professionals (Adesokan, Akinseye, & Adesokan, 2015). Managers in Chinese restaurants may find training useful in helping to modify food allergen handling practices in hopes of reducing food allergy incidents.

Based on the findings, respondents' knowledge and training gaps also extended to responding to food allergy reactions as participants struggled with identifying the correct medication used in a severe food allergy reaction and selecting the best first response to a reaction in the restaurant. This study supports previous research reports that foodservice employees felt unsure and untrained on what to do if a customer has a food allergy reaction (Radke et al., 2017) with just over a quarter (n = 9, 28%) of respondents reporting no training on how to handle a food allergy reaction as compared to training on identifying food allergens (n = 2, 6%), reading food labels (n = 3, 9%), cross-contact (n = 2, 6%), and risk communication (n = 2, 6%). Despite the participants' low knowledge scores regarding reaction management and self-reported lack of training regarding reaction management, participants' perceived need of training regarding food allergy reaction was lower than other topics of food

allergy training, supporting previous research concluding that foodservice employees had misplaced confidence in their own food allergy knowledge and training needs (Ahuja & Sicherer, 2007; Bailey, Albardiaz, Frew and Smith, 2011; Common et al., 2013). Medical journals and food allergy advocacy groups advise immediate action particularly when handling a severe food allergy reactions (anaphylaxis) to reduce the risk of fatalities (NASEM et al., 2016; Sicherer & Sampson, 2018). Given the importance of a timely, appropriate, and accurate response to a food allergy reaction it is critical in the prevention of a fatality, trainings should not only include, but heavily emphasize, how to appropriately respond to reactions to reduce preventable deaths as foodservice employees are not aware of their own knowledge gaps and training needs.

Implementation of food allergy accommodation policies or strategies can help reduce incidents of food allergy reactions in restaurants by improving communication between staff and with customers, and by ensuring accurate information is provided to customers (Wen & Kwon, 2016). Previous literature indicates that a lack of formal policies had been common in foodservice (Enriquez, Furlong, Ibrahim, & Twersky-Bumgardener, 2007). More recent research suggests that for many restaurants across the U.S. the trend has changed, and food allergy accommodation strategies are increasingly commonplace (Lee & Barker, 2017). This was not necessarily reflected in the restaurants included in this sample, as seen in the kitchen and service staff's self-reported practice score for policies and training, suggesting that the sample's restaurants likely lacked formal food allergy policies or accommodation procedures. Despite this, the respondents of this study had high attitude scores toward providing customers with accurate food ingredient information and adapting food handling practices to accommodate food allergy customers indicating that employees are willing to participate in practices to help reduce food allergy reactions in restaurants. Given the importance of risk communication in the reduction and prevention of food allergy reactions in restaurants (Wen & Kwon, 2016; Leftwich et al., 2011), and the willingness of employees to communicate accurately with customers regarding food allergies as found in the current study, it may be beneficial for future food allergy resources to provide information specific to managers, about how to develop and implement food allergy policies that capitalize on employee interest in improving their own practices, particularly with regard to risk communication with customers, for their foodservice operations.

Overall, the current study found food allergy knowledge to be poor. In a previous study assessing food allergy knowledge of foodservice professionals using a separate questionnaire, a national sample reported food allergy knowledge scores of 70.5% (M = 19.74 ± 4.61) and 72.2% (M = 20.21 ± 4.64) for Alabama (Lee & Barker, 2017), both higher than the current study's score of 62.5% (M = 7.5 ± 4.61). Although the results of the two studies cannot fairly be compared given the different instrument used in knowledge assessment, the Lee and Barker (2017) study provides some data to contrast these findings

**Table 10: Participants' Preferred Format for a Food Allergy Training**

Format	n
Printed Format (booklet/poster/flyer)	24
In-Person Class (lecture/seminar/class/presentation)	16
Online Class	11
Mobile application	4

against. Thus, the lacking food allergy knowledge of the study's participants may provide one possible explanation for the higher allergy incidence rate in Chinese restaurants.

