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**A Study of Food Allergy Awareness and Knowledge
among Owners and Managers of Wellington City
Eating-houses**

**A thesis presented in partial fulfilment of the requirements
for the degree of**

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Food Technology**

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Kanchan M Sharma

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ABSTRACT

The aim of this study was to explore the awareness and knowledge related to food allergy among owners and managers of registered eating-houses in Wellington city. Trained interviewers were recruited to administer a questionnaire to eating-house owners and managers. The questionnaire sought to evaluate awareness about declaration of food allergens, knowledge about how food allergens could become part of a meal, the type and content of food allergy management plans in place, use of latex gloves and food allergy training received. Data from the questionnaire was analysed using simple frequency distribution for all variables. Chi-squared (X^2) tests were used to assess relationship between variables.

Of 163 managers and owners of eating-houses invited to participate in the study, 124 (76%) accepted and 39 (24%) declined. Reasons for refusal were due to time constraints (n=23) and inability to communicate in English (n=16). More than half of the respondents were not aware there were legal requirements to declare food allergens and only seven percent knew the requirements were set out in the Food Standards Code. Knowledge of food allergens requiring declaration significantly differed among eating-houses that specialised in ethnic foods compared to those that did not ($p<0.05$).

Most respondents had good knowledge about the preparation, serving and cross-contamination of food allergens. However more than half of the respondents erroneously agreed or were unsure that serving water would help dilute an allergic reaction and 65% agreed or were unsure that food allergens could be transmitted through an ill food handler. There was a high level of self-efficacy to provide a safe meal and to manage an allergy emergency.

Owners and managers of eating-houses who reported previous training in food allergy management were more likely to have in place a written food allergen management plan ($p=0.05$) and a plan for handling a food allergy emergency ($p=0.05$) compared to those

without training. They were also more likely to have a training programme in place for their staff ($p<0.05$). Most respondents were interested in further training.

There was higher usage of latex gloves in food preparation among respondents who had received past training of food allergy management compared to those without training ($p<0.05$) however; latex gloves were used less among those who were aware of skin allergy issues associated with latex glove use compared to those who were unaware ($p<0.05$).

The findings from this study suggest the development of an education programme may help improve the awareness and knowledge of owners and managers of eating-houses and thereby help to reduce the risk of food allergic reactions amongst consumers in this setting. A change in food establishment registration requirements to include a competency to communicate in English is warranted. To help provide safe meals a written food allergy management plan and training for staff is recommended. For the protection of public health such requirements could be mandated as part of the annual verification process for renewal of eating-house registration.

*To my mother, Mrs Gyanmati Prasad,
who instilled the value of knowledge in me*

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CHAPTER 1: INTRODUCTION

Food allergy is an important public health problem in developed countries such as New Zealand. There is currently limited data on the prevalence of food allergy in New Zealand. A study undertaken on behalf of the European Community Respiratory Health Survey collected data from 1148 New Zealanders on the prevalence of reported food allergies and intolerances found that 11.4% reported illness from food. Most commonly reported foods were cow's milk (18.2%) and hard cheese (13.6%) (Woods et al. 2001). Findings were limited from this European study however as food allergy was determined by self-report. International studies which include United States of America (USA), Canada and European Union Countries estimate the prevalence to be between 1% and 4% in adults overall (Zarkadas et al. 1999). The estimates of prevalence vary depending on the study design and method of diagnosis used. Self-reported food allergies tend to provide higher estimates of prevalence.

Food allergy has been defined as adverse immune mediated reactions to specific food proteins that can sometimes be rapid and serious and lead to a life threatening anaphylactic reactions (Sampson et al. 2006; Wang and Sampson 2011). The Codex Alimentarius Commission (1985) and Food Standards Australia New Zealand (New Zealand Government 2002) recognise a list of eight food and ingredients that are known to cause food allergy and should always be declared. These are outlined in the Food Standards Code. For people with food allergies, eating outside the home carries more risk as there is limited control over what food components are added to recipes and sauces and over what food items may have been contaminated with allergens during the food preparation process.

New Zealand is a multicultural society with an ethnically diverse food supply. Eating out is increasingly popular (Restaurant Association of New Zealand 2007). Ensuring the safe provision of allergen-free food from eating-houses and other food establishments is not only time-consuming but can be prone to unforeseen errors. This is evident in a report in the New Zealand Listener of a fatal allergic reaction to food eaten at a restaurant in Auckland (Bowden 2008). In this instance the person was aware of their allergy to eggs and nuts and had made prior arrangements with the eating-house concerned to request food free

of these ingredients. Despite the efforts to take these steps the person suffered a fatal anaphylactic reaction.

Reducing the risk of food allergic reactions is clearly of paramount importance to restaurateurs. In the USA, a survey was undertaken in New York to identify, from a restaurant's perspective, factors that relate to the provision of allergen-safe meals (Ahuja and Sicherer 2007). Among a range of 100 food establishments important deficits in knowledge of restaurant personnel were found. For example, 24% of restaurant personnel believed that consuming a small amount of food allergen would be safe, 35% believed that fryer heat would destroy a food allergen, 54% considered a buffet to be safe from food allergies if kept clean and 25% thought removing a food allergen from a finished meal was safe. The overall findings from this study indicated the need for more industry training and consumer education.

The awareness and knowledge of owners and managers of eating-houses in New Zealand is unknown. Therefore it is difficult to gauge if adequate protection is in place to reduce the risk of food allergy among diners. To protect consumers with the provision of allergy-safe meals, guidelines are provided to restaurants and cafes by Allergy New Zealand and New Zealand Food Safety Authority. Compliance to these guidelines is unknown. Government legislation provided in the Food Standards Code provides specific obligations to allergen labelling and controls. For example, restaurants are obliged to declare the presence of above mentioned eight foods either with the display of the food or to the purchaser upon request. Compliance with this legislation is a significant issue for the food industry including the food service and hospitality sectors (Crooks et al. 2008).

An adequate awareness and knowledge base is important for changing individual behaviour. Studies have shown that a significant amount of variance in behaviour is accounted for by knowledge alone. Enhancing awareness and knowledge subsequently contributes to behaviour modification (Rimal 2000). However translating awareness and knowledge to behaviour change remains a challenge. According to Bandura's social learning (or cognitive) theory, self-efficacy plays a key role in behaviour change (Strecher

et al. 1986; Rosenstock et al. 1988; Rimal 2000). Rimal (2000) reports that most health behaviours involve at least some degree of both knowledge and self-efficacy and that knowledge-behaviour link is strengthened by self-efficacy. Self-efficacy is one's belief in one's capability to successfully execute behaviour to produce the desired outcomes (Gist 1987; Rosenstock et al. 1988).

This study was undertaken to explore the food allergy awareness and knowledge among owners and managers of eating-houses and their self-efficacy to provide safe meals to food allergic consumers. The eating-houses were chosen from the Wellington City. The purpose of the study was to understand the gaps in protection for food allergic consumers in the eating-house setting.

CHAPTER 2: LITERATURE REVIEW

2.1 Food Allergy: Symptoms, Causes and Prevalence

Food allergy is an adverse reaction experienced by an individual following ingestion of a food and develops when oral tolerance fails to develop normally following the original exposure of the food allergen (Walls 1997; Sampson 2004). There are many kinds of food allergies and food hypersensitivity is often used interchangeably with food allergy. For purposes of this study, food allergy refers to reactions that involve the immune system and is an IgE mediated reaction that occurs following exposure to specific food proteins (Wang and Sampson 2011). In some individuals these reactions can progress to potentially life threatening anaphylactic reactions. Anaphylaxis is a severe, potentially fatal, systemic allergic reaction that occurs suddenly after contact with an allergy-causing substance (Sampson et al. 2006; Sampson 2008).

Food allergy symptoms most commonly begin with itching or tingling of the lips, palate, tongue, throat, swelling of lips or tongue, a sensation of tightness in the throat, dysphonia (difficulty in speaking) and a dry cough. In the gastrointestinal tract, it manifests as abdominal cramps, diarrhoea, nausea and vomiting. Degranulation of the mast cells in the skin can lead to angioedema (swelling), urticaria (hives) and eczema (skin rash). In the lungs it presents as rhinitis (runny nose), asthma and laryngeal edema (constriction of throat). In most severe cases symptoms can progress rapidly to potentially life threatening stages involving the cardiovascular system, leading to hypotension and shock. This is known as systematic anaphylaxis (Hefle 1996; Sampson 1997, 1999). Typically anaphylactic reactions are unpredictable, rapid in onset and may rapidly progress to death, making these difficult to manage (Pumphrey 2000; Sampson 2008). The severity of anaphylactic reactions can range from mild to severe.

According to Sampson (2008), food allergy is the leading cause of anaphylaxis treated in emergency departments in the USA and most frequently implicated foods for severe or fatal reactions are peanuts, tree nuts, fish and shellfish. Similar findings are reported in United Kingdom (Pumphrey and Stanworth 1996), France (Moneret-Vautrin D and Kanny G

1995), Italy (Novembre et al. 1998), Australia (Boros et al. 2000) and Canada (Simons F. Estelle R. 2004). Pumphrey (2000) investigated the circumstances leading to fatal anaphylaxis in the United Kingdom from 1992-1998. Of 164 fatalities on the register, 37 were food-induced. These were caused by peanut (10), walnut (5), other nuts (10), chickpea (1), seafood (3), milk (2), banana (1), nectarine (1) and 4 from uncertain sources. Nineteen of these occurred in restaurant/bar or take-away settings.

In 2007, Pumphrey (2007) reported 48 additional fatal allergic reactions to food in United Kingdom for the period 1999 to 2006. The food allergens implicated were similar to 2000 report with peanuts and nuts causing the highest number of fatalities. Fifteen of these incidents occurred at restaurants and takeout food establishments. The author concluded that improved education of food allergic individuals, their caregivers and food industry might help reduce the risk of fatal food allergic reactions.

A similar conclusion was reached by Bock et al. (2001) following their investigation of 32 fatalities due to anaphylactic reactions to foods in USA between 1994 and 1999. In their study the authors reported that peanuts and tree nuts accounted for more than 90% of the fatalities and 11 fatal reactions occurred at commercial food premises.

Six years later, Bock et al. (2007), reported further 31 fatalities due to anaphylactic reactions to food between 2001 and 2006. Again peanut was the leading food allergen with 17 deaths and 8 caused by tree nuts. Eight of these occurred in restaurants.

The most common causative agents of food allergy are crustacea and other shellfish and their products, egg and egg products, fish and fish products, milk and milk products, peanuts, soybeans and products of these, and tree nuts, sesame seed and product of these (Hefle 1996; Bousquest et al. 1998; Zarkadas et al. 1999; Sampson 2004). While legumes, poppy seeds and sulphite in concentrations of 10 mg/kg or more are listed by Codex Alimentarius Committee as major food allergens, these were rejected by the International Life Sciences Institute (ILSI) Europe Food Allergy Task Force in its scientific criteria for selection of allergenic foods for product labelling (Hefle 1996; Bousquest et al. 1998).

Internationally, self reported prevalence of food allergy ranges from 1.6% to 34.9% in adults and 0.6% to 25.8% in children. Objectively assessed food allergy using diagnostic tests such as clinical history, skin prick test, open food challenge or double-blind placebo-controlled food challenge; either by itself or in combination shows much lower prevalence that ranges from 2.4% to 3.2% for adults and 0.1% to 3.2% in children (Jansen et al. 1994; Hill et al. 1997; Sicherer et al. 1999; Dalal et al. 2002; Zuberbier et al. 2004; Pereira et al. 2005; Bakos et al. 2006; Venter C. et al. 2006; Venter C. et al. 2006a).

There is limited data on food allergy prevalence in New Zealand. The first of two studies aimed to report prevalence, type and reported symptoms of food tolerance in adult population of 15 countries using standardised methodology (Woods et al. 2001). Participants were from second phase of the European Community Respiratory Health Study, which had four questions relating to diet in the questionnaire. The key question that was used for analysis asked: 'Have you ever had an illness or trouble caused by eating a particular food or foods?' and if so, 'have you nearly always had the same illness or trouble after eating this type of food?' From 3334 respondents, 12.2% reported food allergy or intolerance. The rates were lowest in Spain (5%) and highest in Australia (19%) with New Zealand rating fifth (13%). About 87 foods were cited as cause of illness or trouble and whilst no particular food group stood out, ones that featured several times were fruits, dairy products, nuts and chocolate. It is important to note that the prevalence of 13% is self reported and is not supported by diagnostic tests such as skin prick or food challenge tests. The second study reported a prevalence of cow's milk allergy of 11% among children in New Zealand (Konstantynowicz et al. 2007) . However it is unclear how this figure has been derived or objectively assessed.

2.2 Food establishments

Food establishments are food premises where food is manufactured, prepared, packed, stored or handled for sale to public. In New Zealand food premises are regulated by two Acts: Food Act 1981 and Health Act 1956 and regulations pursuant these Acts: Food Hygiene Regulations 1974, Food (Safety) Regulations 2002 and Health (Registration of premises) Regulations 1966. Food Hygiene Regulations 1974 categorise food premises as bakehouses and cake kitchens (premises that sell bread, cakes, pastry and baker's

smallgoods), delicatessens (premises that sell cooked meat, cooked pastry containing meat, meat pies, meat pasties, meat savouries, cooked poultry, cooked fish, smoked fish, fish pasties, fish savouries) and eating-houses (food sold for consumption on the premises or more commonly known as cafes and restaurants). The New Zealand Food Safety Authority (now amalgamated with Ministry of Agriculture and Forestry) administers the overall food legislation which is implemented by Health Protection Officers based in local public health units and Environmental Health Officers based in territorial authorities who register and inspect food premises within their respective districts (New Zealand Food Safety Authority). Schedule 1 of Food Hygiene Regulations 1974 outlines the requirements for registration of food premises that are based around the construction of the premises such floor, walls, ceiling, lighting, ventilations, water supply, and wastewater disposal. It does not have any requirements around food allergy management in food premises.

In 1996, the Food Act 1981 was amended to provide an alternative registration process for food establishments. Food establishments could volunteer to develop food safety programmes, now referred as food control plans, based on the principles of Hazard Analysis Critical Control Point (HACCP) and good manufacturing practices. A food safety programme is designed to identify and control food safety risk factors at each point from production to sale of food in order to maintain food safety. It goes beyond the requirements of Schedule 1 of Food Hygiene Regulations 1974 and includes food allergy management. As the amendment was voluntary, this alternative process was mostly taken up by larger manufacturers and large chain restaurants such as McDonalds.

In 2003 the New Zealand Food Safety Authority began a review of domestic food production which is now known as the Domestic Food Review. The intent of the Domestic Food Review is to implement a more efficient, effective and risk-based food regulatory regime that will manage food safety and suitability. The project is now in an implementation phase and waiting for the new food bill to be enacted to allow the changes to the regulatory regime (New Zealand Food Safety Authority 2010). While waiting for the new food bill to become law, the New Zealand Food Safety Authority has initiated a voluntary implementation programme (VIP) which is available for food establishments to

uptake. This VIP promotion has included training for food establishment owners, managers and staff on HACCP principles and good manufacturing practices. It includes written guidelines on food allergy information, risks and management.

