TRINITY COLLEGE DUBLIN
COLÁISTE NA TRÍONÓIDE, BAILE ÁTHA CLIATH
THE UNIVERSITY OF DUBLIN

B.Sc. (Hons) Information Systems

Final Year Project (CS4105)

Academic Year 2016/2017

"How can technology provide food allergy awareness to catering customers?"

Project Report

Project Team:

Camino Rufo

Guillaume Van Aelst

Jeffrey Healy

Piush Vaish

Project Supervisor: Howard Shortt

Declaration

We declare that the work described in this dissertation is, except where otherwise stated, entirely our own work, and has not been submitted as an exercise for a degree at this or any other university. We further declare that this research has been completed in full compliance with the ethical research requirements of the School of Computer Science and Statistics.

Signed:

23/03/2017 Jeffrey Healy

23/03/2017 Piush Vaish

23/03/2017 Guillaume Van Aelst

23/03/2017 Camino Rufo

Permission to lend and/or copy

We agree that the School of Computer Science and Statistics, Trinity College may lend or copy this dissertation upon request.

Signed:

23/03/2017 Jeffrey Healy

23/03/2017 Piush Vaish

23/03/2017 Guillaume Van Aelst

23/03/2017 Camino Rufo

Acknowledgements

We would like to acknowledge and thank a number of people for the assistance, guidance and understanding they provided during the completion of this research project. Firstly, we would like to thank our supervisor Howard Shortt. We would also like to thank the guidance of Paula Roberts and that of Trinity College Dublin, all of whom made this research project possible.

Abstract

This study has been conducted as a means to investigate the current technologies raising awareness to a real and dangerous everyday occurrence in our society: food allergies in the catering sector. We discovered that the number of allergy sufferers has increased significantly over the years. Furthermore, our ability to communicate with each other through social media, the internet and other electronic means has also increased significantly but the distribution of information regarding food allergies has not evolved between the customers and catering companies. A viable and reliable means to create awareness provide countermeasures and bolster the information available in relation to allergies is needed.

Food allergies are experienced when the food triggers the immune system in our bodies and this in turn causes a histamine reaction as the body feels it is under attack. This can lead to further complications as some immune systems reactions can also be potentially fatal if they develop further.

In chapter 2, literature review, we examined published works to learn that, at the time of writing, there were in excess of one billion affected people allergy sufferers globally and the trend appeared to be on the increase. As stated by Nicholson, *"Allergic diseases are affecting the lives of more than one billion people worldwide. With an epidemic rise during the last 60 years"* European Academy of Allergy and Immunology (EACCI) (Nicholson, 2015). We learned that some of the most successful means to predict, detect and control allergies are through the use of applications on mobile devices and devices that administer medication, i.e. The EpiPen®.

This thesis firstly outlines what an allergy is from its first discovery and up to its recognised evolved state by today's standards. We examine the process for the use of technology to increase awareness for both customers and caterers in relation to allergies.

To fully understand the impact on food allergy sufferers and the catering industry, i.e. consumers and clients in restaurants, restaurant owners and employees including chefs, purchasers, caterers, waiting staff and hosts, we conducted an online survey during our study. The survey allowed us to extract information from a large sample of respondents to questions aimed at food allergy sufferers and service providers.

The paper concludes with what we felt were some interesting facts regarding the lack of awareness to allergens in both the catering industry and customers. We all discovered a potential marketing benefit to caterers if they were willing to list all of their allergens for the customers to see.

Contents

List of Tables

List of Figures

Abbreviations

AAFA –	Asthma and Allergy Foundation of America
EAACI –	European Academy of Allergy and Clinical Immunology
EU –	European Union
FARE –	Food Allergy Research and Education
FATC –	Food Allergy Training Consultancy
FSA –	Food Standards Association
FSAI –	Food Safety Authority of Ireland
HACCP –	Hazard Analysis and Critical Control Point
HSE –	Health Service Executive
IFAN –	Irish Food Allergy Network
INDI –	Irish Nutrition and Dietetic Institute
PPM –	Parts Per Million
RAI –	Restaurant Association of Ireland
TCD –	Trinity College Dublin
WAO –	World Allergy Organisation
WHO –	World Health Organisation

Glossary of Terms

Allergen –	A substance that causes an allergic reaction.
Anaphylaxis –	An allergic reaction to an antigen which the body is hypersensitive to.
Autoimmunity –	The human immune systems targets its own healthy cells and tissues.
Caterer –	A person or business that provides food.
EpiPen® –	A type of adrenaline auto-injector that comes with different doses
Food Intolerance –	Food that cannot be properly processed or absorbed by our digestive systems.
Food Protein –	A nutrient found in food that consists of amino acids.
Histamine –	A compound involved in the response of the human immune system to a foreign body.
SurveyMonkey® –	A type of survey software that allowed us to construct and analyse our results.

Chapter 1 Introduction

Our research question for our final year project is: "How can technology provide food allergy awareness to catering customers?" Throughout our thesis we have examined and formed conclusive results on how technology can inform the public who suffer from allergies by increasing awareness. In order to examine this area effectively this paper targets the topic of allergies incorporating the reactions and the treatments. This paper also identifies that there are technologies currently in existence and that they are indeed creating an awareness. The research question also aims to address what is the degree of awareness.

Due to the nature of prevailing allergies they are not confined to a specific minority or majority, they do not differentiate between ethnicity or gender and they do not show quarter when they target infant new-borns or the elderly. Allergies target the human race as a whole on this planet and they do not show discrimination when they become part of a person's daily routine or life style. Due to their elusive nature allergies can develop at any stage of a person's lifetime but can also lie dormant in the same manner.

In all cases the person's environment will simply act as a trigger of either becoming active or going dormant.

1.1 Research Question

The research question asked is:

"How can technology provide food allergy awareness to catering customers?"

For the research question our team firstly looked at the legal definition of the food allergy, impact on society and requirements for greater awareness in the food industry for allergy sufferers. Was there sufficient awareness for members of the public with regard to food allergies and food intolerances? We also examined currently available methods using technology to assist the public with regard to food allergies. Using the above question helped define the scope of our project and aided in keeping focus on the question.

1.2 Rationale

Our team is made up of four fourth-year students Piush Vaish, Guillaume Van Aelst, Jeffrey Healy and Camino Rufo all of whom are studying Information Systems in Trinity College Dublin. The establishment of our topic was initially born from the concept of an application we were hoping to develop. We discovered that the project should specifically focus on a thesis as the development of an application simultaneously would incur a much larger workload. Our team decided to focus only on the research question. The research question stemmed from team members and extended family members having specific allergies. We each maintained an interest in allergy management and had experience in managing allergic reactions such as anaphylaxis that is a severe reaction to a food allergy.

The application of technology towards raising awareness can be measured in the count of device applications available today and we felt it would be essential that the core theme of our research would be to conduct a review of what is currently available and identify common patterns and expose potential gaps. We evaluated methods of delivering this information via technology applications to food allergy sufferers and their families from the catering sector.

Anaphylaxis is a reaction of the body caused by the ingestion of a food allergen. In some cases, it can be fatal but fortunately it can also be avoided. It has become a growing concern that there is not enough awareness of the dangers of it nor how its dangers can be circumvented. In order to visualise how anaphylaxis could be prevented we decided to use a Venn diagram broken up into three sections, namely A, B & C.

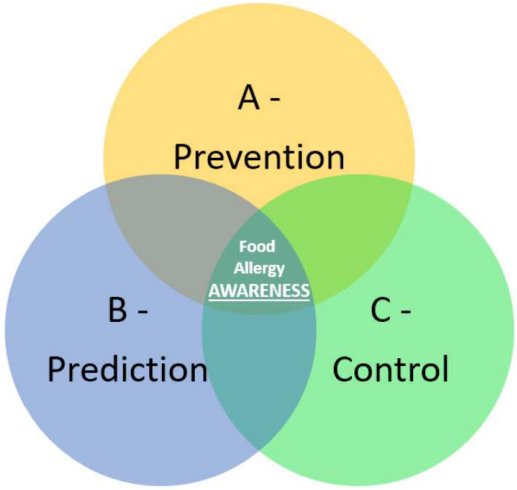

Figure 1.0 - Displays the allergy diagram as an aid to visualising how anaphylaxis can occur.

With more information, readily available and accessible on demand we could have a decrease in the occurrences of food allergies and their subsequent reactions *(A-Prevention) – Figure 1.0* and ultimately prevent the third section *(C-Control) – Figure 1.0* of the Venn diagram from taking place that is the most crucial stage. This countermeasure inhibits the autoimmune reaction of the body. An example would be an adrenaline shot in the form of an EpiPen® to counteract the release of histamines.

Our team felt it necessary to research what was available to the public and how best to make it accessible using technology.

1.3 Scope and limitations

The main objective of our thesis was to examine how technology can provide increased awareness and access to relevant accurate information in a timely manner to consumers. It was not our aim to inform the public directly about food allergies and the dangers associated with it.

We were concerned with two target audiences namely the catering customers and the catering employees. We sought to understand both perspectives to determine the best method of raising awareness.

1.4 Roadmap of document

The thesis is divided into five (5) chapters:

Chapter 1 is an introduction into what our research question was and why we chose it. It contains the question, the rationale and also the scope and limitations of our research.

Chapter 2 contains our literature review. The literature review examines the history and types of allergies as they currently exist in relation to food. Existing technologies in the form of applications and devices have been researched to determine currently available features, relevance to food allergy sufferers and quality of information. This chapter continues to examine current legislation and outlines examples where it remains unenforced. Finally, the literature review also sets out a review of published case studies in this area.