Participants with food safety certification were found to have higher knowledge, attitude, and self-reported practice scores than participants that did not, and those with food allergy training resulted in even higher mean scores across all categories. The results show that food safety certification may improve food allergy knowledge, attitude, and practice scores, and that food allergy specific training can result in even greater improvement of food allergy knowledge, attitude, and practice scores. However, only practice scores saw a significant mean difference between those that did and did not receive food allergy training (Table 10). Food safety certification and food allergy trainings were found to significantly correlate with increased knowledge, which in turn saw greater attitude scores, contributing to safer food allergen handling practices. Ensuring the ready availability of food allergy training and resources for foodservice employees of Chinese restaurants to address the gaps in knowledge and the resulting attitude and practice gaps may help reduce incidence of food allergy reaction.

Although past research reports barriers to food allergy training including lack of awareness, knowledge, and training (Kwon & Lee, 2012), as well as lack of employee commitment and interest, scheduling issues, and high employee turnover (Lee & Barker, 2017), this study did not find respondents had a negative attitude toward food allergy training, suggesting alternate barriers to training may be to blame.

Participant knowledge, preferred language, and self-reported English fluency results suggest language as a training barrier, supporting previous findings of food safety training in ethnic restaurants (Choi & Rajagopal, 2013; Liu & Kwon, 2013). Respondents with comfort communicating in English and with high levels of English fluency had greater knowledge scores than those more comfortable communicating in Mandarin or Cantonese, or that reported "poor" fluency levels.

Additionally, differing cultural values have been identified in past research has barriers to the promotion of food safety (Mauer et al., 2006; Liu & Kwon, 2013). Results found the level of knowledge regarding food allergies were lower for foodservice employees born outside the U.S., supporting previous findings that food allergies were relatively unfamiliar to Asians and not yet recognized as a medical condition in the general population within Asia (Lu, Elliot, & Clarke, 2014). Lu, Elliot, and Clarke (2014) found food allergies were unknown to many of the study's participants and allergen terms were not familiar to participants as only 28% of participants were able to say food allergy in Chinese (Mandarin or Cantonese) and none could identify a Chinese term for "anaphylaxis", confirming the need for culturally appropriate food safety resources to improve consumer food safety in ethnic restaurants (Mauer et al., 2006). Thus, for future food allergy trainings, simply translating food allergy training programs in a greater diversity of languages to address language barriers may not be sufficient, as trainings translated into Chinese still may not adequately address whether the programs are appropriately meeting the cultural needs and using the correct terminology to best communicate the varied topics within food allergy as it pertains to the foodservice industry.

Although previous research has found that food safety training can have positive outcomes on food safety knowledge, the literature on training and improved knowledge on improving safe food handling

behaviors or practices indicate that transferring knowledge to practice can be inconsistent. Several studies (Koechlin, 2009; Mathias et al., 1994; Mitchell, Fraser & Bearon, 2007) have noted the gaps that exist between training and behavior change, while some have found mixed results or some success (Adesokan, Akinseye, & Adesokan, 2015; Pilling et al., 2008; Roberts et al., 2008). Frash and MacLaurin (2010) concluded that while adequate knowledge was a mandatory prerequisite for positive transfer of training, training alone was insufficient to motivate a behavioral change. The authors noted that employee attitudes and outlooks towards food safety training may help promote safe food handling behaviors. Additional research also suggests that foodservice employees' behaviors are more likely to improve when training is sensitive to other motivating factors, such as managerial commitment, and addressing organizational and individual barriers (Mitchell, Fraser, & Bearon, 2007).

Previous literature found customers' perceived employee attitudes towards individuals with food allergy as a barrier to food allergy accommodation, believing restaurant staff considered accommodation requests as a nuisance (Kwon & Lee, 2012). Attitude score results indicated foodservice employees in Chinese restaurants had predominately positive attitudes towards welcoming customers with food allergies and did not wish to exclude them from the restaurant or perceive them to be difficult diners. This mirrors previous studies about foodservice employees' attitudes and food allergies with the majority of employees having more positive attitudes towards food allergies than are believed or perceived by customers (Choi & Rajagopal, 2013; Leftwich et al., 2010). In light of previous research regarding transfer of knowledge to behavior, future trainings may wish to address motivating factors, such as organizational barriers and managerial commitment. Trainers may consider exploring programs that encourage empathy for individuals with food allergies and emphasize the potential benefits of accommodating individuals with food allergies to help improve attitudes. It may also be useful to explore development of manager-focused training on how to create supportive food allergy safe workplaces, in promotion of managerial support and to support positive work habits for food safety (Arendt, Strohbeh, & Jun, 2015).