2.3 Food allergy in the food establishment setting

Food establishments (all types of food premises) are an important setting for food allergic consumers. With complex foods prepared containing numerous ingredients and limited control over the preparation process, this setting presents very high risk to food allergic consumers (Uguz et al. 2005; Ahuja and Sicherer 2007).

In addition to being aware of and complying with legal obligations, in order to provide safe meals for food allergic consumers, key personnel at the food establishments need to have a basic knowledge of food allergy. This includes common allergens, ways in which an allergen can become part of finished meal through cross-contamination during preparation, cooking and serving, knowing what ingredients are used in their recipes, and having a management plan that documents policies and procedures for all personnel to follow when serving a food allergic consumer as well as plan for handling a food allergy emergency. It is also very important for key personnel of food establishments to receive regular training in food allergy to keep their knowledge current. For example, lack of adequate controls previously have led to errors thus compromising the health of food allergic consumers.

A study of food-induced anaphylaxis in the USA found that 10 out of 32 (31%) fatalities occurred from meals consumed in food establishments between 1994 and 1999, and eight out of 31 (26%) between 2001 and 2006 (Bock et al. 2001, 2007). Similarly a study of fatalities in the United Kingdom between 1991 and 1998 identified about 51% of fatal reactions occurred from meals consumed in food establishments (Pumphrey 2000) and a further study between 1999 and 2006 attributed 31% of fatal reactions to this setting (Pumphrey 2007).

In New Zealand there is one reported fatality due to food-induced anaphylaxis. A 38-year old male who was aware of his allergies was attending a work function at an Auckland restaurant. He had given prior notification of his allergies to the restaurant and introduced

himself to the restaurant personnel on arrival. Despite taking all the precautions, the case collapsed following consumption of his entrée and later died in the hospital (Bowden 2008). The coroner found the cause of death to be hypoxic encephalopathy due to a severe allergic reaction (New Zealand Food Safety Authority June 2010). The offending allergen and how it got in the entrée was reportedly not identified by coroner's investigation. However it was suspected to be either a trace of allergen in one of the food ingredients or cross-contamination in the kitchen (Bowden 2008). The case highlighted the gap in knowledge of restaurant personnel about sources of food allergens and risks of cross-contamination.

The second documented New Zealand case of food allergic reaction was in a café and involved a child with diagnosed milk allergy (Ameratunga and Woon 2010). The child visited the café with her parents and chose a drink from the drinks display cabinet that appeared to be flavoured water. However this drink contained a high concentration of bovine whey proteins. The child had a reaction after consuming approximately 5ml of the drink and complained of throat discomfort, abdominal cramps and had vomiting. She was given anti-histamines and recovered over next few hours. While the drink was correctly labelled and declared milk protein in its ingredient list, because it looked like water, the parents relied on visual identification rather than reading the label. This highlights the importance of high vigilance and joint responsibility between food allergic consumers and the food industry.

There are only two studies that can be found that specifically investigated food allergies in a restaurant setting in the USA. The first one studied the features of allergic reactions to peanut and tree nuts in restaurant foods and foods purchased from other establishments such as ice-cream shops and bakeries (Furlong et al. 2001). In this study the authors used a structured questionnaire to telephone interview registrants from the Peanut and Tree Nut Allergy Registry who reported reactions associated with restaurants and other food establishments. Food establishments commonly cited were Asian restaurants (19%), ice-cream shops (14%) and bakeries and donut shops (13%). Desserts were most commonly implicated among meal courses. Of 106 registrants who were aware of their food allergy,

45% gave prior notification to the food establishment about their allergy. In 50% of the cases, the food allergen was hidden in sauces, dressings etc while 23% were caused by cross-contamination. The authors concluded that food establishments posed a number of risks for food allergic individuals especially from cross-contamination and hidden ingredients and that clear communication between the patron and establishment may prevent some these errors.

The second study looked at food allergy management from the perspective of restaurant and food establishment personnel and factors that affect provision of a safe meal for food allergic consumers (Ahuja and Sicherer 2007). The authors used a structured questionnaire to telephone interview 100 individuals (42 managers, 32 servers, 24 chefs and 2 others) in 100 selected food establishments in New York (48 restaurants, 18 fast-food and 34 take-out places). The questionnaire included items relating to demographic features of the respondents and the food establishments, perceived comfort with providing safe meals, likely action in the event of a reaction, food allergy knowledge and educational preferences. While a high percentage (~70%) of respondents were very or somewhat comfortable in providing and guaranteeing a safe meal, 24% indicated that consuming a small amount of allergen would be safe, 35% believed that deep frying would destroy allergens and 25% thought that removing an allergen from a finished meal would make a meal safe. Forty-seven percent were very or somewhat comfortable managing a food allergy emergency and 58% reported having a plan in place. Forty-two percent reported having received food allergy training in the past and 61% expressed an interest in further training. The deficits in food allergy knowledge of restaurant personnel in this study highlighted the need for more training.

Besides food allergens, latex allergy is emerging as a hazard for this setting with the wide use of latex gloves in food preparation. Several studies have reported cross-reaction between latex and food allergies. Most commonly foods reported to cause these cross-reactions are banana, avocado, kiwi fruit, chestnuts, and more recently potatoes, tomatoes, fish and shellfish (Beezhold D et al. 1996; Brehler R et al. 1997; Kim K and Hussain H 1999; Warshaw EM 2003). Warshaw (2003) postulated a “Latex-food allergy syndrome”

which is a term used to describe the cross-reaction between food and latex allergies where individuals allergic to food have an allergic reaction to latex and those allergic to latex have an allergic reaction to a food.

Schwartz (1995) documented two case studies that involved customers experiencing allergic reactions to latex after eating food prepared at fast food restaurants by food handlers wearing latex gloves. These cases demonstrate the transference of latex proteins from gloves to the wearer and to other individuals through cross-contamination with food. The first was of a 25-year-old man who suffered an allergic reaction after eating a ham sandwich prepared by a food handler wearing latex gloves. While the man reacted positively to tree, grass, ragweed pollens, house dust mite, several moulds and chicken with skin prick tests, he did not show positive reaction to any of the ingredients of the ham sandwich. Tests to latex were positive. Consumption of the same sandwich without the use of latex gloves did not cause any further reaction. The second was a 31-year-old woman who was diagnosed with latex allergy. She developed generalised urticaria following consumption of lunch in a fast food restaurant. The lunch contained chicken, mashed potatoes, corn bread, coleslaw, baked beans and iced tea with sugar. The woman had no history of reaction to any of these foods and the lunch was prepared by food handlers wearing latex gloves. Skin prick tests were positive for tree, grass, ragweed pollens and dust mite but negative for the ingredients in the lunch. Tests to latex were positive.

2.4 Legal requirements

Changes to labelling legislation to include food allergens began in late 1990s with the USA leading the way in introducing new requirements for food allergen labelling. Prior to the legislation review, studies highlighted a number of issues with allergen labelling such as case studies of cross-contamination by undeclared allergens, omissions and errors in ingredients panel, outer package labelling different from inner package labelling, ambiguous terminology, labels in foreign languages and lack of education of food allergic consumers about reading labels (Altschul et al. 2001; Joshi et al. 2002; Vierk et al. 2002; Wood 2002; Simons E. et al. 2005).

Between 2001 and June 2009, the New Zealand Food Safety Authority recorded 189 food recalls of which 70 (37%) were due to undeclared allergens. Following the introduction of mandatory declarations of allergens in December 2002 there was a marked increase in number of food recalls due to undeclared allergen in years 2003, 2004 and 2005 (New Zealand Food Safety Authority 2009). This increase was mostly due to manufacturers and consumers becoming aware of new labelling requirements and consequently identifying errors and omissions on product labels, ambiguity in labels (nondisclosure of sources of lecithin, soya vs. protein), and products labelled in foreign languages.

New Zealand and Australia were among the first to introduce new legislation; the Australia New Zealand Food Standards Code took effect on 20 December 2002. Standard 1.2.3 of the code sets out the mandatory declarations for food labelling that must be made for foods containing the following eight major food allergens:

- cereals containing gluten and their products (wheat, rye, barley, oats and spelt and their hybridised strains),
- crustaceans and their products,
- egg and egg products,
- fish and fish products,
- milk and milk products,
- peanuts and soybeans and their products,
- added sulphites in concentrations of 10 mg/kg or more, and
- tree nuts and sesame seeds and their products.

The standard requires these allergens to be declared when present as an ingredient, or an ingredient of a compound ingredient, or a food additive or component of a food additive, or a processing aid or component of a processing aid. For packaged foods, a declaration is required on the label of the food. Where the food is not required to bear a label; a declaration is required to be displayed with the food or declared to the purchaser upon request either verbally or in writing. These labelling requirements have been adopted from Codex Alimentarius Standards (Codex Alimentarius Commission 1985).

For food establishments such as eating-houses where food is made to order, a food label is not practical or warranted. Instead, the legislation requires that personnel at the establishment must be aware of Standard 1.2.3 and when requested be able to advise the consumer of any of the eight food allergens present in the food or indicate the presence of them in their menus. Under the Food Act 1981, the overall responsibility to sell safe food rests with the owner of the establishment.

Similar legislation is available in other countries. In the USA, the Food Allergen Labelling and Consumer Protection Act 2004 became effective on 1 January 2006. It outlined the eight major allergenic foods that require declaration on the food labels. These foods were milk, eggs, fish, crustacean shellfish, tree nuts, peanuts, wheat and soybeans. The food manufacturers are required to identify these allergens on food labels in plain English and identify the food source of the allergen e.g. type of tree nut (almonds, pecans, walnuts etc). Where the food is not required to bear a label; e.g. takeaways or food made to order, the consumer is advised to ask for ingredient and preparation information and the server is expected to provide this information verbally (USDA 2006).

Labelling issues prior to the introduction of legislation was not unique to USA. Similar issues had been identified across Europe (Gern et al. 1991; Mills et al. 2004) which led the European Union to amend its directive on allergen labelling in 2005. It required declaration of twelve food allergens on food labels regardless of the quantity present (Cornelisse-Vermaat et al. 2007). The twelve allergens were:

- cereals containing gluten (wheat, rye, barley, oats, spelt, kamut),
- crustaceans,
- egg,
- fish,
- peanuts,
- milk,
- nuts (almond, hazelnut, walnut, cashew, pecan, Brazil nut, pistachio, macadamia and Queensland nut),
- soy,

- sesame,
- celery,
- mustard and
- sulphur dioxide and sulphites .

However a study conducted post implementation of the new legislation was undertaken to assess satisfaction with new requirements among food allergic individuals. It found many problems linked to the readability of the label (e.g. font size, contrast), not all labels contained relevant allergy information, many participants found the ingredients list insufficient for their needs and there were frustrations with frequent changes to product recipes (Cornelisse-Vermaat et al. 2007).

Similar to the European Union, Canada's labelling legislation requires declaration of ten priority food allergens in the ingredients list of food labels regardless of quantity present (Health Canada 2008). These include:

- nuts (almonds, Brazil nuts, cashews, hazelnuts, macadamia nuts, pecans, pine nuts, pistachios or walnuts),
- peanuts,
- sesame seeds,
- cereals containing gluten (wheat, kamut, spelt or triticale),
- eggs,
- milk,
- soybeans,
- crustaceans,
- shellfish,
- fish and
- added sulphites .

Following introduction of the Food Allergy Labelling and Consumer Protection Act in the USA , Pieretti et al. (2009) undertook an audit of food product labels from supermarkets to assess compliance with new legislation and identify labelling ambiguities. A total of 500

products from 99 different supermarkets representing 45 parent chains were audited. Problems identified were the exclusion of molluscs from labels, the use of non-specific terms such as 'natural flavours' and 'spices', the type of flour not identified and the type of tree nut not identified. The study found that although the general compliance with the legislation was high, discrepancies and ambiguities identified posed potential risks and challenges for food allergic individuals. Such discrepancies can frustrate food allergic individuals which may lead to unwarranted diet restrictions. It has been suggested by Wood (2002) that education of food allergic individuals is the key. The legislation changes cost money and are therefore unlikely to be totally embraced by the average food manufacturer until the regulators implement a more formal system that makes labelling clearer and more straightforward.

In addition to pre-packaged food, the food allergy labelling legislation is required to address foods not required to bear a food label. In settings such as food establishments the food allergic individual has to rely on the correct ingredient and preparation information being provided. This presents far greater risks for errors because the onus is upon the consumer to find out about the presence of food allergens (Wood 2002; Mills et al. 2004).

2.5 Knowledge and behaviour change

In order for food establishments to serve safe food to food allergic consumers, the key personnel at the establishment must have adequate food allergy knowledge. Knowledge is an essential component for any behaviour change (Sharma and Romas 2008). However translating knowledge to behaviour modification remains a challenge as behaviour is affected by other variables such as beliefs, attitudes and values (Rimal 2000; Sharma and Romas 2008). A number of theories and models explain behaviour psychology. These include the Health Belief Model (Rosenstock et al. 1988), the Theory of Planned Behaviour (Ajzen 2005) and the Social Cognitive Theory (Rosenstock et al. 1988).

The Health Belief Model hypothesises that health related behaviour change depends on simultaneous occurrences of (a) perceived threat; (b) perceived benefits of particular action in reducing the perceived threat; and (c) value of reduction of perceived threat (Rosenstock et al. 1988). While the Health Belief Model is useful for planning programmes it is not

ideal for long-term behaviour change because the model lacks predictive power as it does not consider factors other than health beliefs. Cultural factors, socioeconomic status and previous experiences also shape health behaviours (Sharma and Romas 2008).

Bandura's social learning theory (also known as social cognitive theory) emphasises that behaviour is determined by expectancies and incentives. For example individuals who value and understand the outcome of their behaviour such as consequences of serving peanut to a peanut allergic patron, will attempt to change if they believe that (a) their current behaviour poses a threat; (b) that a particular behaviour change will reduce that threat; and (c) that they are personally capable of adopting new behaviours (self-efficacy). Incentive or reinforcement is defined as the value of a particular object or outcome which may be economic gain, legal compliance or other consequences (Strecher et al. 1986; Rosenstock et al. 1988).

Self-efficacy is one's belief in one's capability to successfully execute behaviour to produce the desired outcomes (Gist 1987; Rosenstock et al. 1988). Studies have shown that a high level of self-efficacy is required to initiate and maintain behaviour change (Strecher et al. 1986; Gist 1987; Rosenstock et al. 1988; Kelly et al. 1991; Rimal 2000; Zimmerman 2000).