Chapter 3 provides the methodology used for our research. We examined mixed methods in relation to qualitative and quantitative. This chapter explores research techniques as well as our justification behind changes and adjustments to our methodology.

Chapter 4 contains our findings and our analysis during our research.

Chapter 5 concludes our research.

Chapter 2 Literature Review

2.1 Introduction

Food allergy is a global issue with an estimated 17 million Europeans and 15 million Americans affected directly with different severity (Dupuis et al., 2016). The number of incidents has been continually increasing since last 10-15 years in both developing and developed countries despite increased awareness (Carrad et al., 2015). With this increase of incidents in food allergies there have been new technologies developed to raise awareness and manage allergies.

2.2 Food Allergies

As stated by Haeusermann, "The medical term allergy first surfaced in the early 20th century along with the advances in clinical practice and biomedical science" (Haeusermann, 2014). There is a distinction between the definition of food allergies and intolerances. A consensus as to how a food tolerance or allergy can be defined has been determined.

Food proteins are mistaken by the body's immune system to be a foreign object. An object that does not belong in the body and therefore poses a threat. Some of these proteins do not get metabolised and as a result are tagged by the immune system as a foreign body. It is at this stage that the body begins to react to the foreign body or invader protein. The immune system is effectively fooled into thinking that there is a threat and moves to defend itself by releasing white blood cells to deal with the invader protein. White blood cells are the human immune systems frontline defence against foreign bodies that have already breached the physical barrier of the human body and entered the bloodstream. This is the stage where the allergic reaction presents itself in the form of a histamine reaction.

Histamines are chemicals released by the body after the white blood cells attack the tagged cells. Histamines present the physical symptoms of an allergic reaction such as headaches, dizziness, vomiting, itching and/or tissue swelling.

Conversely, food intolerances are a reaction that is not immunologically induced instead they are pharmacological, enzymatic, or from unidentified causes.

According to the Oxford English dictionary, *Anaphylaxis* is defined as "an acute allergic reaction to an antigen (e.g. a bee sting) to which the body has become hypersensitive" (Oxford University press, 2017).

In 2006 EU-funded project EuroPrevall, International Food Safety Authorities Network alongside the World Health Organization worked together to increase knowledge about food allergies around the globe and promote national and international information exchange (Haeusermann, 2014).

According to the Irish Food Allergy Network (IFAN) the three most common forms of food allergies are dairy, egg and nuts.

In relation to diary, egg and nut, their reactions can be quite serious and in some cases can even lead to fatalities if not properly managed.

According to Food Allergy Research & Education (FARE), there are up to eight main food types which cause up to 90% reactions in humans, these are dairy, egg and nuts, as previously mentioned, but also tree nuts, soy, wheat, fish and shellfish.

2.3 A brief history of food allergies

The first reference to allergies in history originates back to 400 BC in the time of the ancient Greeks. However, it was not really until the first half of the 20th century that the issue of allergies and reactions to food were considered. It was these studies which formed a springboard for future research into allergies and their effect on the human physiology.

"Allergens can be classified as plant food allergens with pollen allergen cross-reactive responses, plant food allergens without pollen allergen cross-reactive responses or animal derived food allergens." (Carrad et al., 2015)

Scientists proved that our diet has a major impact on our health and our quality of life. Beyond that, some food can become dangerous to some people while not affecting others at all. Thus, it is fundamental to watch and carefully choose what we eat as our diet is seriously impacted on how well we live life.

Dr. Francis Hare was a physician who in 1905 gave an important step on the research of the impact of food in our lives. He had a massive number of writings about the power of food triggering serious diseases and having a serious impact on people's life. (Hare, 1905)

Dr. Clemens von Pirquet, in 1906 first proposed the word "allergy" to describe such a disease that is caused by the food we eat and what is even more intriguing affecting people in different ways and degrees. According to him an allergy can be developed by some people as a strong and even lethal reaction to some specific food or substances that at first can be considered innocent and in fact have positive affects to others. Dr. Pirquet threw light on the large range of different reactions people can have towards the exact same food. (Von Pirquet, 1906)

What all these authors were concluding through their vast researches was the same point that diseases can be avoided or treated just by a change on a patient's diet. Dr. Albert Rowe published a book in 1931 entitled "Food Allergy: Its Manifestations, Diagnosis, and Treatment". He pointed to evidences that showed that food allergy is very peculiar to each individual and it can be expressed though a vast range of symptoms. It can also be expressed in different parts of the body and developed at any stage in life. (Rowe, 1931)

In 1941 another book was launched after extensive researches made by Dr. Vaughan. The book named Strange Malady aimed to foster the value of knowing what is exactly that we eat. He concluded after his studies that food allergy is the most common type of allergy reaction that the human body suffers from. He also says that there is no clear nor concise set of rules when it comes to food allergy thus, anybody can become sensitive to any type of food at any time. Hence, it seems that there is no straightforward formula or easy way to avoid it. (Vaughan, 1941)

According to another food allergy researcher, Dr. Coca, "*More commonly 'food-allergens' are common foods that are eaten at every meal*" (Coca, 1956). In other words, the best way to cope with this frequent problem is to watch closely what is being consumed in order to avoid the food that is already known to cause one's body to battle. It also helps to observe and acknowledge at all times the changes in our body.

Dr. Arthur Coca was another great contributor to the field of food allergies. His studies resulted in a few books and important papers among them "Familial Nonreaginic Food Allergy" and "Journal of Immunology". In 1956, he created a tool used to uncover possible food intolerances. Dr. Coca called it "The Pulse Test" because he observed that food allergens alter the heartbeat. "*It is based on the fact that allergens speed up the pulse. It consists essentially of testing isolated foods in order to tell which ones accelerate the pulse.*" (Coca, 1956)

Dr. Rinkel, Dr. Theron G. Randolph and Dr. Zeller contributed to enrich our understanding of food allergy by publishing in 1951 a book to describe the Feeding Test and the Rotary Diet (Rinkel, 1951).

This new concept was based on their findings that if you eat a different food every day it helps to detect which food or substances causes the allergic reactions and preventing these allergies from happening again. They also realised that some food impact us with different degrees of allergies such as mild or borderline which can be also influenced by the person's mood. The rotation of aliments throughout a week helps individuals analysing the causes of their food allergy and the degree of its impact. Developing this deeper knowledge of the body reactions and linking them to the specific food can help to prevent the development of new allergies.

As previously mentioned food allergies can be experienced in different degrees, intensities and time. At the time of our research, only serious allergies with an immediate response from the body were examined. These allergies account for only 5-10% of food allergies, while the other 90-95% of allergies are of less intensity that are experienced over time and usually are not given the due attention. (Lundy, 2007) These however, also have an impact on people's lives and once discovered could be controlled with a balanced diet. The aim of this research is to leverage technology to help widen knowledge of what is in their food, thus being better informed of what it is they have consumed. This way certain degrees of allergies can be better controlled and the more serious degrees of food allergies can be combated with an immediate response. The result being the threat to the body being completely extinguished.

2.4 Reactions

Any reaction to dietary allergies can be either severe or in the majority of cases, mild. It is noted however that all types have the potential to become serious. A mild reaction can manifest itself in the form of a rash, redness and mouth tingling sensation whereas a severe reaction can manifest itself with severe swelling and autoimmune reaction that can sometimes be fatal. When speaking of food allergies, it is common to refer to also about food intolerances but it is to be noted that they are two separate entities. Food intolerances are associated with people who have a hypersensitivity to digesting certain foods. This may make them unable to digest the food and create issues in the alimentary canal when processing the food. A food allergy refers to when the food triggers the immune system and this subsequently causes a histamine reaction that can lead to further complications.

We referred to histamines earlier when we discussed allergies. In order to better understand the impact that reactions have on allergy suffers we have included a list below:

Symptoms Of Histamine Intolerance	
Acid reflux	Heartburn
Angioedema	Hypotension
Anxiety	Indigestion
Asthma-like symptoms	Irritability
Chest pain	Nasal congestion
Chronic headache	Pruritus
Confusion	Rhinitis
Conjunctivitis	Runny nose
Diarrhea	Tachycardia
Digestive tract upset	Urticaria
Fatigue	Vomiting
Flush	Heartburn

Table 2.1 - Lists symptoms of histamine intolerances after the reaction has begun (The Paleo Diet, 2017)

The main factors affecting a person with food allergy are genetic makeup, environmental and lifestyle choices. The reactions can range from mild local systems to anaphylactic reactions. Moreover, the time-period when the reaction happens can vary. Some reactions occur immediately after ingestion while others can happen after several hours with serious consequences. While the cure for food allergy has yet to be discovered, the food allergy sufferers and their friends and families manage the food allergy by changing their eating habits, life choices and social engagements. This can have an effect on their quality of life. The management of food allergy is exercised through constant vigilance in avoiding specific food which could trigger an acute reaction or by preparing for accidental exposure.