## CONCLUSIONS AND APPLICATIONS

This study assessed food allergy knowledge, attitudes, practices, and food allergy training needs and preferences of employees of Chinese restaurants. Findings showed most employees in Chinese food restaurants did not receive food allergy training, however those that did complete food allergy training were found to have higher knowledge, attitudes, and practice scores. Only one-third of participants reported having receiving food allergy training, however, employees' attitudes and self-reported accommodation practices were high, suggesting employees may be willing to adapt—or already be incorporating—practices to accommodate individuals with food allergies. Despite a willingness to accommodate customers with food allergy, the gaps in food allergy knowledge, particularly with regards to cross-contact, suggest that practices may have limited efficacy as practices completed without the context of knowledge may not be helpful in keeping food safe from allergens.

This study supported past research findings that food safety training for ethnic restaurants should be culturally appropriate and specific to ethnic-foods, to ensure effective communication in the appropriate languages, and be easily accessible to the foodservice industry (Mauer et al., 2006). Training preferences noted by respondents also included an interest in printed materials (poster, flyer, booklet) with information and/or visuals that referenced Chinese cuisine specific dishes in the appropriate Chinese dialect (Mandarin, Cantonese, etc.)

that could be kept as a reference guide in future. Programs should also be further developed to meet the needs of food allergy training identified in this research, placing greater emphasis in preventing food allergy reactions (cross-contact, risk communication) and responding appropriately to incidences when they do occur.

To ensure accessibility, reference resources for employees of Chinese restaurants should be developed and provided to restaurants to ensure food allergy information is reaching foodservice staff other than the managers required to complete ANSI-accredited training. Thus, capitalizing on the willingness of employees to accommodate food allergy customers and provide opportunities to improve food allergy knowledge without necessitating formalized food allergy training. Future trainings should also look towards developing programs specifically targeted at managers to assist in the development and implementation of accommodation policies and strategies to ensure the lessons of food allergy training are continued in the workplace.

This study has some limitations. The study used a small sample of employees in Chinese restaurants in Chicago, Illinois, therefore, the results cannot be generalized to other ethnic restaurants or other metropolitan areas and may not be representative of the entire population of employees in Chinese restaurants. The effect size of the study was also small and so the findings and conclusions should be considered carefully before its use and application in future food allergy training programs.

The respondents' higher food allergy attitudes scores may be due to avidity bias among the participants, as those willing to participate in the study had a greater interest in the topic, potentially enhancing the study's overall attitude scores. Additionally, food allergy handling practices were self-reported which may have resulted in higher scores due to social desirability bias, as participants may have selected what they believed to be the desired responses and not responses that reflected their actual practices. While it is not possible to determine the extent to which the participants followed the practices reported by the data, it is very likely that respondents over-reported their adherence to following safe food allergy handling practices. Future research may wish to use research designs that can explore the actual, observed practices of foodservice employees in Chinese restaurants to help mitigate some of the bias due to self-reporting.

Participants in this study reported their roles included responsibilities spanning the front and back of house which created variation in the sample size for self-reported practices in the data. Future research may wish to modify the questionnaire used to collect greater detail regarding the job roles and categories of the study's participants.

During data collection, several respondents preferred discussing their attitudes and practices to completing the survey, revealing information that was not necessarily reflected by the data collected by the questionnaire. Given that attitudes towards food allergies have been found to be a possible cultural barrier for safe food allergy practices, future studies examining attitudes of Chinese restaurant employees may wish to use a qualitative approach to more fully explore attitudes. Future research exploring the food allergy training needs of employees of other ethnic cuisines that have been identified as high risk for individuals with food allergies could also help provide information for improving food allergy training.

Although the participants in this study indicated a preference for trainings to be presented in printed forms, in-person classes, online classes, or mobile applications, previous research has found

foodservice professionals preferred or generally enjoyed video-based learning for food safety training (Lillquist, McCabe, & Church, 2005; Salazar, Ashraf, Tchong, & Antun, 2005). Future research may wish to further explore the training format preferences of employees of Chinese restaurants or examine the efficacy of the various training delivery methods on food safety knowledge, attitudes and practices for this population.