Self-efficacy plays an important role in the knowledge-behaviour link. Whilst knowledge is important for behaviour modification, the knowledge-behaviour link is greater for those individuals with high level of self-efficacy compared to those whose self-efficacy is low (Rimal 2000). High self-efficacy will facilitate the knowledge-behaviour link while a high knowledge and low self-efficacy may be a poor predictor of behaviour change.

Self-efficacy is also one of the determinants of Ajzen and Fishbein's Theory of Planned Behaviour which is based on the premise that behaviour is guided by intention (Holloway and Watson 2002; Ajzen 2005). The other two determinants are attitude towards the behaviour and social pressure to perform the behaviour. The Theory of Planned Behaviour

has been widely used in health education to predict behaviour intention and behaviour but is limited by lack of specific guidance for behaviour change (Sharma and Romas 2008).

For food establishments to provide safe meals to food allergic consumers, changes to behaviour of key personnel are necessary. Possessing adequate food allergy knowledge will play an important role in facilitating this change.

2.6 Food allergy training

One way in which knowledge can be enhanced is through training. Currently food allergy training for food establishment personnel is voluntary and depends on the initiative of the food establishment owners and managers. Attempts have been made in almost every country by regulatory authorities and food allergy associations/ organisations to work collaboratively in developing appropriate training resources for this setting.

The Food Allergy and Anaphylaxis Network (FAAN), a USA based food allergy association is most probably the largest non-profit organisation that aims to raise awareness, to provide advocacy and education, and to advance research on behalf of food allergic consumers. It has produced a number of training resources and sessions for food allergy consumers, schools, regulatory authorities, health professionals, restaurants and policy makers (The Food Allergy & Anaphylaxis Network 2009). In New Zealand, Allergy New Zealand works with New Zealand Food Safety Authority and the food industry to provide similar support (Allergy New Zealand 2006).

The common themes identified in all training resources are for food establishments to have (Allergy New Zealand 2006; The Food Allergy & Anaphylaxis Network 2008):

- written plans and formal training programmes around awareness of common food allergens,
- general knowledge about food allergies (source, storage, handling, preparation and serving of food that contain food allergens),
- knowledge about symptoms of food allergic reactions,
- knowledge about dealing with food allergic reactions and

- knowledge about the importance of partnership between food allergic consumers and food establishment personnel to successfully manage food allergies in food establishments.

In 2007 the New South Wales Food Authority in Australia developed a training program and resources for the food service sector and piloted the training with a group of businesses within two council areas (New South Wales Food Authority 2008). The success of the training was measured by a pre and post training survey involving 27 businesses with managers and owners as main participants. A similar study was conducted by the Department of Health Victoria in Australia with food premises in Melbourne and Ballarat in 2009 (Department of Health Victoria 2010). Both studies found that formal training and distribution of information materials achieved marginal improvements in the knowledge of respondents. However the intensive face-to-face training undertaken in the Victoria study was found to be more useful.

Published studies about food allergy in the food establishment setting are limited. Cases reported in the USA along with two documented cases of food allergic reactions in New Zealand highlight gaps in food allergy knowledge of food establishment personnel and the importance of clear communication between the food allergic consumer and the restaurant personnel. This study is the first of its kind in New Zealand.

2.7 Aims and Objectives

The aim of this study was to explore the awareness and knowledge related to food allergy among owners and managers of registered eating-houses in Wellington City. The objectives were to explore:

1. The level of awareness among owners and managers of eating-houses about mandatory declaration of food allergens
2. The level of knowledge about the source, content of ingredients, storage, handling, preparation and serving of food that contain food allergens
3. The level of self-efficacy to provide a safe meal to an allergy prone customer

4. The level of self-efficacy for handling an allergy emergency
5. Occurrence of allergic reactions in eating-houses in the past two years
6. Use of latex gloves and knowledge related to skin allergy
7. Whether a training programme was in place for management and staff as well as for future training needs

CHAPTER 3: METHODS

3.1 Study Design

This was a cross sectional study designed to investigate food allergy awareness and knowledge amongst owners and managers of eating-houses in Wellington city. The study was conducted between September and November of 2008. The study was modelled on an investigation of food allergy management in 100 New York restaurants which aimed to identify factors affecting restaurants' ability to provide allergen-safe meals (Ahuja and Sicherer 2007). The New York sample included a broad range of food establishments including restaurants, fast food outlets, ice-cream parlours, takeaways and ethnic food providers. A structured questionnaire was used to interview restaurant personnel, which included managers, servers, chefs and others.

For this study food allergy awareness and knowledge amongst owners and managers of eating-houses was determined by a self-administered questionnaire.

For the purpose of this study, "eating-house" met the general dictionary definition of a restaurant where consumers pay and sit on the premises to eat the food prepared on the premises. A list of registered eating-houses was obtained from the Wellington City Council.

3.2 Interviewers

Environmental Health Officers for the Wellington region, employed by the Wellington City Council, were recruited as interviewers. They have an intimate knowledge of food safety legislation and are often the first investigators of food allergy incidences in food premises. Their role is to register and inspect food premises in their region and to educate the operators to ensure compliance with health and food safety legislation. During their daily work the Officers form a professional relationship with the owners and managers of food premises. They were therefore uniquely qualified to explain the significance of the study to participants. The researcher met with the Environmental Health Officers to explain the purpose of the study and training was provided for the interview administration. The

interviewer provided the questionnaire to the participant and was available to oversee its completion.

3.3 Sample

The sample recruited for this study was managers and owners of eating-houses. There were 480 eating-houses registered with the Wellington City Council as at 11 August 2008. The eating-houses included cafes, restaurants and delicatessens that seated ten people or more.

The sample size was calculated from OpenEpi, statistical software for public health practitioners and researchers created by Centres for Disease Control and Prevention (CDC) (Dean et al. 2008). At 97% confidence level the sample size calculated by the software was 126. With anticipation of a response rate of approximately 80%, a sample size of 163 was determined.

A database was used to organise the names of eating-houses in an alphabetical and then numerical order. The same software (Dean et al. 2008) was used to generate 163 random numbers between one and 480. The random numbers were used to select the sample of 163 eating-houses from the list of 480.

3.4 The questionnaire

A structured questionnaire was designed to evaluate the food allergy awareness and knowledge amongst owners and managers of the eating-houses (Appendix 1). The items were adapted from the questionnaire designed by Ahuja and Sicherer (2007) upon which this study was modelled (Appendix 2). The following changes were made:

1. The questions were arranged in a different order to improve flow and engagement from participants.
2. Additional questions were included to elicit information about awareness around legal requirements to declare food allergens, key components of a food allergen management plan, the use of latex gloves and its relation to food and skin allergies, identification of key areas of training and more detailed demographic information.

3. The responses for statements were changed from 'true/false' to 'agree, disagree, and don't know'. The 5-point Likert scale was changed to 'very confident, confident, don't know, less confident and not at all confident'.

The questionnaire contained three parts with a total of 48 questions.

Part A: Consent

Section one (preface) had three questions for the interviewer to complete. These related to confirming that the participant was provided with the information sheet, obtaining consent for participation, determining the response rate and whether non-participation was due to language being a barrier. Confidentiality was upheld. The questionnaire did not contain the name or any other information that would identify the eating-house. The exception was where the participant requested a copy of the summarised results of the study and therefore provided a mailing address.

Part B: Knowledge and awareness of food allergy

Section two (main questionnaire) consisted of 32 items relating to:

- Awareness about declaration of food allergens (3)
- Knowledge about preparation and serving of food that contain food allergens (11)
- Knowledge about content of ingredients and recipes used (1)
- Type and content of management plans in place (4)
- Occurrence of allergic reactions in eating-houses (4)
- The use of latex gloves in eating-houses (1)
- Knowledge of food and skin allergy issues associated with use of latex gloves (2)
- Training on food allergies (4), and
- Self-efficacy in providing a safe meal and taking action in event of a reaction rated on a five-point Likert scale of 'very confident, confident, don't know, less confident and not at all confident' (2).

Part C: Eating-house Characteristics

Section three was comprised of 13 questions that related to participant characteristics. These identified the type of eating-house, the position of the person completing the questionnaire, the size of the eating-house, if the eating-house was a member of any industry associations, experience of the interviewee in the food service sector and eating-house, if the eating-house was part of the New Zealand Food Safety Authority Food Control Plan Voluntary Implementation Programme and if the interviewee would like a copy of summarised results of the study. The participant was prompted for any general comments they would like to add.

3.5 Questionnaire pilot

The questionnaire was reviewed in several stages of development to reduce ambiguity, improve the flow of questions and to ensure that questions were specific. The interviewers checked that the questions were clear, easy to understand and practical for the respondents to answer.

A pilot interview was then undertaken among six eating-house owners to ensure that aims and objectives of the study were being met and that the questions were understood and adequately interpreted. From the pilot, the following were determined:

1. The need to change the data collection method from interviewer-administered to interviewer-supervised self-administered. This approach meant that the interviewers introduced the questionnaire to participants and participants completed the questionnaire themselves, with the interviewer in attendance to answer any queries. Both the interviewers and participants found this method to be more time efficient and user-friendly.
2. The required time estimated to complete the questionnaire was established to be approximately 30 minutes.
3. A need to rearrange the questions to improve the flow of questions. Eight of the questions were re-written to improve comprehension and to remove unnecessary jargon.

3.6 Data collection

The list of 163 eating-houses was divided among seven interviewers. Each interviewer visited the eating-houses on their list and approached the owner or the manager for participation in the study. An information sheet was given to all the eating-house participants prior to administration of the questionnaire. Participants could then make an informed decision about whether or not they were prepared to participate in the study. If the participant did not wish to participate, this was noted by the interviewer and the next eating-house on their list was approached. If the participant agreed to participate, the questionnaire was completed with the interviewer present. Once completed, the questionnaire was collated by the interviewer. If the owner or the manager of the eating-house was unavailable during the first visit, the interviewer made further three visits before omitting the eating-house from their list. Completed questionnaires were collected and checked for completeness by the researcher.

3.7 Ethics

Ethical approval for this study was obtained from the Massey University Research Ethics Committee. The participation in this study was voluntary. The interviewers (Environmental Health Officers) personally approached the owner or manager of the eating-house to invite them to take part. Potential participants were fully informed of the research requirements. They were given an information sheet detailing the background and aim of the study, ethical considerations, name and contact details of the researcher and supervisor and details about the study sponsor (Appendix 3). Participants provided consent at the beginning of the interview.

3.8 Data analysis

The data from the questionnaire was entered into a database using EpiData entry software (Lauritsen 2000-2008). EpiData is a free software programme designed to support the work of public health research and investigation of outbreaks. It was created in 1999 by the EpiData Association based in Denmark. EpiData is widely used internationally by organisations such as the World Health Organisation and in New Zealand by Public Health Units to support outbreak investigations and research.

Data from each questionnaire was entered into the database and saved as numerical records. Upon completion 16 random questionnaires were used for data entry quality check. No systematic issues were identified.

Data was exported to Epi Info™ Analysis software for analysis (Centers for Disease Control and Prevention 2008). Similar to EpiData, Epi Info™ is a free software programme for public health research and investigation and can be downloaded from web.

Categorical variables were analysed using simple frequency distributions. Yates corrected chi-squared (X^2) tests were used to assess relationship between following variables:

- Different types of the eating-houses
- Eating-houses that specialised in ethnic food to those that did not
- Position of the interviewee
- Different sizes of the eating-houses
- Eating-houses that were members of an industry association compared to those that were not
- Number of years the participants had worked in the eating-house and in the food service sector
- Participants who had received past training compared to those who did not
- Eating-houses that participated in the Voluntary Implementation Programme compared to those that did not.

Fisher exact test was used when the overall total of the table was less than 20, or when it was between 20 and 40 and smallest of the four values was less than five. Statistical significance was determined at levels where $P < 0.05$ (Kirkwood 1999).

In order to compare the overall knowledge level of eating-houses with other variables, each eating-house was scored on 11 knowledge related questions with score of one for correct answer and zero for those that answered 'don't know' or answered incorrectly. The sum of the 11 questions was used as the overall knowledge score for each eating-house (range 0-11). The total score was then compared with following variables using t test:

- Different types of eating-houses
- Eating-houses that specialised in ethnic food to those that did not
- Position of the interviewee
- Different size of the eating-houses
- Number of years the participants had worked in the food service sector
- Self-efficacy of the participants for providing a safe meal
- The participants' training history.

CHAPTER 4: RESULTS

4.1 Characteristics of the eating-houses

Of 163 eating-houses approached, 124 owners and managers participated in the study giving a participation rate of 76%. Of 39 that refused to participate, 16 (41%) declined because the owners and managers were unable to read and complete the questionnaire due to their inability to understand English. The other 23 declined due to reasons of time constraints. Three of the selected eating-houses were closed for business. These were replaced by alternative eating-houses from the main list.

The characteristics of the eating-houses are provided in (Table 1). The 124 eating-houses comprised of 47 cafes, 72 restaurants, and five that referred themselves by other names. Forty-four classified their eating-houses as ethnic. More restaurants specialised in ethnic food than cafes ($X^2=7.1$, $p<0.05$). Of 124 participants, 60 were managers and 64 were owners of eating-houses. The size of the eating-houses was measured by number of people the eating-house could seat which ranged from 10 to more than 100. Sixty-two participants (50%) were from 20-60 seat range, 36 (30%) from 60-100 seat range, six (5%) from 10-20 seat range and 20 (16%) were from eating-houses that could seat more than 100 people. The larger eating-houses were mostly restaurants while smaller ones were cafes ($X^2=9.4$, $p<0.05$). There was a good range of experience between owners and managers with 18 (15%) having worked at the eating-house for less than one year, 35 (28%) between 1-3 years, 27 (22%) between 3-5 years, 24 (19%) between 5-10 years and 20 (16%) been at the eating-house for more than 10 years. Experience in the food service sector was high among the participants with 69 (56%) having worked in the sector for more than 10 years and 34 (27%) between 5-10 years. Fifty-two eating-houses (42%) were members of an industry association of which 22 were with the Restaurant Association of New Zealand and 29 with the Hospitality Association of New Zealand. Eating-houses that specialised in ethnic food had lower membership level to an industry association compared to eating-houses that did not specialise ($X^2=4.1$, $p<0.05$). Twenty-two eating-houses were trialling the New Zealand Food Safety Authority Voluntary Implementation Programme. Eating-houses that were

members of an industry association had higher participation rate in the New Zealand Food Safety Authority Voluntary Implementation Programme ($X^2=4.3$, $p<0.05$).

There were two main types of ethnic eating-houses; European and Chinese (Table 2).

4.2 Awareness about declaration of food allergens

Of 124 respondents, 50 (40%) correctly identified that there were legal requirements to declare food allergens in New Zealand, 15 (12%) indicated there were no requirements and 59 (48%) didn't know (Table 3). Of 50 respondents who were aware of legal requirements, eight correctly identified that these requirements were set out in the Food Standards Code. Fifteen respondents indicated that these requirements were set out in the Food Act, 12 in the Food Safety Regulations and eight in the Food Hygiene Regulations. Seven respondents knew there were legal requirements but didn't know where these were set out.