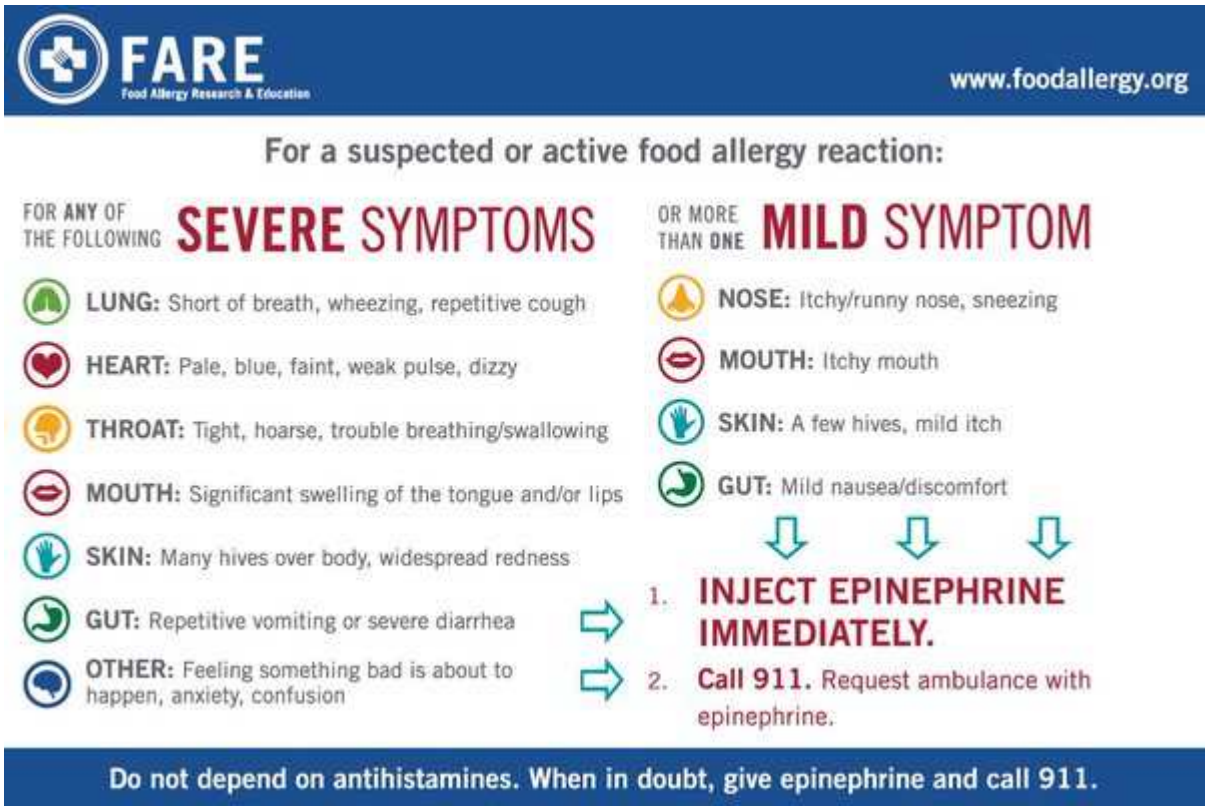

Figure 2.1 – Show the symptoms of a food allergy reaction (Allercom, 2017).

2.5 Cross-contamination

Cross-contamination in relation to food is the passing of dangerous bacteria or microorganisms indirectly from one person to another person. It can be through the improper use of food utensils or by the use of unsterile equipment and insufficient food preparation procedures. An example in the catering industry would be handling cooked meats with hands or utensils that raw meat has come into contact with. The result would be cooked food being contaminated with bacteria that would normally be destroyed by cooking the meat.

Cross-contamination relates to food allergy when food and/or utensils come into contact with allergens. For example, if a chef uses a knife to chop cooked tuna for a salad and then uses the same knife to prepare beef for a sandwich then an allergic reaction might occur to a person who is allergic to fish due to cross-contamination.

According to the FSAI, “all food businesses must have a food safety management system based on the principles of Hazard Analysis Critical Control Points (HACCP)” (FSAI, 2010). HACCP is a food safety management system that consists of seven principals as guidelines to food preparation and the avoidance of cross-contamination.

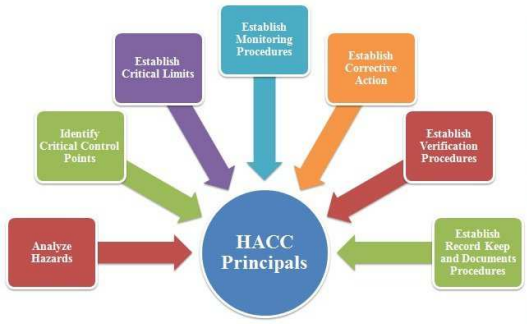

Figure 2.2 – Displays the seven principles of HACCP (BD Food safety, 2017)

Furthermore, the responsibilities of these control measures lie with the owner of the business. These measures are legislated for by the European Communities Hygiene of Foodstuffs Regulation, 2000 (S.I. No. 165 of 2000), which outlines what responsibilities the owner of the business has in relation to food safety. It clearly states that the proprietor of the business has a legal obligation to understand "what the Hygiene of Foodstuffs Regulation demands and be able to explain how it is applied in the food business" (FSAI, 2010).

2.6 Treatments

The treatment of any allergic reaction regardless of its severity is affected by both the concentration of the allergen and the time passed as the immune system begins to react. At the time of our writing the main treatment is still avoidance. This means that the sufferer or patient simply need not eat certain foods. As this is not always possible the primary course of action for the time being is for the management of the condition which involves educating sufferers and patients on how to evade their allergens and to identify early symptoms of the allergy (Sampson, 2004).

Another theory to consider when researching treatments is The Hygiene Hypothesis (Rook, 2009). This hypothesis suggests that in order for the human immune system to effectively respond to bacteria, micro-organisms or even an allergen in later life, it is necessary for ourselves to be exposed to it in an early stage of life, i.e. childhood, crèche, etc. In regards to today's standard in hygiene most children may develop a tendency towards an allergy early on by virtue of not being exposed to enough bacteria. A recent study showed the researchers how Clostridia, a common bacterium which occurs naturally in our digestive tracts, could potentially alleviate allergies or help prevent them and in some cases even be used as a treatment.

A recent study carried in Finland showed that a lower socioeconomic status was associated with a decreased risk of cow-milk allergy with infants of up to two years of age (Metsälä et al., 2010).

This study and its associated results can be paralleled by other studies demonstrating that suffering from self-reported food allergies has been reported to strongly coincide with:

- A person's socioeconomic class (Gupta et al., 2011; Kotz et al., 2011; Sheikh and Alves, 2001),
- People having a higher education (Luccioli et al., 2008; Soost et al., 2009),
- People living in relatively small-sized households (Ege et al., 2008; Al-Hammadi et al., 2010).

2.7 Legislation

On the 13th December 2014, in Ireland a law (Regulations 2014 (S.I. 489 of 2014)) was enacted to ensure allergens are labelled clearly on all food to help consumers make informed decisions before purchasing and consuming food products. It covered various food service outlets including restaurants, caterers, food stalls, food bought on the internet and even food being delivered (Food Safety Authority of Ireland, 2015).

According to Annex II of Regulation (EU) No. 1169/2011 of the European Parliament and Council of 25 October 2011, as amended by Commission Delegated Regulation (EU) No. 78/2014 of 22 November 2013; "Allergen is defined as any ingredient or processing aid listed in the annex, or derived from a substance or product listed causing allergies or intolerances used in the manufacture or preparation of a food and still present in the finished product even if in an altered form" (Food Safety Authority of Ireland, 2015)

The list includes 14 most common allergens (Food Safety Authority of Ireland, 2014):

- Eggs
- Soybean products
- Milk
- Cereals containing gluten
- Shellfish
- Fish
- Molluscs
- Nuts (including almonds, walnuts, cashews, hazelnuts, Pecan nuts, Brazil nuts, Macadamia nuts)
- Sesame Seeds
- Peanuts
- Celery
- Mustard
- Sulphur dioxide and sulphites
- Lupin

By listing 14 ingredients as common allergens the EU legislation goes further than what is commonly referred to as "The Big 8" or "The Top 8" (EatingWithFoodAllergies.com, 2017). The US law for example only identifies the following eight allergens as the most common due to accounting for 90% of all food allergic reactions:

- Milk
- Eggs
- Fish (e.g., bass, flounder, cod)
- Crustacean shellfish (e.g. crab, lobster, shrimp)
- Tree nuts (e.g., almonds, walnuts, pecans)
- Peanuts
- Wheat
- Soybeans

Moreover, these ingredients are also the food-sources from which countless of other ingredients and products are based on, for example: flour (wheat) or lecithin (soy). (FDA, 2016)

2.8 A global issue

According to Mark Jackson in his book the History of the Malady the allergy is considered to be is the archetypal disease of the 21st century (Jackson, 2006). Furthermore, the Asthma and Allergy Foundation of America Allergies claimed that allergies are one of the five leading chronic diseases in America and Europe. Although there are legitimate sufferers of allergies on a global scale, it is not without the phenomenon of an increase in self-diagnosis. Allergists have struggled to restrict the definition to *immunologically induced hypersensitivity*, i.e. Allergic reaction. However, due to the common usage of the term it had already expanded to include a broad range of psychological and physical conditions.

In today's society, we use and exchange information and knowledge worldwide and on a daily basis. This keeps us informed about general knowledge in existence but also on expert's knowledge. While some traditional allergies such as hay fever and soap sensitivity have been in the public's general knowledge for a while, food allergies have only recently been brought into the spotlight. According to Hugh Sampson, he suggests that "While the past three decades have witnessed a major expansion in funding and the number of investigators pursuing food allergy research" (Sampson, 2016).

Food allergy affects approximately 17 million Europeans and 15 million Americans (FARE, 2017). This figure includes 3.5 million under the age of 25 in Europe and 1 in every 13 children in the USA. Although the main cause of food allergies is still indefinite, research has shown that over 60% of allergic patients are women. This is mainly down to their biological and psychological anatomy. It should be noted in this figure that "8% of people were exposed to the risk of a severe reaction due to food allergies resulting in death" (Thomson Reuters, 2011).