## REFERENCES

- Adesokan, H. K., Akinseye, V. O., & Adesokan, G. A. (2015). Food safety training is associated with improved knowledge and behaviors among foodservice establishments' workers. *International Journal of Food Science*. <http://dx.doi.org/10.1155/2015/328761>
- Ahuja, R., & Sicherer, S. H. (2007). Food-allergy management from the perspective of restaurant and food establishment personnel. *Annals of Allergy, Asthma and Immunology*, 98(4), 344-348. [https://doi.org/10.1016/S1081-1206\(10\)60880-0](https://doi.org/10.1016/S1081-1206(10)60880-0)
- Ajala, A. R., Cruz, A. G., Faria, J. A. F., Walter, E. H. M., Granato, D., & Sant' Ana, A. S. (2010). Food allergens: Knowledge and practices of food handlers in restaurants. *Food Control*, 21(10), 1318-1321. <https://doi.org/10.1016/j.foodcont.2010.04.002>
- Anibarro, B., Seoane, F. J., & Mugica, M. V. (2007). Involvement of hidden allergens in food allergic reactions. *Journal of Investigational Allergology and Clinical Immunology*, 17(3), 168-172. <http://www.jiaci.org/summary/vol17-issue3-num221>
- Arendt, S., Strohbeh, C., & Jun, J. (2015). Motivators and barriers to safe food practices: observation and interview. *Food Protection Trends*, 35(5), 365-376. <http://www.foodprotection.org/files/food-protection-trends/Sep-Oct-15-arendt.pdf>
- Bailey, S., Albardi, R., Frew, A. J., & Smith, H. (2011). Restaurant staff's knowledge of anaphylaxis and dietary care of people with allergies. *Clinical and Experimental Allergy*, 41, 713-717. doi: 10.1111/j.1365-2222.2011.03748.x
- Bailey, S., Kindratt, T. B., Smith, H., & Reading, D. (2014). Food allergy training event for restaurant staff; a pilot evaluation. *Clinical and Translational Allergy*, 4(1), 26. <https://doi.org/10.1186/2045-7022-4-26>
- Chicago Chinatown Chamber of Commerce. (2013). Restaurants. Retrieved from <http://chicagochinatown.org/Restaurants/>
- Choi, J. H., & Rajagopal, L. (2013). Food allergy knowledge, attitudes, practices, and training of foodservice workers at a university foodservice operation in the Midwestern United States. *Food Control*, 31, 474-481. <http://dx.doi.org/10.1016/j.foodcont.2012.10.023>
- City of Chicago. (2018). Community and Economic Development, Business Affairs and Consumer Protection, Business Licenses – Current Active. Retrieved from <https://data.cityofchicago.org/Community-Economic-Development/Business-Licenses-Current-Active/uupf-x98q>
- Common, L. A. R., Corrigan, C. J., Smith, H., Bailey, S., Harris, S., & Holloway, J. A. (2013). How safe is your curry? Food allergy awareness of restaurant staff. *Allergy & Therapy*, 4(4), 1-4. doi:10.4172/2155-6121.1000140
- Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative and Mixed Methods Approaches* (4th ed). Thousand Oaks, California: SAGE Publications, Inc.
- Dillman, D. A., Smyth, J. D., & Christian, L. M. (2014). *Internet, Phone, Mail, and Mixed-Mode Surveys: The Tailored Design Method* (4th ed). Hoboken, New Jersey: John Wiley & Sons, Inc.
- Enriquez, L. P., Furlong, T. J., Ibrahim, J. K., & Twersky-Bumgardner, S. (2007). The prevalence of policies and procedures for serving customers with food allergies in restaurants in center city, Philadelphia. *Journal of the American Dietetic Association*, 107(8), A73. doi:10.1016/j.jada.2007.05.182
- Food Allergy Research and Education [FARE]. (2018). Avoiding cross-contact. Retrieved from <https://www.foodallergy.org/life-with-food-allergies/living-well-everyday/avoiding-cross-contact>
- Food Handling Regulation Enforcement Act Amendment of 2017, ILCS §§ 100-0367.HB2510 (2017). Retrieved from <http://www.ilga.gov/legislation/publicacts/fulltext.asp?Name=100-0367>
- Frash Jr., R. E., & MacLaurin, T. (2010). Restaurant food safety: The influence of employee outlooks on transfer of training. *International Journal of Hospitality & Tourism Administration*, 11(4), 328-346. DOI: 10.1080/15256480.2010.518523