Eleven respondents (9%) correctly identified all food allergens that require mandatory declaration under the food labelling legislation. Table 4 shows respondents' knowledge of food allergens that require mandatory declaration under the Food Standards Code. While common allergens such as gluten, tree nuts, peanuts, seafood, dairy and egg were identified by most respondents, less common allergens such as sulphites, soya bean and sesame seed were identified by less than 50% of the respondents. Other foods that were incorrectly identified as major food allergens requiring declaration were strawberry (15), tomatoes (15), kiwifruit (11), pineapple (9) and carrot (8). Eating-houses that specialised in ethnic food were more likely to declare tomatoes ($X^2=5.8$, $p<0.05$), carrot ($X^2=4.1$, $p<0.05$) and pineapple ($X^2=2.8$, $p=0.05$) as allergens required to be declared under the legislation. The declaration for sulphite ($X^2=5.9$, $p<0.05$) and dairy ($X^2=2.9$, $p<0.05$) were higher among eating-houses that did not specialise in ethnic food. The declaration for gluten was higher in eating-houses that were members of an industry association ($X^2=2.9$, $p<0.05$). Three respondents thought there were no major food allergens that required declaration and eight didn't know. More managers declared gluten as major allergen than owners ($X^2=3.1$, $p<0.05$). More owners didn't know which allergens required declaration when compared to managers ($X^2=3.0$, $p<0.05$).

Table 1 Demographic features of 124 eating-houses

| | n | % |
|---|-----|------|
| Type of eating-houses | | |
| Café | 47 | 37.9 |
| Restaurant | 72 | 58.1 |
| Other | | |
| Bistro/Bar | 1 | 0.8 |
| Caterer | 1 | 0.8 |
| Convention centre | 1 | 0.8 |
| Private function centre | 1 | 0.8 |
| Takeaway | 1 | 0.8 |
| Total | 124 | 100 |
| Specialise in ethnic food (No.) | 44 | 35.5 |
| Position of interviewee (No.) | | |
| Manager | 60 | 48.4 |
| Owner | 64 | 51.6 |
| Size of food establishment (No. of people can seat) | | |
| 10-20 | 6 | 4.8 |
| 20-60 | 62 | 50.0 |
| 60-100 | 36 | 29.0 |
| >100 | 20 | 16.1 |
| Experience of respondents | | |
| Years worked in food establishment (No.) | | |
| <1 year | 18 | 14.5 |
| 1-3 years | 35 | 28.2 |
| 3-5 years | 27 | 21.8 |
| 5-10 years | 24 | 19.4 |
| >10 years | 20 | 16.1 |
| Years worked in food service sector (No.) | | |
| <1 year | 2 | 1.6 |
| 1-3 years | 9 | 7.3 |
| 3-5 years | 10 | 8.1 |
| 5-10 years | 34 | 27.4 |
| >10 years | 69 | 55.6 |
| Food establishment member of industry association (No.) | | |
| Restaurant Association New Zealand | 22 | 17.7 |
| Hospitality Association New Zealand | 29 | 23.4 |
| Other | 1 | 0.8 |
| Part of Voluntary Implementation Programme (No.) | 22 | 17.7 |

Table 2 Types of ethnic eating-houses

| Type | n |
|-----------------------|----|
| European | 10 |
| Chinese | 9 |
| Malaysian | 5 |
| Italian | 4 |
| Japanese | 3 |
| Thai | 3 |
| Indian | 2 |
| Korean | 2 |
| Middle Eastern | 1 |
| Mexican | 1 |
| Cambodian | 1 |
| Caribbean | 1 |
| South Western America | 1 |
| Vietnamese | 1 |
| Total | 44 |

Table 3 Awareness of legal requirements to declare food allergens

| | n | % |
|--|----|------|
| Legal requirements to declare food allergens | | |
| Food Act | 15 | 12.1 |
| Food Safety Regulations | 12 | 9.7 |
| Food Hygiene Regulations | 8 | 6.5 |
| Food Standards Code | 8 | 6.5 |
| Don't know where requirements are set out | 7 | 5.5 |
| Total | 50 | 40.3 |
| No legal requirements | 15 | 12.1 |
| Don't know if there are legal requirements | 59 | 47.6 |

Table 4 Foods identified by respondents to be declared under the food labelling legislation

| Foods | n | % | Ethnic eating-houses compared to General ones (p value) |
|-------------|-----|------|---|
| Peanut | 102 | 82.3 | 0.07 |
| Dairy | 94 | 75.8 | 0.03 |
| Egg | 94 | 75.8 | 0.28 |
| Gluten | 89 | 71.8 | 0.40 |
| Tree nuts | 79 | 63.7 | 0.34 |
| Seafood | 73 | 58.9 | 0.34 |
| Soya bean | 50 | 40.3 | 0.32 |
| Sesame seed | 48 | 38.7 | 0.35 |
| Sulphite | 38 | 30.6 | 0.004 |
| Strawberry | 15 | 12.1 | 0.07 |
| Tomatoes | 15 | 12.1 | 0.005 |
| Kiwi fruit | 11 | 8.9 | 0.34 |
| Pineapple | 9 | 7.3 | 0.05 |
| Carrot | 8 | 6.5 | 0.02 |
| Don't know | 8 | 6.5 | 0.10 |
| None | 3 | 2.4 | 0.26 |

(Shaded rows represent food allergens that require mandatory declaration)

4.3 Knowledge about preparation, serving and cross-contamination of food allergens

Sixteen respondents (13%) correctly answered all 11 questions related to knowledge about preparation, serving and cross-contamination of food allergens and 16 (13%) had scores of five and lower. The mean and median score was eight with scores ranging from three to 11 (Table 5). About 44% of the respondents had scores higher than the mean value.

While 107 respondents (86%) correctly agreed that small amounts of allergens was unsafe for food allergic individuals, about 25 respondents (20%) incorrectly indicated that if an individual was having an allergic reaction, it was appropriate to serve them water to dilute the allergen and reduce the reaction. A similar proportion incorrectly indicated that removing an allergen from a finished meal may render a meal safe for a food allergic consumer. Although 112 respondents (90%) correctly identified cross-contamination during serving as one of the ways food allergens could become part of finished meal, 17 (14%) did not recognise that risk with a buffet counter. Sixty-seven respondents (54%)

incorrectly thought that food allergens could become part of finished meal through an ill food handler and 47 (38%) through under-cooking of food.

Table 5 Agreements to food allergy knowledge items

| Question | Agree n (%) | Disagree n (%) | Don't know n (%) |
|--|----------------|-------------------|---------------------|
| 1. Individuals with food allergies can safely consume the foods that cause the allergies if only a small amount is consumed | 9 (7.3) | 107 (86.3) | 8 (6.5) |
| 2. High heat (e.g. deep frying) can destroy most food allergens | 6 (4.8) | 109 (87.9) | 9 (7.3) |
| 3. If an individual is having an allergic reaction, it is appropriate to serve them water to dilute the allergen and reduce the reaction | 25 (20.2) | 52 (41.9) | 47 (37.9) |
| 4. A buffet counter is a safe choice for a food allergic patron as food are kept in separate containers and therefore there is no risk of cross-contamination of allergens to different containers | 17 (13.7) | 93 (75.0) | 14 (11.3) |
| 5. Removing an allergen from a finished meal (e.g. taking off nuts) may be required to provide a safe meal for a food allergic patron | 22 (17.7) | 97 (78.2) | 5 (4.0) |
| Some of the ways in which food allergens can become part of finished meal | | | |
| 6. Accidental or unknown presence in ingredients | 104 (83.9) | 9 (7.3) | 11 (8.9) |
| 7. Transmission through an ill food handler | 67 (54.0) | 44 (35.5) | 13 (10.5) |
| 8. Insufficient or ineffective cleaning | 103 (83.1) | 15 (12.1) | 6 (4.8) |
| 9. Under-cooking of the food | 47 (37.9) | 70 (56.5) | 7 (5.6) |
| 10. Cross-contamination during preparation | 116 (93.5) | 4 (3.2) | 4 (3.2) |
| 11. Cross-contamination during serving | 112 (90.3) | 6 (4.8) | 6 (4.8) |

(Shaded cells represent the correct answer)

There was no significant relationships between knowledge related items and type of eating-house, owners and managers, size of eating-house, whether eating-house was a member of an industry association, number of staff employed, experience of owners and managers at the eating-house or in the sector and eating-house being part of New Zealand Food Safety Authority Voluntary Implementation Programme. However eating-houses that specialised in ethnic food were more likely to answer two knowledge questions incorrectly (Table 6).

Table 6 Comparison of knowledge questions between eating-houses that specialise compared to eating-houses not specialising in ethnic food

| Question | Ethnic eating-houses (% Answered correctly) | Non ethnic eating-houses (% Answered correctly) | P value |
|---|--|---|---------|
| If an individual is having an allergic reaction, it is appropriate to serve them water to dilute the allergen and reduce the reaction | 36.5 | 63.5 | 0.02 |
| Food allergens can become part of finished meal through under-cooking of the food | 25.7 | 74.3 | 0.02 |

While majority of cafes, restaurants and other eating-houses had knowledge scores higher than the mean score of eight; more restaurants had scored below the mean (Figure 1). The distribution of knowledge scores was similar for eating-houses that specialised in ethnic food and those that didn't but more eating-houses that specialised in ethnic food had the lowest knowledge score of three (Figure 2).

Figure 1 Knowledge score by Type of eating-house

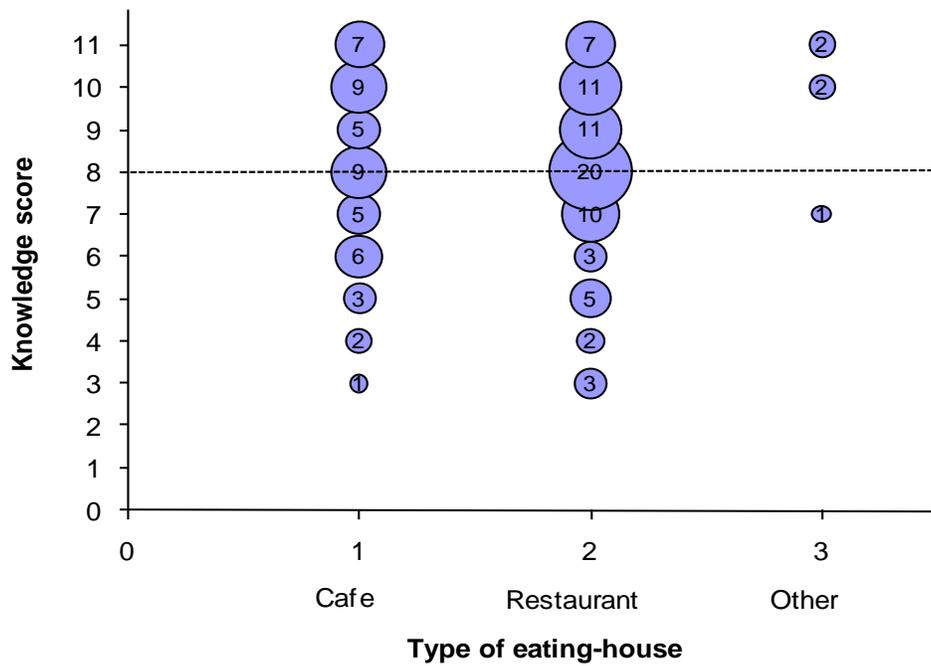
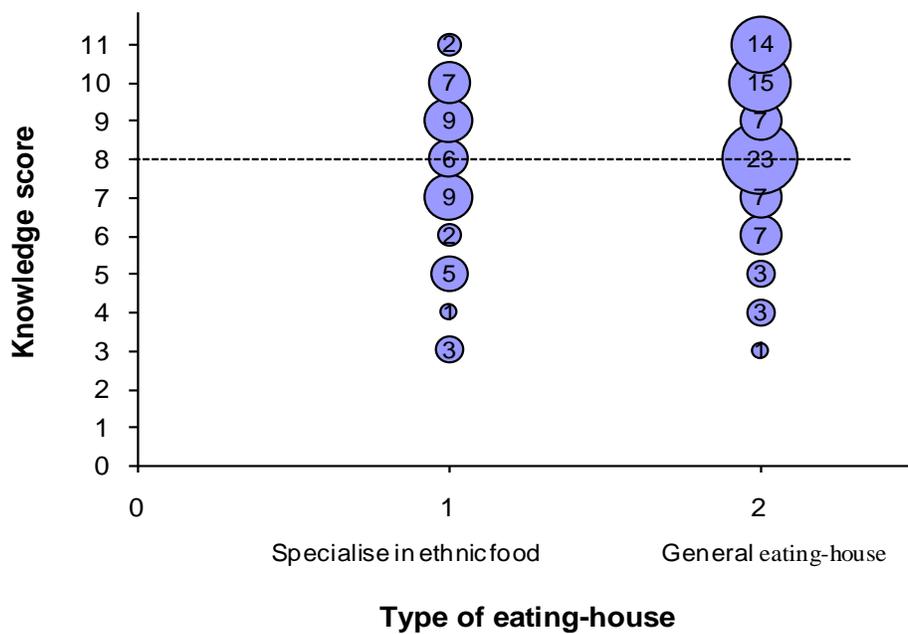
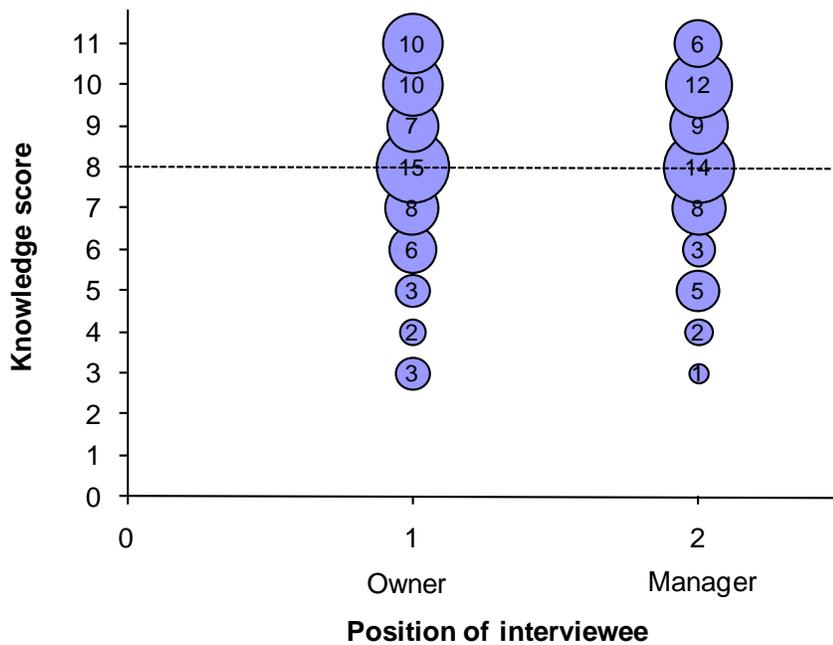


Figure 2 Knowledge score by eating-houses that specialise in ethnic food and those that are general



No major difference was observed for distribution of knowledge scores between owners and managers although more owners had the lowest score of three (Figure 3).