As stated in our introduction, the number of incidents has continually risen over the last 10-15 years despite an increase in awareness. Between 1997 and 2011, the number of children with food allergies increased by 50% approximately in US (FARE, 2017) and doubled in children between ages of 0 and 5 in Europe over the last decade. "Prevalence of allergies in children changes within Europe, with rates ranging from 1% to 7% in Greece to 4% in Italy and Spain, to over 5% in France, UK, Netherlands, and Germany." (Thomson Reuters, 2011)

The UK and Australia has shown a significant increase in children between ages of 0 and 14 being admitted in hospitals due to anaphylactic reactions over a period of 10 years. In the US, every 3 minutes a person was admitted to hospital due to a food allergy reaction (Thomson Reuters, 2011). The impact on the local economies is quite significant as it leads to large costs. It was estimated that managing food allergies cost on average each American citizen about $4,800 per year. This puts the diseases such as diabetes on the bottom of the scale (EAACI, 2016). With regard to managing food allergies in children it costs nearly $25 billion per year (FARE, 2017). This figure is based on the United States alone.

According to research conducted in the UK, 20% of the population considers themselves suffering from food allergies or intolerances. However, the real number affected is only 5% of the adult population and slightly higher percentage among children. Between 1992 and 2006, there were about 64 deaths due to anaphylactic shock from foods (World Allergy Organisation (WAO), 2010).

There are many self-diagnosed cases of food allergies that undermine the legitimacy of food allergy sufferers. "Self-reported adverse reactions to food were considerably more common in mothers from Germany (30%), Iceland, United Kingdom, and the Netherlands (all 20–22%) compared with those from Italy (11%), Lithuania, Greece, Poland, and Spain (all 5–8%)" (McBride et al., 2012: 230).

With all the evidence considered, we can deduce that food allergy is a growing health and economic issue with increasing prevalence. This dynamic is not going to change anytime soon. It would appear that increasing the awareness is also increasing the irrational diagnosis of food allergies and further blurring the line between allergies and intolerances.

Some theories about why food allergies occur are:

- Dr Isabel Skypala (Clinical lead for food allergy at Royal Brompton and Harefield NHS Foundation Trust) considers rise in pollen allergies as the reason for increase in food allergy due to the structure of protein in food being similar to tree pollen.
- Health conditions such asthma and eczema can suggest a person has food allergy.
- Change in diet of humans in modern society. The bacteria in gut are changing due to consumption of foods, which are high in fat and sugars. These diets are also low in fruits and vegetable.
- Suppressing acid reflux by consuming antacids. Potential foods with allergies are not completely digested due to lack of less acid in the stomach.

(Lee, 2014)

- Omnivore's paradox/dilemma proposes that increase in food allergies is due to the abundance of food variety, globalization and change in diets.
- Socioeconomic and education background has an effect on food allergy. There is a direct relationship between wealth and education of population and the awareness about food allergies.

(Haeusermann, 2014)

2.9 Food Allergies in Catering Sector

Between 1994 and 2006, approximately one in four food-induced anaphylaxis death happened due to food being consumed in restaurants and other food services (Dupuis et al., 2016). Therefore, food service industry plays an important role. Staff and communication between staff and consumers are crucial to mitigate the food adverse events. The absence of this can still result in adverse events even with EU regulations and Irish law.

Few important steps in the management of food allergy to reduce risks are by:

- Appropriate training of staff,
- Efforts by staff to elicit food allergy information from all consumers,
- Correct labelling of food ingredients.

Mislabelling is an important issue. In a typical bakery, 50% of food products labelled as dairy free contained dairy. Furthermore, 20% of products contained quantities of dairy exceeding the amount as labelled (Trendelenburg et al., 2015).

Use of allergy cards by restaurant consumers did not improve food service employee engagement or desire to help the consumer. Furthermore, several studies show that failure of consumers communicating their food preferences and allergies can result in adverse events (Dupuis et al., 2016).

Case Study 1 – Restaurant owner

In May 2016, the owner of Indian Garden restaurant at Easingwold, North Yorkshire (U.K.) received a custodial sentence for six years for the manslaughter of Paul Wilson (38). Paul Wilson died of a severe anaphylactic shock after consuming a curry sauce containing peanuts. Although Paul carefully managed his peanut allergy condition since the age of seven, he was unaware of the fact that his curry sauce contained nuts. Furthermore, he had not declared his allergy to the staff. As a result, no indication of an allergy was written on his order. Ultimately the restaurant staff served him curry sauce containing peanuts causing a severe anaphylactic shock (The Guardian, 2016).

The owner of the restaurant was also convicted of gross negligence of several other food safety offenses, even though at the time of the incident, he was not on premises. After further examination, it was discovered that the restaurant chefs had swapped almond powder in their recipes for peanut powder to cut costs. It was also evident that the staff was not properly trained in relation to food preparation or control and contamination measures and that the staff had also ignored many warnings from food inspectors in the U.K. with regard to customer's health and their association to food preparation and storage. Even after the death, the staff member assured a tester purchaser that they could buy a nut free curry (The Guardian, 2016).

Case Study 2 – Customer

Ben Abbott from South-West London asked for a fresh jug of water without a slice of lemon in a restaurant. The waiter brought water without any lemon in it. However, it had some bits of lemon because as soon as Ben took a sip of water his lips swelled up, was breathless, had a red face and had an asthma attack. According to Ben, the restaurant failed to provide adequate precautions to help him not have an attack even though he mentioned his condition to the restaurant.

In UK, there were about 2 million food allergy sufferers in 2014 and a substantial number have allergy from lesser-known foods. The number of food allergy sufferers has risen by 5% every year. Furthermore, more than 5,000 people are hospitalized and 10 people die due to reaction to food

allergies each year. According to Food Safety Agency, most of the cases occur due to incorrect information provided to people dining out of their home (Lee, 2014).

2.10 Technology already available:

In this section of the review, we researched and analysed the existence of some of the current and future technologies available to the consumer with regard to food allergy prediction, detection and control. We say "prediction, detection and control" because these are the main defences against allergies. They provide the sufferer with sufficient information to make informed decisions on where they would expect to be exposed to an allergen (Prediction), have already been exposed to an allergen (Detection) and what to do if they have begun to react to an allergen (Control). There were numerous websites by government agencies we researched on an international scale that provided an excellent source of information to the public regarding food allergies. One of the main issues with these websites is the accessibility of the information or the lack of it. It is for this reason that we looked specifically at the technology available to the consumer and future technologies that at the time of our research would become available to consumers. The technologies were broken down into the following two categories namely applications and devices.

2.11 Applications

Three applications were examined in this sub-section; they are MenuCal® by the Food Safety Authority of Ireland, Food Allergy Menus by Web Shoppes LLC and AllergyEats by AllergyEats INC. It should be noted that we researched multiple applications that are available to the general public and the majority of them had similar functionalities and requirements. We chose from a selection of available products based on publication date, application rating, update frequency and popularity, i.e. from a reliable source such as a government sponsored agency (FSAI) but also customised applications such as in the case of "Food Allergy Menus".

When we examined the following three applications it was necessary that we analysed their accuracy regarding information available and also their features and functionalities. Price was also considered as there are generally two mind-sets when choosing an application. Some applications were free initially and then offered in-app purchases whereas others were purchased initially and the price encompassed all the features and functions. This was also the case with monthly paid applications. Our analysis also included merits discovered while researching and other possible improvements that we felt contributed to the application and ultimately to answering our research question. During our research, we aimed to keep the question asked at the forefront of our conclusions when we analysed the applications.

MenuCal

We discovered that MenuCal is a free online tool application created by the Food Safety Authority of Ireland (FSAI). Due to the nature of the application both the Food Standards Agency (FSA) in the U.K. and Northern Ireland also use it. The application acts as both a calorie recording and food allergy advisor role and is readily available to use. It acts as public information system and has several links to other websites allowing users to seek further medical clarification as well as necessary medical advice in relation to food allergies. MenuCal allows the user to identify up to 14 different types of food allergies. As we examined it further we determined that what makes MenuCal accurate is because it was built by food professionals like chefs and it is for this reason that it is also used by chefs and people

within the catering industry in helping to identify and narrow down the chance of a food allergy/reaction.

a) Information available:

MenuCal has multiple training videos to allow the user to utilise it properly and effectively. There are step-by-step guides in setting up your own profile that will be specific to your own dietary needs and resources are available to provide further awareness of how the technology works but also about food allergies in general.

The information is sourced by the FSAI as the Republic of Ireland's main government agency responsible for food safety for the general Irish public. "We have national responsibility for co-ordinating the enforcement of food safety legislation in Ireland" (FSAI, 2016)

MenuCal relates back to the main FSAI website where more in-depth information and relevant links are available to the customer.

b) Functionality and Features:

MenuCal comes with its own user account feature that allows the user to utilise the application to its full capability.

In order to gain full access and to utilise all functions in MenuCal it was necessary to set up a user account. For this, we used a team member's email address: healyj8@tcd.ie and selected a catering business as our business choice. Once the account was created, it was ready to begin creating a dish. A dish is a selection of ingredients to create a plate of food, e.g. Lasagne. For the purpose of research and analysis, we created a generic dish containing some known allergens to demonstrate the functionality of MenuCal and how people in the catering industry could use it.

The ability to download, set-up an account and create dishes or recipes allows the user to predict, detect and control allergens in relation to their own diet or diets of their children.

c) Merits and improvements:

The FSAI website that is the core to MenuCal is a repository of useful links and information that is even used to inform government ministers. As the MenuCal application feeds off this large database the information contained on the application is extremely broad and accurate.