- Furlong, T. J., Maloney, J. M., & Sicherer, S. H. (2006). Seafood allergic reactions in restaurants. *The Journal of Allergy and Clinical Immunology*, 117(2), Supplement, S1-S428, S41. <http://dx.doi.org/10.1016/j.jaci.2005.12.169>
- George, S., Duran, N., & Norris, K. (2014). A systematic review of barriers and facilitators to minority research participation among African Americans, Latinos, Asian Americans, and Pacific Islanders. *American Journal of Public Health*, 104(2), e16-e31. doi:10.2105/AJPH.2013.301706
- Jarvinen, K. M. (2011). Food-induced anaphylaxis. *Current Opinion in Allergy Clinical Immunology*, 11(3), 255-261. doi: 10.1097/ACI.0b013e32834694d8.
- Koechlin, K. (2009). Does Educational Intervention Reduce the Number of Food Violations? An evaluation of the Food Employee Education And Safety Training (FEEST) in Orange County, California. [https://scholarworks.gsu.edu/cgi/viewcontent.cgi?article=1068&context=iph\\_theses](https://scholarworks.gsu.edu/cgi/viewcontent.cgi?article=1068&context=iph_theses)
- Kwon, J., & Lee, Y. M. (2012). Exploration of past experiences, attitudes and preventative behaviors of consumers with food allergies about dining out: A focus group study. *Food Protection Trends*, 32, 736-746. <http://www.foodprotection.org/files/food-protection-trends/Dec-12-Lee.pdf>
- Lee, Y. M., & Barker, G. C. (2017). Comparison of food allergy policies and training between Alabama (AL) and national restaurant industry. *Journal of Culinary Science & Technology*, 15(1), 1-16. doi:10.1080/15428052.2016.1185071
- Lee, Y. M., & Sozen, E. (2016). Food allergy knowledge and training among restaurant employees. *International Journal of Hospitality Management*, 57, 52-59. <https://doi.org/10.1016/j.ijhm.2016.05.004>
- Lee, Y. M. & Xu, H. (2015). Food allergy knowledge, attitudes, and preparedness among restaurant managerial staff. *Journal of Foodservice Business Research*, 18(5), 454-469. <https://doi.org/10.1080/15378020.2015.1093452>
- Leftwich, J., Barnett, J., Muncer, K., Sheperd, R., Raats, M. M., Hazel Gowland, M., & Lucas, J. S. (2011). The challenges for nut-allergic consumers of eating out. *Clinical & Experimental Allergy*, 41(2), 243-249. doi:10.1111/j.1365-2222.2010.03649.x
- Lillquist, D. R., McCabe, M. L., & Church, K. H. (2005). A comparison of traditional handwashing training with active handwashing training in the food handler industry. *Journal of Environmental Health*, 67(6), 13-16.
- Liu, P., & Kwon, J. (2013). The exploration of effects of Chinese cultural values on the attitudes and behaviors of Chinese restaurateurs towards food safety training. *Journal of Environmental Health*, 75(10), 38-46.
- Lu, S. K., Elliot, S. J., & Clarke, A. E. (2014). Exploring perceptions and experiences of food allergy among new Canadians from Asia. *Journal of Allergy*, 2014, 1-7. <http://dx.doi.org/10.1155/2014/964504>
- Mathias, R. G., Riben, P. D., Campbell, E., Wiens, M., Cocksedge, W., Hazelwood, A., Kirschner, B., & Pelton, J. (1994). The evaluation of the effectiveness of routine restaurant inspections and education of food handlers: Restaurant inspection survey. *Canadian Journal of Public Health*, 85(1), S61-S66.
- Mauer, W. A., Kaneene, J. B., DeArman, V. T., & Roberts, C. A. (2006). Ethnic-food safety concerns: an online survey of food safety professionals. *Journal of Environmental Health*, 68(10), 32. <https://www.jstor.org/stable/26329646>
- Mitchell, R. E., Fraser, A. M., & Bearon, L. B. (2007). Preventing food-borne illness in food service establishments: Broadening the framework for intervention and research on safe food handling behaviors. *International Journal of Environmental Health Research*, 17(1), 9-24.