Figure 3 Knowledge scores of interviewees



Knowledge scores were evenly distributed across different size of eating-houses. However, eating-houses that could seat 20-60 and 60-100 people had the lowest knowledge scores (Figure 4). The four respondents who had the lowest score of three had more than three years of food service sector experience; one of which had worked in the sector for more than 10 years (Figure 5).

Figure 4 Knowledge score by size of eating-house

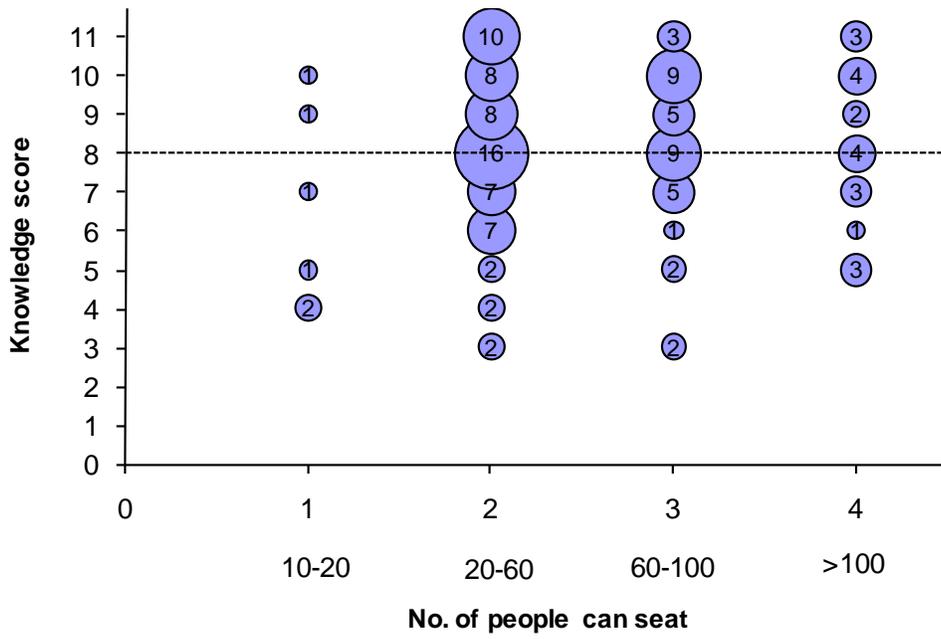
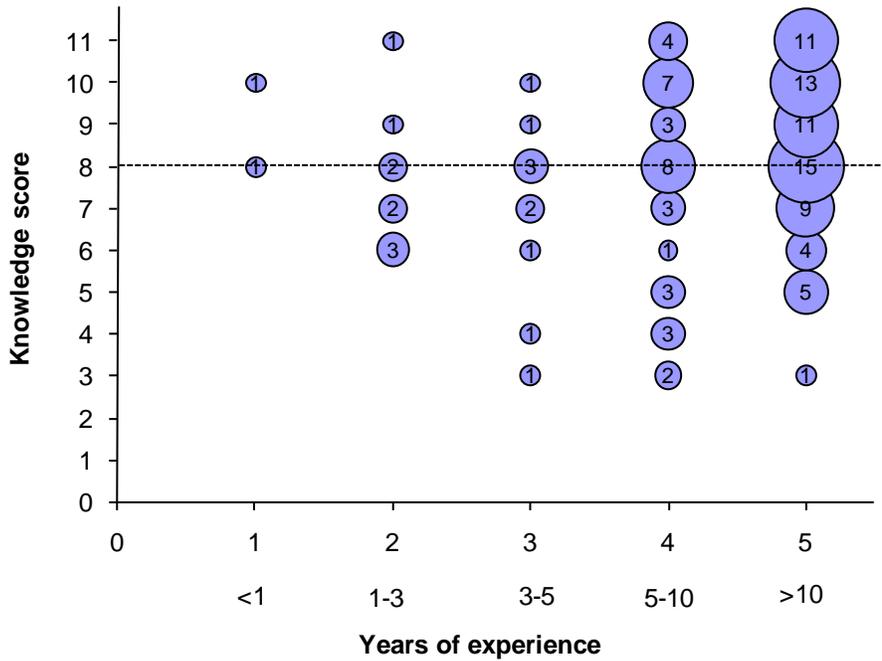


Figure 5 Knowledge score by number of years of experience in food service sector



4.4 Self-efficacy to provide a safe meal

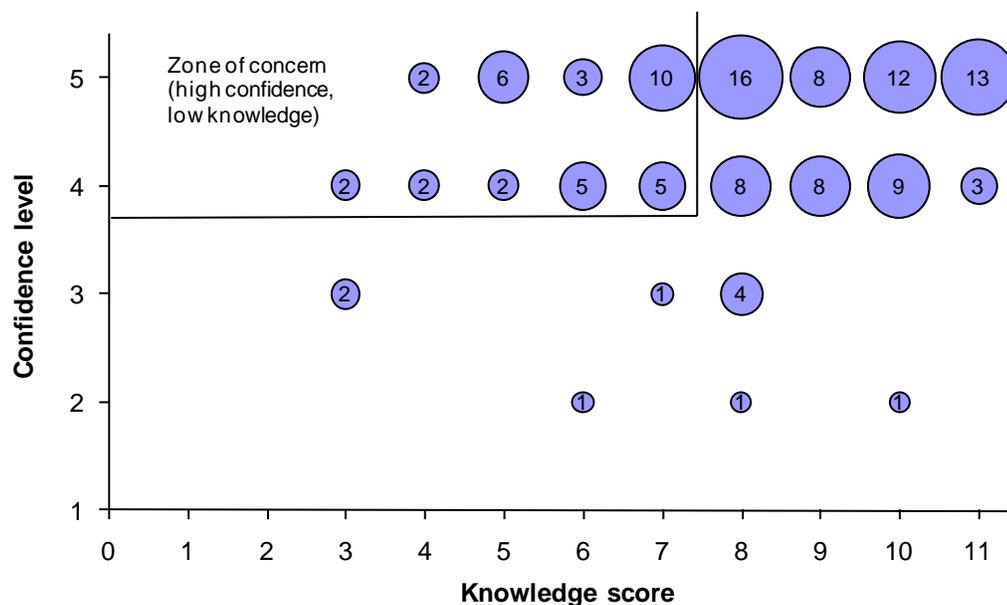
Seventy respondents (57%) were very confident and 44 (36%) were confident in providing a safe meal if a patron advised them of their food allergies (Table 7). The self-efficacy to provide a safe meal did not correlate with knowledge score of eating-houses (Figure 6). One third of the eating-houses that had knowledge score of below the mean value were either very confident or confident to provide a safe meal (Figure 6).

Table 7 Self-efficacy of respondents for providing a safe meal

| | Very confident n (%) | Confident n (%) | Don't know n (%) | Less confident n (%) | Not at all confident n (%) |
|---------------------------------------|-------------------------|--------------------|---------------------|-------------------------|-------------------------------|
| Self-efficacy for providing safe meal | 70 (56.5) | 44 (35.5) | 7 (5.6) | 3 (2.4) | 0 |

Figure 6 Self-efficacy ratings compared with knowledge score

(1=Not at all confident, 2= Less confident, 3=Don't know, 4= Confident and 5=Very confident)



4.5 Knowledge and self-efficacy for managing an allergy emergency

Twenty-five respondents (20%) were very confident and 54 (44%) confident in managing an allergy emergency (Table 8).

Table 8 Self-efficacy of respondents for handling severe allergic reaction

| | Very confident n (%) | Confident n (%) | Don't know n (%) | Less confident n (%) | Not at all confident n (%) |
|---|-------------------------|--------------------|---------------------|-------------------------|-------------------------------|
| Self-efficacy for handling a severe allergic reaction | 25 (20.2) | 54 (43.5) | 26 (21.0) | 15 (12.1) | 4 (3.2) |

Seven respondents (6%) had written food allergen management plan in place and 31 (25%) had a plan in place for managing a food allergy emergency (Table 9). More restaurants had plan for managing a food allergy emergency ($X^2=3.9$, $p<0.05$) compared to cafes. Eating-houses where the respondents had past training were more likely to have in place a written food allergen management plan ($X^2=2.9$, $p=0.05$) and a plan for handling a food allergy emergency ($X^2=2.2$, $p=0.05$) compared to those without training.

Eighty-one respondents (65%) said that they kept written recipes including details of ingredients used in the meals (Table 9). Eating-houses that were members of an industry association were more likely to have written recipes ($X^2=4.3$, $p<0.05$) compared to those that weren't.

Table 9 Knowledge about addressing an allergy emergency

| | Yes n (%) | No n (%) | Don't know n (%) | Received past training compared to those that did not (p value) |
|--|--------------|---------------|---------------------|---|
| Know the key components of a food allergen management plan | 20 (16.1) | 61 (49.2) | 43 (34.7) | 0.02 |
| Have a written food allergen management plan in place | 7 (5.6) | 110 (88.7) | 7 (5.6) | 0.05 |
| Have a plan for handling a food allergy emergency | 31 (25.0) | 87 (70.2) | 6 (4.8) | 0.05 |
| Keep written recipes of ingredients used in meals | 81 (65.3) | 34 (27.4) | 9 (7.3) | 0.39 |

Although 20 respondents (16%) were aware of the key components of a food allergen management plan, nine (7%) had correctly identified all the key components (Table 9 and Table 10). Eating-houses where the respondents had received past training were more aware of the key components of a food allergen management plan ($X^2=4.9$, $p<0.05$) compared to those without training.

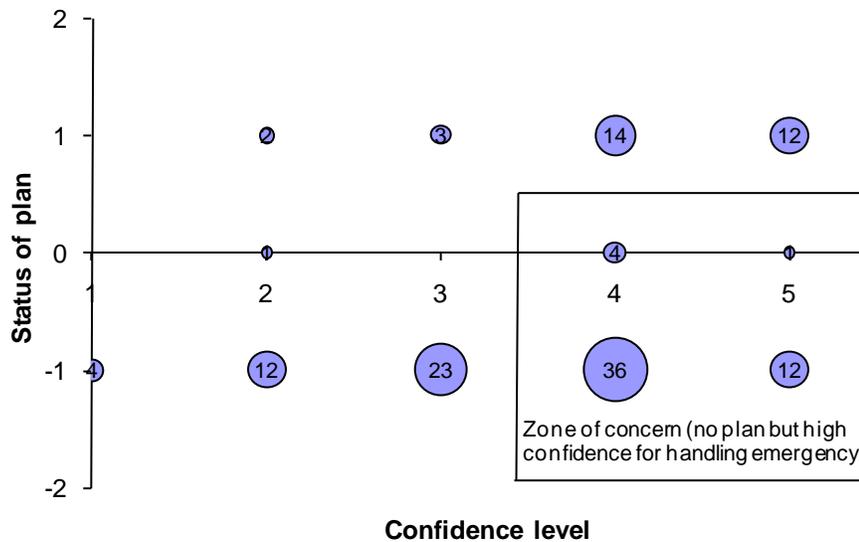
Table 10 Identifying key components of a food allergen management plan

| Components | n | % |
|---|----|------|
| What to do when a customer indicates a food allergy | 19 | 15.3 |
| How to prepare food free of a particular allergen | 18 | 14.5 |
| Common food allergens | 17 | 13.7 |
| Precautions that needs to be taken when serving a customer with a food allergy | 17 | 13.7 |
| What to do when a customer has a severe allergic reaction | 17 | 13.7 |
| Common symptoms of food allergic reaction | 16 | 12.9 |
| Identification of a key person(s) in the food establishment to advise on food allergies | 14 | 11.3 |
| Legal requirements for declaration of food allergens | 11 | 8.9 |

Figure 7 shows the comparison between level of self-efficacy with presence or absence of a plan for handling a food allergy emergency. Amongst those eating-houses with high self-efficacy for handling an allergy emergency, more than half didn't have any plan in place.

Figure 7 Self-efficacy compared with status of plan for handling a food allergy emergency

(1=Not at all confident, 2=Less confident, 3=Don't know, 4=Confident and 5=Very confident) (1=Have plan, 0=Don't know and -1=No plan)



4.6 Occurrences of food allergic reactions

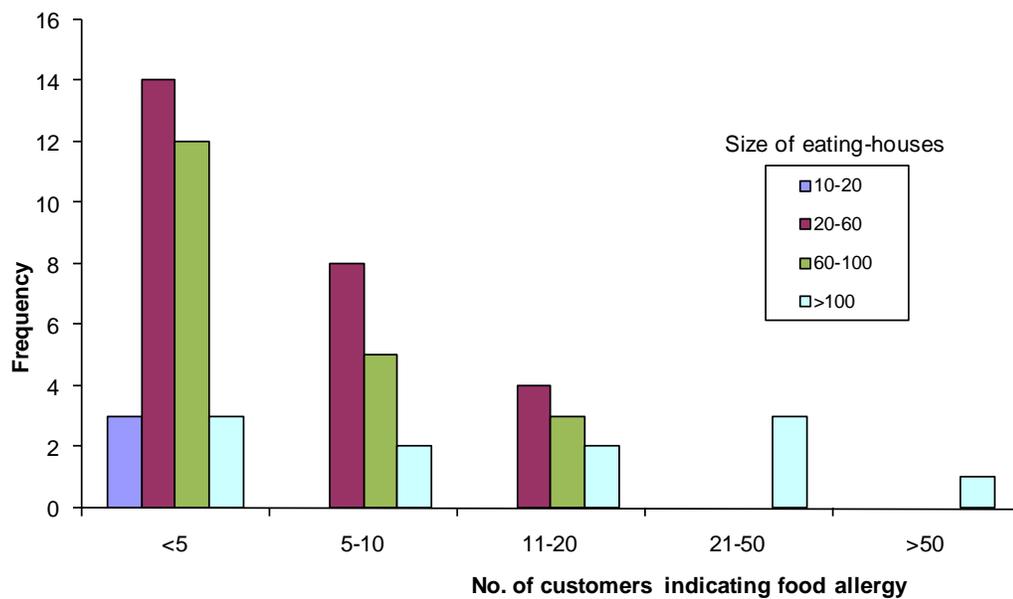
During the month of September 2008 68 (55%) of the respondents reported having customers who indicated that they a food allergy. Sixty respondents (48%) reported the number of customers who had alerted them off food allergy. Of these, 32 had less than 5 customers, 15 had between 5 to 10 customers and one eating-house had more than 50 customers (Table 11). The one eating-house that had more than 50 customers alerting food allergy was the largest eating-house and seated more than 100 people. It had the highest customer turnover of more than 5000. Eating-houses that were members of an industry association were more likely to declare customers indicating food allergy compared to those that were not ($X^2=5.8$, $p<0.05$). Fifteen respondents (12%) reported being aware of food allergic reactions occurring in their eating-house in the past two years (Table 11).