An improvement we discussed and agreed is a campaign of awareness to the information contained on both the application MenuCal and the FSAI website.

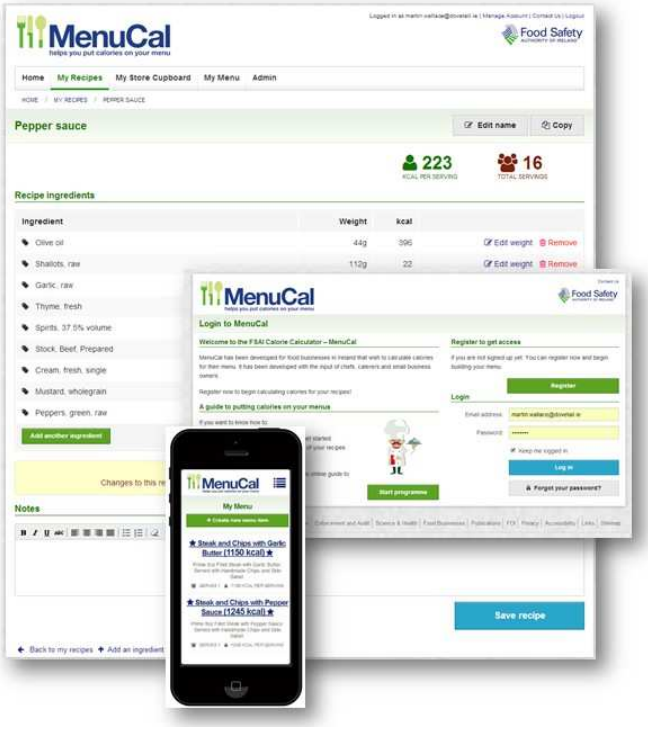

Figure 2.3 – Show the MenuCal "Create New Recipe" form (Dovetail, 2015).

Food Allergy Menus

Food Allergy Menus is an application created by family members for family members so it is significantly geared towards families. The application contains multiple restaurants where you can select the menu in PDF format providing that the restaurant actually has an allergy menu in advance. The requirements of this application mean it is dependent on restaurants to have prepared the menu in advance describing each ingredient and its potential to cause an allergic reaction. The application was originally set up for personal use but has now been upgraded for public distribution with more locations provided.

a) Information Available:

The dietary information is focused specifically on well-known family restaurants in the franchise genre such as McDonalds, Burger King, Chillis, etc. The application can be adjusted to a specific geo-location so it can work off allergy menus from countries such as the UK and Canada. The restaurants themselves provide the information and the application is only the medium that allows the user to access it. It must be noted that the information is not generated by the application; it is only handed off to the user.

b) Functionality and Features:

The application itself is limited in available features and functionality when compared with MenuCal. It allows the user to select from multiple restaurants and only achieves its main function if the restaurant provided actually has an allergy menu. The application does not build its own information or advisory information. For restaurants that do provide an allergy menu, the user can select it and download onto their mobile device for analysis.

One of the main features of this application is the ability to determine geo-location and apply specific allergy menus in relation to location.

c) Merits and Improvements:

One drawback from this application is its sourced information. The application is only as accurate as the information provided by the restaurants. It is not independently validated or verified. Another drawback is that the main functionality of the application depends on whether selected restaurant actually has an allergy menu.

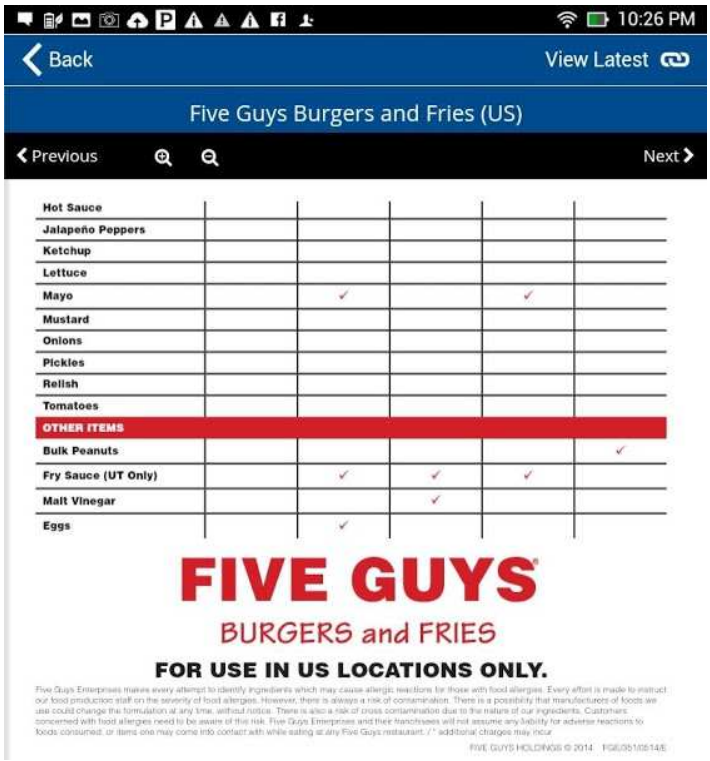

Figure 2.4 – Shows the allergy matrix for Food Allergy Menus (Google, 2017).

Allergy Eats

Allergy Eats is another application that we discovered which was purpose-built by its founder "Paul Antico" for the benefit of his own family three of whom suffered from food allergies. Unlike "Food Allergy Menus", Allergy Eats does not rely on the restaurants to provide it with information regarding allergies; it relies on the customers who visit the restaurant and from a peer-reviewed perspective. This highlights the power of social media and its ability to form online communities. The primary function of the application is to identify the restaurants that are food allergy friendly and according to their website "finding those restaurants ready and willing to accommodate our allergies" (Allergy Eats, 2017). Allergy Eats works off a list of restaurants in the U.S. using a search type feature. The user can select a restaurant from the list and select the associated allergies so they can be highlighted alongside the returned results.

a) Information Available:

The user of the application is the primary source of information for the application. The customer and user visit the restaurant and submit a review. This review either positive or negative is stored on the website and used to compile a database which is then displayed on the application or website. The application draws its primary information from the large dataset on the website. The information contained on the website is the collective opinions of the users of the Allergy Eats application.

b) Functionality and Features:

As stated earlier, the application is paired with the website and has access to all the websites information. A user can download the application and set up a user account. We set-up a user account

with the user "healyj8@tcd.ie" to further analyse the application's functionalities. From this action, we derived that like the MenuCal application, a user can create a customised account that contains the necessary flagged allergies by that person and possibly their family members. Using this user account, the user can then create reviews and submit them without moderation. They can also store their submitted reviews and favourite restaurants either locally or on the cloud. The account can be customised to their needs regarding food allergies and allergy friendly restaurants.

Allergy Eats uses "Gamification" as a feature which gives the ability to gain points for submitting a review. They are called recognition points. Similar to other forums, the more you interact with the application the more recognition points you get and ultimately the more weight and experience is added to your review for others to see.

There is a "My Favourite Restaurants" and a "My Favourite Users" feature that allows the account holder to store and monitor other users and their reviews.

The application has the ability to post on to various social media platforms.

There is a blog feature that allows users to access multiple sub-menus including personal stories, legislation, travel and restaurants.

c) Merits and Improvements:

A significant merit of this application is the "Dining Tips" tab that allows the user to access useful information regarding allergies. This drop-down menu allows the user to access further sub-menus such as "general tips", "From the Chef" or "Tips for parents of Teens" regarding food allergies.

The blog drop-down menu contains useful information as mentioned in the features above.

One limitation of this application is its geo-location. It is only orientated on U.S restaurants in the restaurant search menu but the other information, excluding the U.S Restaurant search, is quite valid internationally regarding food allergy sufferers.

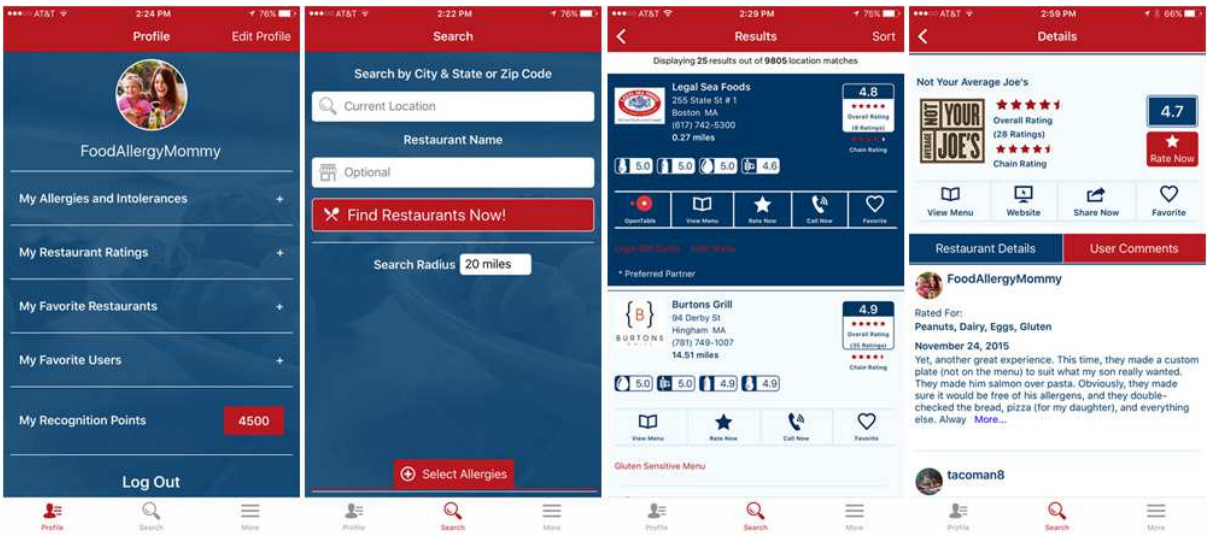

Figure 2.5 – Shows the interface of the Allergy Eats application (AllergyEats, 2017).