- National Academies of Sciences, Engineering, and Medicine; Health and Medicine Division; Food and Nutrition Board; Committee on Food Allergies: Global Burden, Causes, Treatment, Prevention, and Public Policy. (2016). *Managing Food Allergies in Retail, Food Service, Schools, Higher Education, and Travel Settings*. In M. P. Oria & V. A. Stallings (Eds.), *Finding a Path to Safety in Food Allergy: Assessment of the Global Burden, Causes, Prevention, Management, and Public Policy*. Retrieved from <https://www.ncbi.nlm.nih.gov/books/NBK435953/>
- National Restaurant Association [NRA]. (2015). *Global palates: Ethnic cuisines and flavors in America*.
- Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw-Hill.
- Pilling, V. K., Brannon, L. A., Shanklin, C. W., Roberts, K. R., Barrett, B. B., & Howells, A. D. (2008). Food safety training requirement and food handlers' knowledge and behavior. *Food Protection Trends*, 28(3), 192-200.
- Radke, T. J., Brown, L. G., Hoover, E. R., Faw, B.V., Reimann, D., Wong D. R.,... Ripley, D. (2017). Food allergy knowledge and attitudes of restaurant managers and staff: An EHS-Net study. *Journal of Food Protection*, 79(9), 1588-1598. <https://www.cdc.gov/nceh/ehs/ehsnet/docs/jfp-food-allergies.pdf>
- Rajagopal, L. (2013). Educating Immigrant Hispanic Foodservice Workers about Food Safety Using Visual-Based Training. *Journal of Extension*, 51(2), n2. [https://www.joe.org/joe/2013april/pdf/JOE\\_v51\\_2a8.pdf](https://www.joe.org/joe/2013april/pdf/JOE_v51_2a8.pdf)
- Roberts, K. R., Barrett, B. B., Howells, A. D., Shanklin, C. W., Pilling, V. K., & Brannon, L. A. (2008). Food safety training and foodservice employees' knowledge and behavior. *Food Protection Trends*, 28(4), 252-260.
- Salazar, J., Ashraf, H-R., Tcheng, M., & Antun, J. (2005). Food Service Employee Satisfaction and Motivation and the Relationship with Learning Food Safety. *Journal of Culinary Science & Technology*, 4(2-3), 93-108. doi:10.1300/J385v04n02\_07
- Sheth, S. S., Waserman, S., Kagan, R., Alizadehfar, R., Primeau, M-N., Elliot, S., ... & Clarke, A. E. (2010). Role of food labels in accidental exposures in food-allergic individuals in Canada. *Annals of Allergy, Asthma, & Immunology*, 104, 60-65. doi:10.1016/j.anai.2009.11.008
- Sicherer, S. H., & Sampson, H. A. (2018). Food allergy: A review and update on epidemiology, pathogenesis, diagnosis, prevention, and management. *Journal of Allergy and Clinical Immunology*, 141(1), 41-58. <https://doi.org/10.1016/j.jaci.2017.11.003>
- Vierk, K. A., Koehler, K. M., Fein, S. B., & Street, D. A. (2007). Prevalence of self-reported food allergy in American adults and use of food labels. *Journal of Allergy and Clinical Immunology*, 119(6), 1504-1510. doi:10.1016/j.jaci.2007.03.011
- Wanich, N., Weiss, N., Furlong, T. J., & Sicherer, S. H. (2008). Food allergic consumer (FAC) experience in restaurants and food establishments. *The Journal of Allergy and Clinical Immunology*, 121(2), Supplement 1, S182. <http://dx.doi.org/10.1016/j.jaci.2007.12.673>
- Wen, H., & Kwon, J. (2016). Food allergy risk communication in restaurants. *Food Protection Trends*, 36(5), 372-383. <http://www.foodprotection.org/files/food-protection-trends/sep-oct-16-wen.pdf>
- U.S. Food & Drug Administration [FDA]. (2018). Food Code 2013. Retrieved from <https://www.fda.gov/downloads/Food/GuidanceRegulation/RetailFoodProtection/FoodCode/UCM374510.pdf>
- U.S. Department of Labor, Bureau of Labor Statistics. (2019). *Occupational Outlook Handbook*, Food and Beverage Serving and Related Workers. Retrieved from <https://www.bls.gov/ooh/food-preparation-and-serving/food-and-beverage-serving-and-related-workers.htm>