Table 11 Occurrence of allergic reactions in eating-houses

| | n | % |
|--|-----------|------|
| Aware of food allergic reactions in eating-house in past 2 years | 15 | 12.1 |
| Had customers who indicated a food allergy in September 2008 | 68 | 54.8 |
| Number of customers indicated food allergy in September 2008 | Frequency | |
| <5 | 32 | 25.8 |
| 5-10 | 15 | 12.1 |
| 11-20 | 9 | 7.3 |
| 21-50 | 3 | 2.4 |
| >50 | 1 | 0.8 |

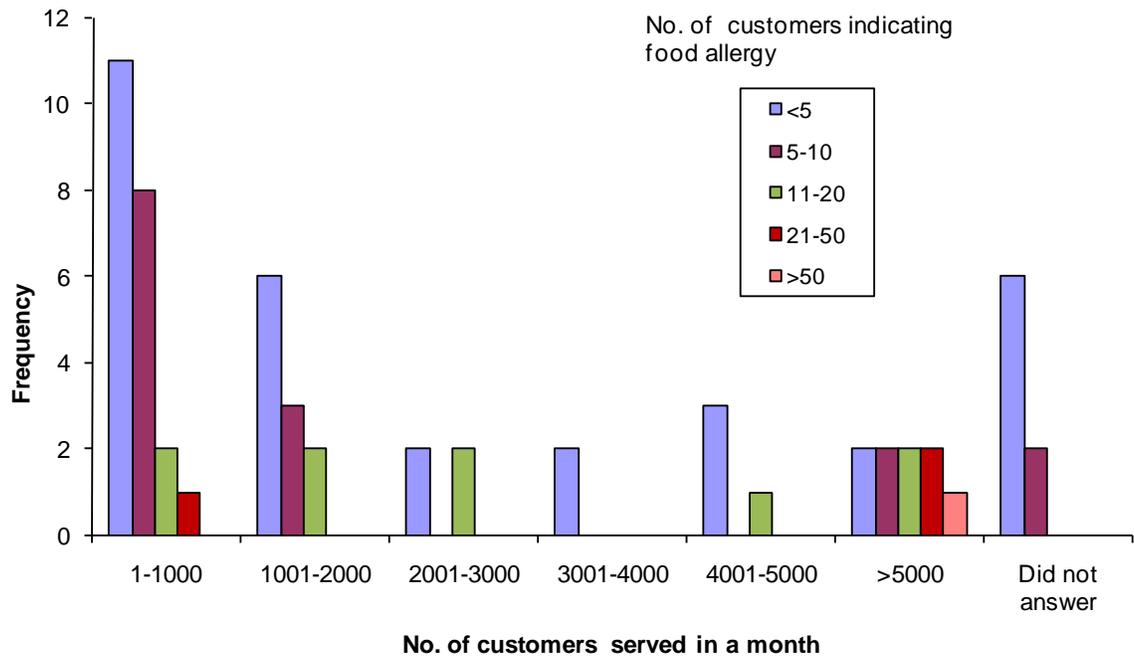
When compared with size of the eating-houses, the two medium sized eating-houses that could seat 20 to 60 and 60 to 100 people had highest number of alerts (Figure 8).

Figure 8 Number of customers indicating food allergy compared with size of eating-house



When compared with total number of customers served for the month, an inverse relationship was noticed with highest number of alerts from eating-houses with lowest customer turnover (Figure 9).

Figure 9 Number of customers indicating food allergy compared to customer turnover rate



4.7 Use of latex gloves

There were 90 eating-houses (73%) that used latex gloves for food handling and preparation. About 35 (28%) were aware of food allergy issues and 68 (55%) of skin allergy issues related with the use of latex gloves (Table 12). Eating-houses that were members of an industry organisation used less latex gloves ($X^2=2.7$, $p<0.05$). The eating-houses where the respondents had received past training had higher use of latex gloves ($X^2=9.6$, $p<0.05$). The respondents who were aware of the skin allergy issues related to the use of latex gloves reported a low use of latex gloves in their eating-houses ($X^2=6.3$, $p<0.05$).

Table 12 Use of latex gloves and awareness of allergy issues

| | Yes n (%) | No n (%) | Don't know n (%) |
|--|----------------------|---------------------|-----------------------------|
| Use of latex gloves in eating-houses for food handling/preparation | 90 (72.6) | 32 (25.8) | 2 (1.6) |
| Aware of food allergy issues related with use of latex gloves | 35 (28.2) | 66 (53.2) | 23 (18.5) |
| Aware of skin allergy issues related with use of latex gloves | 68 (54.8) | 39 (31.5) | 17 (13.7) |

4.8 Training in food allergy

Thirty-one respondents (25%) reported having received past training in food allergy management. Thirteen of these were owners (42%) while 18 (58%) were managers. Twenty respondents (16%) had food allergy training programme in place for their staff (Table 13). More respondents who worked in eating-houses that were not members of an industry association had been to past food allergy training ($X^2=3.8$, $p<0.05$) and had training programme in place for their staff ($X^2=2.9$, $p<0.05$). Ninety-five respondents (77%) were interested in receiving further training in the area of food allergy with owners more interested than managers ($X^2=4.2$, $p<0.05$). The respondents from eating-houses that were members of an industry association were more interested in further training than those that were not ($X^2=4.3$, $p<0.05$). The respondents who had received past training were more likely to have a training programme in place for their staff ($X^2=15.4$, $p<0.05$) compared to those without training.

Table 13 Experience in food allergy training

| | Yes n (%) | No n (%) | Don't know n (%) |
|---|----------------------|---------------------|-----------------------------|
| Had food allergy training in the past | 31 (25.0) | 91 (73.4) | 2 (1.6) |
| Have food allergy training programme in place for staff | 20 (16.1) | 100 (80.6) | 4 (3.2) |
| Interested in receiving future food allergy training | 95 (76.6) | 14 (11.3) | 15 (12.1) |

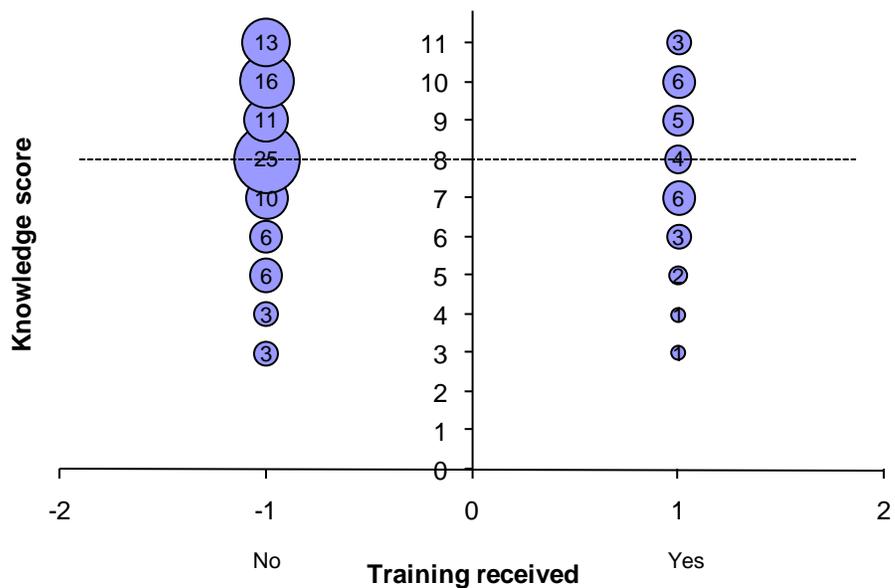
Key areas of future training interest identified were legal requirements, general knowledge on food allergies, allergen management, training and supervision, industry responsibilities, emergency management procedures and reaction plan including CPR (Table 14).

Table 14 Key areas identified for future food allergy training

| | n | % |
|---|----|------|
| General knowledge on food allergies | 92 | 74.2 |
| Legal requirements | 87 | 70.2 |
| Allergen management | 80 | 64.5 |
| Industry responsibilities | 71 | 57.3 |
| Training and supervision | 64 | 51.6 |
| Other – CPR, Emergency management procedures, Reaction plan | 9 | 7.3 |

A comparison of overall knowledge score with past training did not show a significant correlation (Figure 10). While 30% of those who did not receive any training had knowledge scores of less than mean value, 42% of those who had received training had knowledge scores of less than mean value.

Figure 10 Knowledge score compared with respondent’s training history



4.9 Summary of results

The key findings of the study were:

- Language was identified as a key barrier for participation in this study.
- More than half the respondents did not know there were legal requirements to declare food allergens and only seven percent knew these requirements were outlined in the Food Standards Code.
- The knowledge of food allergens requiring declaration significantly differed among eating-houses that specialised in ethnic foods compared to those that did not ($p<0.05$).
- Most respondents had good knowledge about the preparation, serving and cross-contamination of food allergens. However over half of the respondents incorrectly believed that if an individual is having an allergic reaction, it is appropriate to serve water to dilute the allergen and reduce the reaction; and about 44% of respondents incorrectly believed that food allergens can become part of finished meal through under-cooking of food. For these knowledge items, the belief was significantly higher among eating-houses that specialised in ethnic foods compared to those that did not ($p<0.05$). Over half of the respondents also incorrectly believed that food allergens can become part of finished meal through an ill food handler.
- There was high level of self-efficacy to provide safe meal (92% of respondents were either confident or very confident).
- There was high level of self-efficacy to manage an allergy emergency (64% of respondents were either confident or very confident).
- Owners and managers of eating-houses who reported previous training in food allergy management were more likely to have in place a written food allergen management plan ($p=0.05$) and a plan for handling a food allergy emergency ($p=0.05$) compared to those without training. They were also more likely to have a training programme in place for their staff ($p<0.05$).
- While most (70%) of respondents were interested in further training in the area of food allergy; owners of eating houses were more interested than managers ($p<0.05$).
- There was higher usage of latex gloves in food preparation among respondents who had received past training of food allergy management compared to those without training ($p<0.05$) however; latex gloves were used less among those who were aware of skin

allergy issues associated with latex glove use compared to those who were unaware (p<0.05).

CHAPTER 5: DISCUSSION

The aim of the study was to explore the awareness and knowledge related to food allergy among owners and managers of registered eating-houses in Wellington City and gauge if adequate protection is in place to reduce the risk of food allergy among food allergic consumers. More than half the participants were owners and managers from restaurants (58%) with 38% from cafes and 4% from other food establishments. More owners were interviewed from cafes while more managers were interviewed from restaurants. This is because cafes were smaller in size with owners overseeing the management and restaurants were bigger with managers on site. The other five food establishments met the definition of an eating-house but preferred not to be categorised as cafes or restaurants. The owners and managers interviewed were experienced personnel with 85% having worked in the food establishment and 98% in the food service sector for more than one year. About half of the eating-houses surveyed were members of an industry association with more restaurants being members than cafes. The Restaurant Association of New Zealand and the Hospitality Association of New Zealand were the two major industry associations for this setting. The Voluntary Implementation Programme is fairly new to this sector hence the low intake numbers. Just over one third of the respondents classified their eating-houses as ethnic and most of these were Asian (26 out of 44).

One of the key findings of this study was that 41% (16 of 39) of owners and managers declined to participate in this study due to their inability to communicate in English. This is a key concern as all training resources developed for managing food allergies in food establishments emphasise the importance of partnership and communication between the food allergic consumer and the food establishment. To prevent food allergic reactions from occurring there is a need for patrons with food allergies to communicate their dietary requirements and for the food establishment personnel to understand and respond accordingly. This communication is paramount in prevention of allergic reactions.

Currently there are no communication competency requirements for owners and managers of food establishments. This is because the New Zealand food legislation is outdated. The

Food Hygiene Regulations that sets out the requirements for registration of food establishments was established in 1974; a time when eating patterns and the demography of the population were markedly different. Since this time there have been substantial increases in immigration and a greater diversity of food available to consumers. In 1974 the registration requirements focused on safety with respect to the construction of the premises rather than food aspects. There was no mention of food allergy or requirement to manage food allergy for food establishments at the time. While the focus shifted to more towards food safety and processes with the amendment in legislation in 1996, awareness about food allergies was not high among the food service sector until the introduction of the Australia New Zealand Food Standards Code in 2002. This code set the scene for food allergy management by outlining the requirement for food products to bear a label in English and listing the major food allergens that required declaration on that label. However for foods that were not required to bear a label (such as food made to order in food establishments) the requirement was limited to information being supplied to the purchaser upon request. The code did not stipulate that this communication had to occur in English. Hence while the requirement for foods to bear a label in English is enforced and regulated, for foods that are not required to bear a label the requirement to communicate to the purchaser in English does not exist. This is a significant gap in the legislation that needs to be addressed.

One way to address this gap is through the registration process of food establishments. The registration requirements in the Food Hygiene Regulations should require food establishments to have a number of personnel present on the premises that are able to communicate in English. The provision to provide safe food already exists in the legislation; however the Ministry of Agriculture and Forestry need to amend the registration requirements to include a competency to communicate in English.

Food allergic consumers, for their own safety, need to ensure that communication is clear and effective to the food establishment and that they receive sufficient feedback from the food establishment they choose to dine in. The food allergic consumer needs to take appropriate steps to notify the food establishment of their dietary requirements. Furlong et al. (2001) found that of 106 cases that had allergic reactions to peanut and tree nuts at food

establishments, 45% had alerted the food establishment about the allergy in advance. Those that did not notify the food establishment made various assumptions regarding the safety of food and relied on visual inspection, three had forgotten to mention the allergy and in one case the grandparent was not advised of the allergy by the parents of the case. The food allergic consumer also needs to emphasise the severity of their requirements to the food establishment personnel and clearly distinguish the difference between taste preference and health concerns. It is important for the food allergic consumer to possess knowledge of their needs, be aware of the pitfalls in this setting and be willing to inform and educate the food establishment personnel.

Another way to address the gap in legislation is to require food establishments to declare the mandatory food allergens in writing in their menu cards. This will require a change in the Food Standards Code by the Food Standards Australia New Zealand. Some of the training resources developed for food service sector already recommend declaration of major food allergens in the menu cards and a number of food establishments have conformed to this recommendation.

More than half the respondents did not know that there were legal requirements to declare food allergens and of those who knew (40%), most thought that these requirements were part of the Food Act (12%) or the Food Safety Regulations (10%). The knowledge that these requirements were outlined in the Food Standards Code was very low (7%). The lack of knowledge about the Food Standards Code was also reflected in poor identification of all food allergens that require mandatory declaration (9%). More common food allergens such as gluten, dairy, seafood, tree nuts, peanuts and egg were better known by the respondents. These allergens were identified on average by 70% of the respondents. Emerging allergens such as soya bean, sulphites and sesame seed were less understood. This is an area of concern as there has been a rise in popularity of exotic foods with 26 out of 44 ethnic eating-houses being Asian and these have extensive use of ingredients such as soya bean and sesame seed in their recipes. A language barrier is more likely to exist in these establishments which significantly increase the risk for the food allergic consumer.