2.12 Conclusion on applications

Several food allergy applications were examined before we chose the above three. Over the course of the research we identified common themes and features. Of the three applications that were examined one important requirement that existed was that an application needed to be personalised and customised to the user who suffers from the allergies. A user account was necessary for thorough functionality. As the nature of allergies are unique, specific and varied to everyone the options that were available on user account set-up must be as detailed as possible to provide accurate information regarding allergy information for that specific person.

Another on-going theme we discovered was the number of applications that had been originally designed for family members initially and then spring-boarded into general public availability. We discovered that children suffering from allergies were a focus here and it appeared that the majority of applications catered for this.

Regarding successful prediction, detection and control we summarised that the applications we researched were specifically focused on prediction. The information was present to aid in the avoidance of food allergies and not so much on the detection and control of food allergies and reactions. Online applications like MenuCal that is currently paired with the FSAI main website provided useful information for detection and control but from the MenuCal applications perspective it is limited to prediction only, i.e. building your own recipe and being mindful of your own allergies while doing so. The same applied to the Food Allergy Menus and Allergy Eats applications, all of which were focused on predicting and avoiding a reaction in the first place. The Allergy Eats application did refer to detection in the form of a “what to do next” in its “Dining Tips” drop-down menu as well as in its Blog under “Dining out”. There was also a drop-down tab titled “Personal stories” that was quite informative for food allergy sufferers in relation to various situations involving reactions. However, none of it is real-time information available to the food allergy sufferer or person having a reaction.

APPLICATIONS				
Name	**Popularity**	**Information**	**Custom Account**	**Price**
MenuCal	High	Strong	Yes	Free
Food Allergy Menus	Low	Weak	Yes	$2.99 – Once off
AllergyEats	Moderate	Strong	Yes	Free

Table 2.2 – Illustrates a matrix comparison on the three applications researched.

(Results based on the Irish Nutrition and Dietetic Institute (INDI) and Apple store)

Some of the results, i.e. Popularity from the matrix were impacted by geographical location. For example, MenuCal is considered popular in Ireland yet there was insufficient evidence to support its popularity in the U.S. This was similar when comparing AllergyEats and Food Allergy Menus.

Based on our research and the matrix above, we found that MenuCal was popular and had a strong information source. It was also government funded and promoted well within the Republic of Ireland. We also found that Food Allergy Menus was the weakest application researched, even in the U.S. and it was a requirement to purchase it before it could be used.

2.13 Devices

We researched a good variety of applications available to the public aimed at food allergies and the people who suffer from them. However, in order to complete our analysis on technology available it was necessary to examine the devices available that act as successful food allergy prediction, detection and control devices. When examining these devices, it was necessary to assess the ability of these to inform the user if they will be exposed to an allergen (Prediction), have already been exposed to an allergen (Detection) and what to do if they have begun to react to an allergen (Control). Another point to note is that our research needed to expand beyond what is currently available. Our research needed to examine what was coming down the line and that would revolutionise the food allergy and technology industry. It was for this reason that two out of three devices we researched were in the later stages of concept design and funding. We felt it crucial to look to the future technologies in our research in order to fully examine the affect technology will have on food allergy awareness.

As the applications examined above this section followed a similar theme as there were multiple devices available to the general public regarding food allergy prediction, detection and control. We only picked three devices to be analysed namely the Nima Gluten Tester, the Allergy Amulet and AIBI. Our rationale behind picking these devices was based on the fact that the first device was unique in that it was specific to the gluten allergen. According to Irish health, they estimate “that between seven and nine people per 1,000 are affected, or almost 1% of the population.” (Irish Health, 2005)

Regarding the other two devices, they were picked because they are in the concept phase. In the case of the Allergy Amulet it is in the later stage of design. We felt it necessary to include them based on this fact that it represents the future technology.

Nima Gluten Tester

We found that the Nima Gluten Tester worked by pairing with an application that is downloaded on a mobile device initially so the hardware can upload its data to the user account. This is not necessary but it is a feature if you wish to keep track of all information gathered. The device can act as a stand-alone tester as it has built-in indicators to inform the user. The next step is to physically test the food you wish to test by placing it in a minute capsule. Food or liquid can be tested. The capsule is sealed and inserted into the actual tester. After three minutes a result appears in the form of a smiley face which indicates in parts per million (PPM) if it is less than 20. Alternatively, a wheat grain will appear if a significant amount of gluten is detected. The user is now aware of the content of the food in question regarding gluten levels.

a) Information Available:

The information from the device is derived initially from the test of the food it has just carried out. It will alert the user to the presence of gluten. The user can then make an informed decision. As the Nima tester has the ability to pair and sync with an application this allows the user to access further information from the test as well as the historic of the tests and view what it was that they were eating or even where they were. This identifies a tracking feature which must first be enabled by the user, i.e. informed decisions.

b) Functionality and Features:

The main function of the device is to test for the presence of gluten in a food substance. The device is small enough to be carried around in a pocket or purse. The device requires disposable capsules, which the user needs to buy as an extra. The disposable nature of them means cleaning maintenance is negligible.

The device comes with the feature of an application on the user's mobile device.

c) Merits and Improvements

The device is not without limitations. It cannot test certain food types such fermented or hydrolysed foods. Hydrolysed foods are foods that have already been chemically broken down. The device is unable to test non-food items such as knives and chopping boards.

Figure 2.6 – Shows the tri-device technique for the Nima tester (No Gluten, 2017).

Allergy Amulet

The Allergy Amulet was a concept that had so far received $1.1 million investment in research and product design. A small two-tier device allows the user to test food types by using strips that contain microscopic pores that trap food proteins to detect those. A woman called Abigail Barnes who also suffers from a serious nut food allergy has designed it to be worn in a minimalist form, i.e. as a bracelet or attached to car keys. The food substance is smeared onto the disposable strips, first tier, and inserted into the amulet, second-tier, for testing. If a nut protein is detected then the amulet will flash alerting and informing the user of the presence of the nut protein.

a) Information Available:

The information available to the user comes in the form of an alert or detection to the presence of a nut protein and ultimately the possible reaction that will ensue. The user can then make an informed decision about the food they just tested.

b) Functionality and Features:

The main function of the Allergy Amulet is to physically test the food type using specialised strips containing microscopic pores. The microscopic strips, specifically pores, only target specific food protein shapes and traps them if they are detected. It works off the principle that if the protein is trapped it therefore exists and is present in the food. The user is then alerted to this fact.

The amulet can be worn or placed in the pocket. It is designed to be minimalist and discreet by design.

c) Merits and Improvements:

This technology is only able to detect the presence of nut proteins. Although there is evidence to suggest that expansion is within the scope of the company. At present, it is specifically focused on nut allergies.

According to Anaphylaxis Campaign, an organization in the UK, they “contacted colleagues who are world experts in food testing and they expressed serious reservations about such products” (Allergy Amulet, 2016). The problem is the testing kit. Experts feel that it may not be able to test some food types and some may slip through the net. As peanut allergies are one of the more serious allergies with a large fatality rate, it is treated with the upmost importance that prediction is paramount rather than detection and control.

Figure 2.7 – Shows the Allergy Amulet set up including strips (Allergy Amulet, 2016).

AIBI

AIBI is a concept system designed to prevent anaphylaxis specifically with children. It is being created by Chip Dong Lim with the mind-set to help children make others aware of a pending reaction or onset of anaphylaxis.

a) Information available:

AIBI acts as a detecting device which firstly identifies the onset of a reaction and activates an alert to another device or series of devices. The information the device passes on is purely from an alerting point of view. The device triggers a plan such as a cue to contact the emergency services or to administer an EpiPen®.

b) Functionality and features:

AIBI works on a three-tier system. It acts as a detector, treatment advisory and communicator between the user and whoever needs to know (i.e. emergency services or guardian). The detector tier consists of a bracelet that is worn by the user and detects the level of histamines on the skin. The treatment tier consists of a medicine applicator device and the communication tier in the form of Bluetooth consists of a means to contact mobile phones and other portable electronic devices.

c) Merits and improvements:

The system is user friendly and it is designed with the child's mind-set. There are pre-determined contacts for the communication tier, in other words, a parent or guardian can be contacted as well as the emergency services. It can also have an advisory role where it would advise a course of action, including a map and directions to the nearest hospital.

The ability to change the detector in the detecting tier is useful for children to add less of a medicinal look to the device.

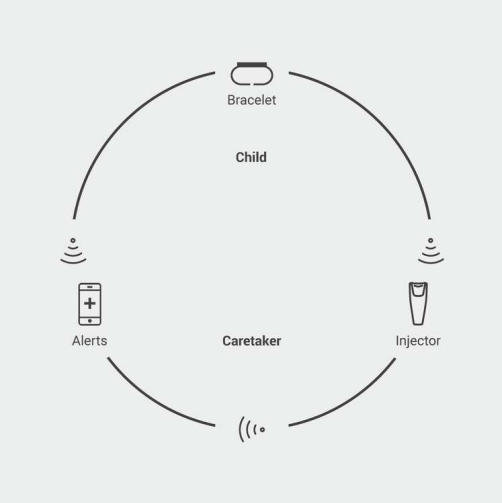

Figure 2.8 – Illustrates the AIBI process (Made by Chip, 2017)

2.14 Conclusion on devices

The devices that were researched followed the similar theme of providing awareness or an alert mechanism. Using technology and information, these devices provided an accurate way to indicate to the user that they have been either exposed or run the risk of being exposed to an allergen.

DEVICES				
Name	**Popularity**	**Information**	**Customised**	**Price**
Nima Gluten	High	Strong	Yes	279$ / 259€
Allergy Amulet (Concept)	Unknown	Strong	Yes	N/A
AIBI (Concept)	Unknown	Strong	Yes	N/A

Table 2.3 – Illustrates a matrix comparison on the three devices researched.

In relation to the Allergy Amulet and AIBI the results on the matrix are based on the information and customised features that the designers themselves have proposed the devices will have. In relation to both popularity and price, we were unable to gather conclusive results due to the concept nature of the devices. However, based on our research we found that the three devices researched were specific to an allergen such as the nut protein allergen and the gluten allergen. In their own respects and the food allergy communities they are associated with, the devices were popular (and highly anticipated). Regarding the Nima Gluten tester, according to Time magazine in 2015, it was boasted as one of the "best inventions of 2015" (Time, 2015), making it quite popular. The Allergy amulet which has now entered its final stages of completion has proposed costs as being between $100 - $300 dollars (€90 - €280 euros).

2.15 Conclusion

The literature review examined the earliest known case of food allergies from their first recorded occurrence in human history all the way to today's standard of medical knowledge of allergens and their subsequent reactions to the human immune system.

As we researched our literature we noted that food allergies have been around for a long time. Allergies have integrated themselves into today's society to the point where they are having a significant impact on people's lives. The research in our literature review was utilised to understand what exactly caused food allergies and also what technologies are available to combat them.

The researchers deducted that at the time of writing there was not enough awareness to alleviate the impact food allergies are having on today's society. This was reflected in the level of technology that was available. Considering the impact food allergies have on society there is still only a limited amount of technology available on a global level. This is surprising as it is a global issue.

The researchers examined three applications and three devices that were both available and in the concept phase. The researchers also examined what were the most important features and also what they were lacking from a requirement perspective.

At the time of writing our report, we were unable to find a price for the AIBI device. However, there is a possibility that one will be released after the conclusion of our thesis as the concept phase is quite advanced. Our researchers also noted that the technology was orientated towards children and adolescents with an aim to better inform parents or guardians of their Childs exposure to food allergens and gain a head start on a potential life threatening reaction.

The next chapter examines our approach to answering the research question.

Chapter 3 Research Methodology

3.1 Introduction

This chapter contains the approaches and methods that our team implemented to answer our dissertation question. The chapter also discusses our method of collecting data in order to provide a sound conclusion as well as our methodology of choosing a survey for our data collection.

When we decided on what the research question was going to be we aimed to formulate and design a structure around answering that question. As a team, it was imperative that we based our method design not only on the question asked but also from the literature review that was born out of it. Having a thorough understanding of the literature pointed towards the correct method that was the online survey questionnaire, SurveyMonkey®.

3.2 Research methods and literature

According to D. M. Levin (Levin, 1988) having research reasoning is vital to determining how data should be gathered, analysed and used. Choosing the correct method of researching the material is paramount. According to Saunders, Lewis & Thornhill, having a specified reasoning aid in establishing a methodology for the research (Saunders, et al., 2009) & (Shamaei, 2012).

Two major research theories have been identified according to R. J. Galliers (Galliers, 1991); these are called Positivism and Interpretivism.

Positivism can be observed as interacting with social reality and concluding your research with generalisations, similar to those produced by physical and natural scientists (Saunders, et al., 2009)

According to Seamus M. Cox (Cox, 2010) positivist research takes the view that knowledge is objective. Furthermore, mathematical and statistical analysis seems to be at the forefront of the analysis used by positivism according to G. Morgan (Morgan, 1983). It is almost impossible to mention positivism without mentioning the Vienna circle and ultimately the British philosopher David Hume. The Vienna circle was a manifesto created by some of the world's leading philosophers such as Karl Popper and Alfred Whitehead. It is considered one of the main references of positivism. It was David Hume, however, who described it as containing "nothing but sophistry and illusion" (Hume, 1910). This was due to the large volume of conclusions which lacked abstract reasoning, fact or quantification.

The fundamentals of interpretivism can be divided into two types. These are the relativists and the subjectivists. Relativist ontology sees reality as inter-subjectively and that is based on understandings on social and experiential levels whereas subjectivists maintain that people cannot be separated from their knowledge and due to this fact there is a definite link or connection between the researcher and research subject.

Interpretivism attempted to examine and explain reality from the perspective of the subject, according to Robert Gephart (Gephart, 1999).

According to Mark Saunders, Philip Lewis and Adrian Thornhill Interpretivism hypothesises that experiences and background of people are key elements in the way in which truth is perceived (Saunders, et al., 2009).

"Where positivism will often view populations at a macro level, Interpretivism is focused on the micro level, or in other words, the individual" (Mc Adam, 2013). This type of methodology does not view people from the perspective of individuals; it views them as entities within their own life context.

Assumptions	Positivism	Interpretivism
Nature of reality	Objective, tangible, single	Socially constructed, multiple
Goal of research	Explanation, strong prediction	Understanding, weak prediction
Focus of interest	What is general, average, representative	What is specific, weak and deviant
Knowledge generated	Laws	-

Table 3.1 – Displays some of the main differences between Positivism and Interpretivism (Pizam and Mansfeld, 2009)

3.3 Our Research methods and approach to answering the question asked

When we were examining the positivism and interpretivism literature we were able to derive the following two approaches from them namely quantitative and qualitative research approaches. It was important to understand the fundamental differences between each approach as neither could be excluded from our research methods.

Quantitative research:

Quantitative research is research that involves surveys, observations and secondary data such as third party account information. According to B. Kaplan and J. A. Maxwell (Kaplan & Maxwell, 1994) “the goals of qualitative research involve understanding a phenomenon from the point of view of the participant”. Quantitative research is essentially "any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification" (Strauss & Corbin, 1990). There is a broad spectrum of analysis techniques used in this form of analysis. These range from graphs and visualisations so that a statistical significance can be visualised.

Qualitative research:

Qualitative research is research that does not rely on numbers or any type of numerical data such as observations and interviews. Foolchand suggests that qualitative research is meanings derived from “the use of numbers and depicted by means of diagrams and statistical comparisons” (Foolchand, 2006).

Whereas the following research suggest that qualitative research “is predominantly used as a synonym for any data collection technique” and “data analysis procedure that generates or uses numerical data” (Saunders, Lewis & Thornhill, 2009).

After examining the two different research methods, we were able to decide what types of approaches were going to be used to examine our collected data. We isolated three approaches namely, the statistical, deductive and inductive approaches.

The Statistical approach:

The statistical approach is using statistical methods to form a conclusion. According to Magar and Sutherland, there are a number of methods that can be used in the statistical approach. Some of these include bulk statistic methods and others include linear and non-linear methods. (Magar and Sutherland, 2011)

In relation to the data gathered using our survey method, we were using bulk methods to determine correlation and trends and make an inference using the data. Inference is reaching a conclusion or result using evidence and reasoning. According to Rohde, he suggests that there are four types of statistical inferences. These are estimation, testing, interval estimation and prediction (Rohde, 2014). Estimation involves selecting a value and reporting it as an estimate. Testing involves comparing two values. Interval estimation involves selecting a region of consistent values and comparing them with observed data and the final type is prediction which involves using the observed data to form a conclusion. In our research, we used the statistical approach to derive data from our survey method.

The Deductive approach:

According to J. Wilson, deductive reasoning is concerned with developing an assumption based on existing theory and then using this theory to design a research strategy to test the hypothesis. (Wilson, 2010)

E. Babbie suggests the "Deduction approach begins with an expected pattern that is tested against observations" and then goes on to suggest about the inductive approach that "induction begins with observations and seeks to find a pattern within them" (Babbie, 2001). In our research, we used the deductive approach to add value to our conclusions and results.

The Inductive approach:

According to E. Babbie, inductive reasoning can be thought of as a "bottom-up" approach to constructing knowledge and information (Babbie, 2001). The researcher however, is required to use observations to find patterns and trends to develop an assumption that will generate a conclusion or finding. During our research, we also used inductive approach to form our conclusions.

3.4 Mixed Methods Approach

During our research, we aimed to gather our data using both qualitative and quantitative methods and answer our research question using deductive, inductive and statistical approaches also referred to as mixed methodology approach. We felt that this approach was necessary to maximise the potential of our analysis. Going forward into chapter 4 of our thesis we would apply our methods and methodology to analyse and determine correlations to form our own conclusions and ultimately answer our research question.

3.5 Literature Review

Using our mixed methodology, we conducted our search using multiple approaches such as examining relevant literature referenced in books and journal articles but also using tertiary literature sources that were also relevant to our question asked. A large amount of time was spent browsing secondary literature in the libraries provided by TCD and for our material searching the Internet. Our initial aim was to review and analyse all the information we compiled in the literature review. Our reasons for this was to gain a thorough understanding of the most current E.U. legislation and also the quantity and calibre of existing technology in relation to food allergy prediction, detection and control. We also needed to understand the impact allergies have on the public as well as in the catering sector.