There were a number of respondents who identified tomatoes, kiwifruit, pineapple and carrot as major food allergens that require declaration. While these foods do not require mandatory declaration under the Food Standards Code, they are known to contain allergenic proteins. These respondents may have experienced food allergic reactions among consumers involving these foods which led them to declare these as major allergens. This is a significant challenge for food establishment personnel and education programmes need to cover allergenic proteins from these foods as well.

The responses to food allergy knowledge questions demonstrated a moderate knowledge among owners and managers about the source, handling, preparation and serving of food that contained food allergens. There were 13% of respondents who answered all eleven questions correctly (n=16). These were ten owners and six managers from seven cafes, seven restaurants, a convention centre and a caterer. Thirteen of these respondents had not received past training. Four of these specialised in ethnic food. While these respondents demonstrated high level of knowledge, none these eating-houses had a food allergy management plan in place, only two were aware of the key components of a food allergy management plan and only four had a plan for handling an allergy emergency.

Most respondents understood the risks relating to cross-contamination of food with allergens during preparation and serving. For example more than 80% of respondents knew that food allergens can become part of finished meal inadvertently from ingredients and through insufficient or ineffective cleaning. These aspects of food allergy knowledge are important for this setting. Furlong et al. (2001) found that 78% of allergic reactions to peanuts and tree nuts at food establishments were caused by a hidden ingredient. The allergen was hidden in a sauce, dressing or egg roll which prevented the visual identification from the consumer. The remaining 22% was caused by cross-contamination of cooking and serving equipment.

There were also 13% of respondents who had knowledge score of less than five out of 11. These were eight owners, eight managers from six cafes and ten restaurants. Eight of these eating-houses specialised in ethnic food and four had received past training. Fourteen

respondents had worked in the food service sector for more than five years. Poor knowledge was attributed to questions relating to the intrinsic properties of food allergens where more than half of the respondents erroneously agreed or were unsure that water can be used to dilute an allergen and reduce reaction, and that food allergens can be transmitted through an ill food handler. About 44% of respondents agreed or were unsure that food allergens can become part of finished meal through under-cooking of the food.

These findings show that along with enhancing the knowledge of owners and managers of eating-houses, change in behaviour is required for this setting. That translation of knowledge to behaviour modification could be a challenge for this setting. Respondents have high level of knowledge about risks relating to cross-contamination but do not have a food allergy management in place to ensure safe practices during preparation and serving which will achieve a safe meal for a food allergic consumer.

Wellington city is the wealthiest region in New Zealand with the highest average income and education compared to other regions in New Zealand (New Zealand Institute of Economic Research 2005; Statistics New Zealand 2006, 2006(a)). One could argue that the knowledge levels of respondents in this study, although moderate, could be one of the best in New Zealand compared to somewhere like Auckland where the diversity of population, food establishments and food are far greater.

Five out of 11 knowledge questions asked in this study were same as used in the New York study (Ahuja and Sicherer 2007). The findings for this study showed respondents had a higher level of knowledge for four of these items compared to the New York participants (Table 15).

Table 15 Knowledge questions compared between the New York study and this study

| Question | Correctly answered in New York study (%) | Correctly answered in this study (%) |
|--|--|--------------------------------------|
| 1. Individuals with food allergies can safely consume the foods that cause the allergies if only a small amount is consumed | 76 | 86.3 |
| 2. High heat (e.g. deep frying) can destroy most food allergens | 65 | 87.9 |
| 3. A buffet counter is a safe choice for a food allergic patron as food are kept in separate containers and therefore there is no risk of cross-contamination of allergens to different containers | 46 | 75 |
| 4. Removing an allergen from a finished meal (e.g. taking off nuts) may be required to provide a safe meal for a food allergic patron | 75 | 78.2 |
| 5. If an individual is having an allergic reaction, it is appropriate to serve them water to dilute the allergen and reduce the reaction | 66 | 41.9 |

The overall knowledge for these five items was higher in this study compared to the New York study with 22% of participants answering all questions correctly in the New York study whereas 35% of participants answered all of them correctly in this study. However the type of food establishments surveyed in the New York study was very different to this study and included fast-food establishments, bakeries and ice-cream parlours.

Overall there was no significant relationships between knowledge related items and type of eating-house, owners and managers, size of eating-house, whether eating-house was a member of an industry association, number of staff employed, experience of owners and managers at the eating-house or in the sector and eating-house being part of New Zealand Food Safety Authority Voluntary Implementation Programme. The knowledge did however significantly differ for eating-houses that specialised in ethnic food compared to those that did not where the eating-houses that specialised in ethnic food incorrectly believed that water could be used to dilute the allergen and reduce the reaction and that food allergens can become part of finished meal through under-cooking of the food ($p < 0.05$). The declaration of mandatory food allergens also significantly differed for eating-houses that specialised in ethnic food compared to those that did not. This may reflect the cultural background of the eating house personnel and warrants further investigation.

While not for knowledge items, membership to industry association did have a positive impact on other aspects of food allergy management. Eating-houses that were members of an industry association were more likely to participate in the Voluntary Implementation Programme trialled by the Ministry for Agriculture and Forestry compared to those that were not members. The industry associations have supported the Voluntary Implementation Programme and have actively encouraged their members to take part in as it helps prepare the food establishments for the new requirements under the new food legislation. The Voluntary Implementation Programme includes food allergy management for food establishments. Consequently those eating-houses that were members of an industry association were more likely to have written recipes, declare number of customers indicating food allergy, used less latex gloves and more likely to declare gluten compared to non-members ($p < 0.05$). Although training history was lower for these eating-houses, there was more interest in further training compared to those eating-houses that were not members. These results confirm that support of the industry associations is important in education of this sector and thereby reducing the risk for food allergic consumers in this setting.

Self-efficacy for providing a safe meal was very high among the respondents with most (92%) being either very confident or confident in providing a safe meal. High self-efficacy was not substantiated by the overall knowledge score of the respondents. About 30% of respondents ($n=37$) who were either confident or very confident in providing a safe meal had knowledge scores of less than the mean value. These were 20 owners and 17 managers from 21 restaurants and 15 cafes. Seventeen eating-houses specialised in ethnic food.

These findings show that although the owners and managers believe in their abilities to provide safe meal, they lack the fundamental knowledge to understand and value the food allergy risks that exist in their setting. This potentially increases the risks for food allergic consumers dining in food establishments. The unsubstantiated high self-efficacy may lead to a false sense of security among owners and managers of food establishments.

Similarly self-efficacy for handling an allergy emergency was very high (64% of respondents either very confident or confident). The majority of these respondents (67%) did not have a plan for handling a food allergy emergency, did not have a food allergen management plan (92%) and did not know the key components of such plan (77%). A written food allergen management plan is the key to improving the awareness and knowledge of food allergy in this setting. The absence of plans for dealing with food allergic consumers and potential emergencies is a critical finding for this study.

Conversely, taking into consideration Bandura's theory of social learning and the strong role of self-efficacy in the knowledge-behaviour link, this could be viewed as a positive finding. A high self-efficacy coupled with high desire for further food allergy training indicated by most (77%) of the respondents is a very healthy and positive sign of behaviour change desired within this setting. However the training content and delivery has to be conducive for achieving the behaviour change.

Bandura's social learning theory emphasises that behaviour is determined by expectancies and incentives. For example owners and managers of eating-houses who value and understand the food allergy risks that exist in their setting will attempt to change if they (a) realise and acknowledge the gaps in their knowledge of food allergies; (b) believe that training will bridge that knowledge gap; and (c) that they are personally capable of enhancing their knowledge through training which will then lead to initiating a change in their practice. Case studies of past food allergic reactions in food establishments could be used as part of training to identify and highlight food allergy risks and measures to prevent such reactions. Sharing the adverse health effects of food allergic reactions on consumers by those consumers may provide an incentive for food service sector personnel to value the risks and effects of their behaviour in reducing the risk of such reactions.

The small percentage of respondents having received training in the past (25%) or having a programme for their staff (16%) indicates the training for the food service sector on food allergy legislation has been ad hoc. The results of this study are therefore not surprising. The self-efficacy that most respondents have in providing a safe meal places the food

service sector at great risk and highlights an urgent need to up skill. About a quarter of the respondents were not interested in receiving further training. This indicates the presence of barriers which needs to be explored and overcome by the regulators and industry organisations to achieve increased education for this sector. Owners of eating-houses were more interested in further training than managers ($p<0.05$). This reflects more commitment from owners to possess adequate knowledge in order to reduce the risk of food allergic reactions at their food establishments. Managers as employees may not have the same level of interest for the food establishment.

Regardless food allergy knowledge and the behaviour of food establishment personnel can make a difference between life and death for a food allergic consumer. This and the New York study (Ahuja and Sicherer 2007) have highlighted the need for regulators and educational organisations to understand the knowledge-behaviour link and develop educational programmes that will address the needs of food service sector with an emphasis on increasing awareness and knowledge of food allergy that will lead to behaviour modification.

Findings of this study show that owners and managers of eating-houses who had received previous training in food allergy management were more likely to have in place a written food allergen management plan and a plan for handling a food allergy emergency compared to those without training ($p<0.05$). They were also more likely to have a training programme in place for their staff ($p<0.05$).

On the other hand findings from two pre and post training studies in Australia showed marginal improvements in the overall knowledge of the participants post training (New South Wales Food Authority 2008; Department of Health Victoria 2010). However, improvement was observed in participants who had face-to-face workshops.

Therefore it is important for this setting to have a training programme that is consistent and regular, and is outcome focused where the effectiveness is measurable. For example the

requirement to complete an assignment as part of successful completion would require participants to engage in reflective learning which may lead to behaviour modification.

The training programme especially needs to capture those that fall into the category of high self-efficacy with low knowledge and awareness. It is more likely that individuals with high self-efficacy would show less interest in receiving further training due to their belief in self capabilities. Even when they attend training they will be less likely to be engaged and have low learning transfer.

The key areas of future training identified in this study were legal requirements, knowledge of food allergies, allergen management, training and supervision, industry responsibilities, reaction plan and emergency management procedures. All of these normally form the components of a food allergy management plan which was found to be lacking for this setting.

The training programme also needs to be regularly reviewed to ensure the content is current with literature and emerging trends. For example there was a high usage of latex gloves in food handling and preparation by personnel of eating-houses surveyed (73%). Results showed a lack of understanding of skin allergy issues arising from use of latex gloves. However respondents that were aware of the skin allergy issues related to the use of latex gloves used it less in their eating-houses. This study did not explore if respondents had received past training on food allergy risks associated with use of latex gloves. It is plausible that high use of latex gloves is due to lack of training in this area.

Lastly training in food allergy and a written food allergy management plan should form part of the registration requirement for food establishments. Key personnel at the food establishment should be required to attend a refresher training at least every two years. The food allergy management plan should be renewed annually. Both of these requirements should be monitored by the regulators through the annual renewal process of registration.

Between 2007 and 2008 about 12% of respondents reported incidences of food allergic reactions in their eating-houses. There is no active surveillance to measure incidences of food allergic reaction in eating-houses. Currently regulators rely on passive surveillance in the form of notification by the food allergic consumer and ad hoc reporting by hospitals of severe reactions such as anaphylaxis. Therefore the prevalence of food allergic reactions in a food establishment setting is unknown. In the USA there is one study which investigated reported incidences of allergic reactions to peanuts and tree nuts in food establishments (Furlong et al. 2001). The study involved interview of 129 registrants from the USA Peanut and Tree Nut Allergy Registry who had reported a reaction in a food establishment. These registrants described 156 reactions of which 127 reactions were from registrants who were aware of their allergies and were actively avoiding them. Analysis of anaphylaxis data have shown that 40% of anaphylaxis treated in the United Kingdom and 30% in the USA were food induced and occurred while dining in food establishments (Pumphrey 2000; Bock et al. 2001, 2007; Pumphrey 2007). In New Zealand there is one reported food induced fatal anaphylaxis which occurred while dining in a food establishment (Bowden 2008).

Therefore food allergy is an important public health issue for food establishment setting. The number of ingredients used, the lack of written recipes, the lack of quality control measures that normally exist in a manufacturing setting, the absence of food labels to alert consumers of allergens present and the preparation practices make this setting a high risk to food allergic consumers. Instead of relying on passive surveillance currently in place, a more proactive approach is needed. This could begin with a prevalence study to better understand the public health issue associated with food allergic reactions in the food establishment setting. Ongoing monitoring in the form of sentinel surveillance for regulators and the food service sector is also recommended to monitor trends of food allergic incidences and measure effects of any interventions.

One of the inadvertent findings of this study was the incidence of food allergy. The number of customers indicating food allergy in a month compared to the population served showed an incidence of food allergy of between 0.1 and 3.3% which is similar to the

prevalence reflected in the literature (Jansen et al. 1994; Hill et al. 1997; Sicherer et al. 1999; Dalal et al. 2002; Zuberbier et al. 2004; Pereira et al. 2005; Bakos et al. 2006; Venter C. et al. 2006; Venter C. et al. 2006a). However these were self reported food allergies and were not objectively assessed using any of the recognised diagnostic tests such as clinical history, skin prick test, open food challenge or the gold standard method of double-blind placebo-controlled food challenge. Self reported food allergies tend to show higher estimates.

There were a number of limitations in this study. Firstly this study interviewed the owners and managers to explore knowledge and awareness of food allergy. It could be argued that chefs were more pertinent personnel to interview as they are responsible for food preparation and serving. However the responsibility to provide safe food lies with the business owners and in absence of owners those responsibilities are normally delegated to the managers of a food establishment.

Secondly the study selected a subset of food establishments and variation in types of food establishment restricted the ability to compare results between different types of food establishment. A larger study was not possible due to time and resource constraints.

The sample size of 163 was another limiting factor due to resource constraints. At 97% confidence level, a participation rate of 80% was expected. The participation rate of 76% (n=124) provided a confidence level of between 95% and 97%. This was considered statistically significant for the study.

The sample recruitment methodology affected the participation rate where due to a language barrier 16 respondents declined to participate. This finding should be taken into consideration for future surveys in order to increase participation. The use of interpreters could increase the participation rate and reveal awareness and knowledge among owners and managers in food establishments where a language barrier exists.

Another limitation was the length of the questionnaire used for data collection. More items in the questionnaire would have provided greater opportunity to assess the food allergy knowledge of the participants. However, the questionnaire had to be short enough to gain engagement from participants, encourage completion and to obtain quality data. The current questionnaire took about 30 minutes to complete.

It is recognised that interviewer bias would be inevitable in a study of this kind. This was managed through training of interviewers and questionnaire pilot. The use of neutral interviewers who were unfamiliar with the study area may have reduced the interviewer bias. However the use of Environmental Health Officers who had existing relationship with respondents assisted in obtaining a higher participation rate.

CONCLUSIONS AND RECOMMENDATIONS

This is the first study in New Zealand to explore food allergy knowledge and awareness among owners and managers of eating-houses. An important finding at the recruitment phase of the study was that inability to communicate in English was a barrier for respondents to participate as they were unable to read the questionnaire. This has important implications for public health and the prevention of food allergic reactions in eating-houses. The problem is compounded by the absence in legislation to require food establishment personnel to be able to communicate in English. It has potentially serious repercussions for food allergic consumers who seek to notify restaurant personnel of their allergies.

More than half the owners and managers of eating-houses in this study were unaware of the legal requirements to declare food allergens with only seven percent knowledgeable that these requirements are outlined in the Food Standards Code. Knowledge of declaration of food allergens was lower among eating-houses that specialised in ethnic foods compared to those that did not. This may reflect the cultural background of the eating house personnel and warrants further investigation.

Most owners and managers had good knowledge about the preparation, serving and cross-contamination of foods containing allergens. However over half were under the misconception that if an individual is having an allergic reaction, serving water could dilute the allergen and reduce the reaction. Similar misconceptions were that food allergens could become part of finished meal through an ill food handler or through under-cooking of food. Knowledge levels were again lower among eating-houses that specialised in ethnic food compared to those that did not.

The study found that only six percent of respondents had a written food allergen management plan in place and a quarter had a plan for managing a food allergy emergency. About 65% of respondents kept written recipes of their meals.

A quarter of the respondents reported having received past training in food allergy management. Those with past training were more likely to have a written food allergen management plan and a plan in place for managing a food allergy emergency. They were also more likely to have a training programme for their staff. Generally most respondents were interested in further training in the area of management of food allergy.

There was higher usage of latex gloves in food preparation among respondents who had received past training of food allergy management compared to those without training however; latex gloves were used less among those who were aware of skin allergy issues associated with latex glove use compared to those who were unaware.

With 12% of respondents reporting incidences of food allergic reactions in their eating-houses, the study confirms that food allergy is an important public health issue for the food establishment setting. The high level of self-efficacy of most respondents to provide a safe meal places the food service sector at considerable risk and highlights an urgent need to provide eating house personnel with greater knowledge and skills. The findings confirm that the current level of protection to reduce the risk of food allergic reactions in this setting is low and therefore food establishments present a high risk for food allergic consumers.

The key recommendations from the findings of this study are for:

- The Ministry of Agriculture and Forestry to include competency to communicate in English as part of the registration process for food establishments or for the Food Standards Australia New Zealand to amend the Food Standards Code to require written declaration of mandatory allergens on menu cards.
- A prevalence study to be undertaken to better understand the incidences of food allergic reactions in food establishments.
- A surveillance programme to be set up to monitor the trends of food allergic incidences in food establishments and effects of interventions.

- The industry organisations such as the Restaurant Association of New Zealand and the Hospitality Association of New Zealand to identify training barriers for the food service sector and address these barriers.
- The Ministry of Agriculture and Forestry and industry organisations to work together to develop a food allergy education programme using an appropriate behaviour model. This programme should aim to improve food allergy awareness and knowledge, and achieve behaviour modification of personnel working in food service sector.
- The Ministry of Agriculture and Forestry to include food allergy training for key personnel in food establishments and a requirement to have a written food allergy management plan as part of the registration requirement.
- The Ministry of Agriculture and Forestry to include food allergy management as part of an annual verification process for renewal of registration for food establishments.

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APPENDIX 1 STUDY QUESTIONNAIRE

A study of food allergy awareness and knowledge among owners and managers of Wellington City eating-houses

Researcher – Kanchan Sharma

Student of Massey University

Contact details – kanchan.sharma@huttvalleydhb.org.nz

**Research sponsor – New Zealand Food Safety Authority
(NZFSA)**

Preface

For interviewer

Research information given to owner/manager

Yes No

Owner/Manager consented for participation?

Yes No

If not willing to participate is it due to language being a barrier?

Yes No

Main Questionnaire

1. Are there legal requirements to declare food allergens in New Zealand?

Yes No Don't know

If you have ticked "No" or "Don't know", go to question 3

2. If yes to Q1, where are these set out? *Tick the appropriate box*

Food Act

Food Hygiene Regulations

Food Standards Code

Food Safety Regulations

3. From the list below, which foods do you think are required to be declared under the food labelling legislation? *Tick as many as applicable*

| | |
|-------------------|--------------------------|
| Gluten products | <input type="checkbox"/> |
| Tree nuts | <input type="checkbox"/> |
| Seafood | <input type="checkbox"/> |
| Strawberry | <input type="checkbox"/> |
| Tomatoes | <input type="checkbox"/> |
| Sulphites | <input type="checkbox"/> |
| Dairy | <input type="checkbox"/> |
| Carrot | <input type="checkbox"/> |
| Egg | <input type="checkbox"/> |
| Soya bean | <input type="checkbox"/> |
| Kiwifruit | <input type="checkbox"/> |
| Pineapple | <input type="checkbox"/> |
| Peanuts | <input type="checkbox"/> |
| Sesame seed | <input type="checkbox"/> |
| None of the above | <input type="checkbox"/> |
| Don't know | <input type="checkbox"/> |

4. If a patron advised you of their food allergies, how confident are you with providing them a safe meal?

- Very confident
- Confident
- Don't know
- Less confident
- Not at all confident

5. If a patron has an anaphylactic (severe allergic) reaction in your food establishment, how confident are you with handling this?

- Very confident
- Confident
- Don't know
- Less confident
- Not at all confident

6. For the following statements, please indicate whether you agree, disagree or don't know.

a) Individuals with food allergies can safely consume the foods that cause the allergies if only a small amount is consumed

Agree Disagree Don't know

b) High heat (e.g. deep frying) can destroy most food allergens (an allergen is the component of the food that an individual is allergic to)

Agree Disagree Don't know

c) If an individual is having an allergic reaction, it is appropriate to serve them water to dilute the allergen and reduce the reaction

Agree Disagree Don't know

d) A buffet counter is a safe choice for a food allergic patron as food are kept in separate containers and therefore there is no risk of cross-contamination of allergens to different containers

Agree Disagree Don't know

e) Removing an allergen from a finished meal (e.g. taking off nuts) may be required to provide a safe meal for a food allergic patron

Agree Disagree Don't know

7. For the following statements, please indicate whether you agree, disagree or don't know.

Some of the ways in which food allergens can become part of finished meal are:

- a) Accidental or unknown presence in ingredients
 Agree Disagree Don't know
- b) Transmission through an ill food handler
 Agree Disagree Don't know
- c) Insufficient or ineffective cleaning
 Agree Disagree Don't know
- d) Under-cooking of the food
 Agree Disagree Don't know
- e) Cross-contamination during preparation
 Agree Disagree Don't know
- f) Cross-contamination during serving
 Agree Disagree Don't know

8. Do you keep written recipes that include details about ingredients used in your meals?
 Yes No Don't know

9. Do you know what are the key components of a food allergen management plan?
 Yes No Don't know

If you have ticked "No" or "Don't know", go to question 11

10. If yes to Q9, from the list below, what are the key components of a food allergen management plan? *Tick as many as applicable*

| | |
|---|--------------------------|
| Common food allergens | <input type="checkbox"/> |
| What to do when a customer indicates a food allergy | <input type="checkbox"/> |
| How to prepare food free of a particular allergen | <input type="checkbox"/> |
| Precautions that needs to be taken when serving a customer with a food allergy | <input type="checkbox"/> |
| What to do when a customer has a severe allergic reaction | <input type="checkbox"/> |
| Common symptoms of food allergic reaction | <input type="checkbox"/> |
| Legal requirements for declaration of food allergens | <input type="checkbox"/> |
| Identification of a key person(s) in the food establishment to advise on food allergies | <input type="checkbox"/> |

11. Do you have a written food allergen management plan in place?
Yes No Don't know

12. Do you have a plan in place for handling a food allergy emergency?
Yes No Don't know

13. In the month of September 2008, did you have any customers who indicated that they had a food allergy?
Yes No Don't know

If you have ticked "No" or "Don't know", go to question 15

14. If yes to Q13, how many? _____

15. How many people in total did you serve in the month of September 2008?

16. To your knowledge has there been any food allergy reactions in your food establishment in the past 2 years?
Yes No Don't know

17. Do you use latex gloves in your food establishment for food handling/preparation?
Yes No Don't know

18. Are you aware of food allergy issues related with use of latex gloves?
Yes No Don't know

19. Are you aware of skin allergy issues related with use of latex gloves?
Yes No Don't know

20. Have you had any training in food allergy management in the past?
Yes No Don't know

21. Do you have any food allergy-training programme in place for your staff?
Yes No Don't know

22. Are you interested in receiving training in this area?
Yes No Don't know

If you have ticked "No" or "Don't know", go to question 24

23. If yes to Q22, what key areas would you like to be covered? *Tick as many as applicable.*

- Legal requirements
- General knowledge on food allergies
- Allergen management
- Training and supervision

Industry responsibilities
Other specify _____

Participant characteristics

24. How would you describe your food establishment?

Cafe
Restaurant
Delicatessen
Other specify _____

25. Does your food establishment specialise in any particular ethnic food?

Yes No

If you have ticked "No", go to question 27

26. If yes to Q 25, tick the box below that represents your establishment overall. Tick only one.

Chinese
European
Indian
Italian
Japanese
Korean
Malaysian
Middle Eastern
Other specify _____

27. What is your position in the food establishment?

Owner
Manager

28. How many people can your food establishment seat at once?

10-20 20-60 60-100 >100

29. Is your food establishment a member of any industry associations?

Yes No Don't know

If you have ticked "No" or "Don't know", go to question 31

30. If yes to Q29, tick the appropriate box.

Restaurant NZ
Hospitality Association of NZ
Other specify _____

31. How many full time equivalent staff do you employ in your food establishment?
<5 5-10 10-15 15-20 >20

32. How many years have you worked in this food establishment?
<1-year 1-3 years 3-5 years 5-10 years >10 years

33. How many years have you worked in the food service sector (overseas and in NZ)?
<1-year 1-3 years 3-5 years 5-10 years >10 years

34. Is your food establishment part of the NZFSA Food Control Plan Voluntary
Implementation Programme?
Yes No

35. Would you like a copy of the summarised results of this survey?
Yes No

36. If yes to Q35, please provide the mailing address.

Thank you for your time.

Interviewer: _____ Date: _____

Comments

APPENDIX 2 QUESTIONNAIRE FROM NEW YORK STUDY

Food Allergy Management in Restaurants and Other Food Establishments: A Survey

1) Please indicate your responsibility(ies) in your restaurant/food establishment.

Manager/Owner Server Chef/Cook Other (Please Specify)_____

2) Please identify your type of restaurant

"Sit Down"/Table service Circle one: Continental, Asian, Italian, Other (list)_____

Fast food

Take-out (Circle one): Bakery, Ice Cream, Asian, other_____

Other_____

3) Have you received prior training/instruction regarding the issue of food allergy?

Yes No unsure

IF YES, how is this done? set program one-on-one other_____

4) In the past month, approximately how customers indicated to you they have a food allergy? _____(insert number)

Approximately what percent of your customers is that? _____%

5) How comfortable are you in providing a person with food allergies a safe meal?

Very comfortable Somewhat comfortable Comfortable Somewhat uncomfortable Very uncomfortable

7) How comfortable are you that your restaurant can guarantee a "safe meal" for an individual with a food allergy?

Very comfortable Somewhat comfortable Comfortable Somewhat uncomfortable Very uncomfortable

8) How comfortable do you feel you are about handling a life-threatening food allergic emergency if one was to occur in your restaurant establishment?

Very comfortable Somewhat comfortable Comfortable Somewhat uncomfortable Very uncomfortable

9) To your knowledge, has a food allergic emergency occurred in your establishment in the past 3 years? Yes No Unsure

Survey page 2

10) Individuals with food allergies can safely consume the foods that cause the allergies if only a small amount is consumed.

True False

11) High heat (e.g., oil frying) can destroy most food allergens.

True False

12) If an individual is having an allergic reaction, it is appropriate to serve them water to “dilute” the allergen and suppress the reaction

True False

13) If a buffet (serve-yourself) counter contains allergens but is kept clean, it can be a safe choice for a food-allergic patron.

True False

14) Removing an allergen from a finished meal (e.g., taking off nuts) may be required to provide a safe meal for a food allergic patron

True False

15) Mark all of foods (may be more than 1) that are considered “major allergens”:

Peanuts Seafood Strawberry Tomato Milk/Dairy
 Egg Chocolate Casein Orange Carrot

16) Do you have a plan in place should a customer experience a food-allergic reaction?

Yes No Unsure

17) Would you be interested in training programs about food allergy safety?

Yes No Unsure

18) Should restaurants/food establishments be “certified” and regulated regarding food allergy education?

Yes No Unsure

19) Do you currently have a plan in place to separate food allergens and provide safe meals for food-allergic customers?

Yes No Unsure

20) On average, how many new hires are there each year in your establishment that would require training about food allergy? _____

Thank you for your time!

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APPENDIX 3 RESEARCH INFORMATION SHEET FOR PARTICIPANTS

Food allergy is an important public health problem in developed countries such as New Zealand. There is currently no reliable data on the prevalence of food allergy for New Zealand, however international prevalences are reported to be between 1% and 4%.

There is no cure for food allergy so people who suffer from it need to avoid the food allergen completely. Every time they eat a meal at a restaurant they place their trust into those who have prepared the food that they are receiving a safe meal. Unfortunately this hasn't always been possible. For example in early 2007, a death resulted from allergic reaction to food eaten at a restaurant in Auckland. In this case the person was aware of their allergy to eggs and nuts and had made prior arrangements with the restaurant to provide a meal free of these ingredients. However, despite the efforts to take these steps the person suffered a fatal anaphylactic reaction.

The knowledge around food allergens for restaurant personnel working in eating-houses in New Zealand is unknown. Therefore it is difficult to gauge what protection is in place to prevent the risk of food allergy.

The aim of this study is to explore the awareness and knowledge related to food allergy among owners and managers of registered eating-houses in Wellington City. The survey will focus on about 163 registered eating-houses in Wellington City.

We request you to participate in this study by completing this questionnaire. This study is anonymous which means that you are not required to name yourself or your restaurant. You have the right to refuse to participate.

This study is being conducted by Kanchan Sharma, who is a Massey University student to fulfil the requirements of the Masters of Food Technology programme.

The study is sponsored by the Ministry of Agriculture and Forestry who is interested in the data for development of future training and education resources for the food service sector. Other agencies such as Allergy NZ and Restaurant Association are also supporting this research.

If you have any further questions regarding this research or would like a copy of the final report, please contact Kanchan Sharma on kanchan.sharma@huttvalleydhb.org.nz.

Your participation is appreciated.