During our literature review, we were able to identify where we would focus our survey questions, i.e. catering industries, general public, restaurant owners and chefs to name but a few.

We then reviewed case studies, specifically from the customer, restaurant owner and technology point of view. It was very difficult to isolate a case study that was relevant to our research question as the majority of articles we examined related to the medical aspect of allergies as opposed to the technological aspect. We were able to gain a further insight into answering our research question having identified case studies we thought relevant.

We also examined allergies from a sociological perspective in an effort to understand fully the impact allergies have on the public. We were able to determine that it is one of the five leading chronic diseases in the world, according to the Asthma and Allergy Foundation of America (AAFA, 2017).

Throughout our literature review, we were able to identify gaps in E.U. legislation that is circumvented by many food companies, i.e. the mislabelling of food items but also legislation circumvented by caterers, i.e. the omitting or generalised notices on food menus such as “may contain nuts”. In our opinion we felt that there should be a more definitive posture to labelling whether an allergen exists on a menu and not just a mere “covering themselves” action. Our research also enlightened us to how big of an issue food allergies are on a global scale.

3.6 Rationale for our chosen method

At the inception of our project proposal, we had hoped to use both interviews and surveys to gather our research data. However, this ended up not being the case due to the reasons explained below. We decided to use the online survey to gather our primary data. As our research progressed to the point where we needed to make a decision on gathering our primary data, we felt that our primary data collection option would be the use of surveys. Our decision was based on two major factors. Our first factor was the ethical committee. When we first applied for our approval we insisted on having both surveys and interviews. Using these methods, we would be able to combine a mixed methods approach to our research. Facing resistance with the ethical committee led us to factor two.

Factor two was reviewing the need for interviews. It was at this point during the research we came to the conclusion that we could gather the required and sufficient amount of data using only surveys. The need for interviews was doubling our workload because we felt that regardless of the interviews data we would be able to reach the same conclusion based on the data from the surveys alone.

A review decision on our data collection led our research team to choose the method of surveys to gather our primary data. Due to the abundance of online survey tools available free of charge, we had to find the online survey that best suited our needs. Based on our comparison matrix below, as well as the familiarity of our team with this tool we decided that SurveyMonkey® would be best suited to our needs.

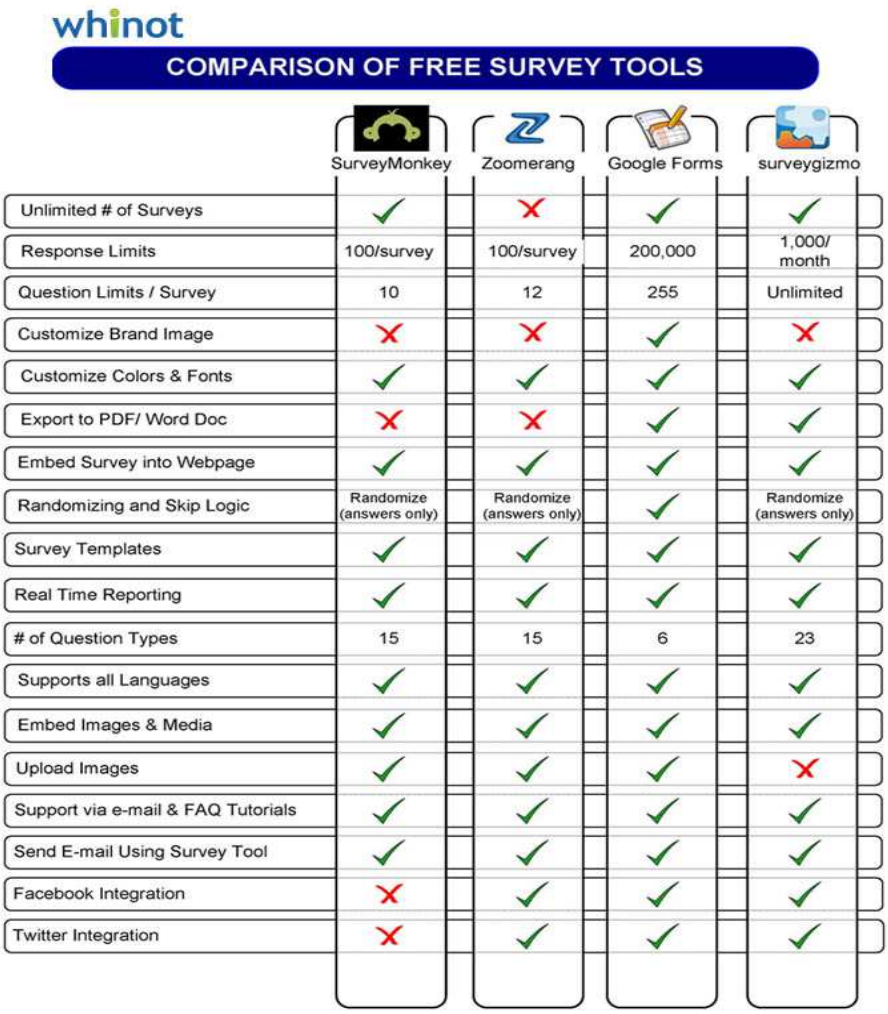

Figure 3.1 – Displays our online survey comparison and justification for our choice of SurveyMonkey® (Whinot, 2016)

The online survey was a valuable tool to gather our primary data but there was also a bittersweet element to using a tool like this. It was necessary to understand the advantages and disadvantages while utilising it so we could avoid pitfalls in implementing it. While an Internet based questionnaire can provide flexibility and ease, it can also bring disadvantages for the researchers in terms of data quality, i.e. Anonymity

Pros of online survey:

1. Ease of access

Participants can access the survey in their own time and suitability. They can also complete the survey in a location of their choice. The survey can be posted on social media to amplify the distribution methods. Participants have access to the survey regardless of their geo-location around the globe.

2. Costs

The majority of online surveys are free with the exception of a few. Extra features to aid distribution and analysis come with extra costs.

3. Data

Online surveys facilitate the set up and configuration of a tailored questionnaire to suit researcher's line of questioning and facilitate the handling and storage of data. This is an important fact when abiding by the ethical committee's standards of data protection.

4. Quality

Due to the nature of online surveys, participant's answers can be reviewed by themselves before submitting the completed questionnaire.

5. Design and lay out

We felt it was necessary to create a user-friendly survey to keep the participants engaged. If participants were prepared to give up their own time to complete the survey, it was only fair to make it user-friendly and easy to use. The online survey tool we used, SurveyMonkey® allowed us to achieve this with our surveys.

Cons of online survey:

1. Relevancy

One of the biggest disadvantages of the survey was that they were Internet based and the accuracy of the answers can sometimes be skewed especially if an open question was asked.

2. Genuine participants

We had to consider that when posting via social media, there was a potential for non-targeted audiences to complete the questionnaire.

3. Nature of the answers

We also noted that some participants may decide not to answer a particular question resulting in blanks that can affect the overall analysis of the data gathered.

4. Commitment

We were under no illusion that some of our targeted audiences may receive an invitation and decide not to take part and in some cases refuse to take part unless there was an incentive, i.e. Book token.

5. Reaching

Although our surveys were spread across all of the team's social networks as well as the re-sharing by some of our family members and friends we found it hard to actually reach and convert a view into a survey answer. Some of the social media were more effective than others, but the emails proved to be even more effective as the number of answers following emails sent used to peak within a few hours of being sent.

3.7 Method of collecting our primary data

Our method of collecting our primary data was online surveys, specifically SurveyMonkey®. As researchers, we felt that SurveyMonkey® provided the necessary platform to both gather our data and if necessary display it with the use of visual aids. We made a decision based on what tool was best to produce the visual aids depending on if they supported the findings and only used them if they were relevant. During finding and analysis stage of our research we decided not to use the graphs generated automatically by SurveyMonkey® due to the lack of personalisation. We wanted to visualise the data using our own representations and colour schemes.

SurveyMonkey® incorporated two features of calculation that we were particularly interested in for analysing our data. These features were margin of error and confidence level.

Margin of Error:

The margin of error feature allowed us to know how much error surrounded a measure. It is displayed as a percentage and allowed us to visualise how much of our sample is likely to deviate from the total population.

It was important for us to minimise the margin of error to increase our accuracy at a given confidence level. To achieve this, we needed to have a large sample size as the larger the sample we could collect meant the lower the margin of error and ultimately the more representative our results were likely to be.

We used the recommended 95% confidence level with the recommended ±5% margin of error. Incorporating this into a survey run over 100 times the response would be somewhere between 50% and 60%.

Confidence Level:

The confidence level told us how reliable a measure is. The recommended standard used by the majority of researchers was between 90% and 95%.

A 95% confidence level meant that if we were to run our survey over 100 times, 95 times out of 100, our measure would intercept the margin of error and fall within it.

During our analysis, we had to calculate the sample size using the following formula:

$$\frac{\frac{z^2 \times p(1-p)}{e^2}}{1+\left(\frac{z^2 \times p(1-p)}{e^2 N}\right)}$$

Figure 3.2 – Sample Formula (Survey Monkey, 2017)

The z-score represented the standard deviations our proportions were from the mean.

Confidence Level	z-score
90%	1.65
95%	1.96
99%	2.58

Table 3.2 – Confidence level and score (SurveyMonkey®, 2017)

3.8 Random sampling and central theorem

We used the method of random sampling when choosing our participants. Random sampling is taking a small group from a much larger group or a sample from a population. This sample is randomly chosen, hence the name, random sampling. We also needed to understand the central limit theorem which states that the distribution of sampling in relation to a statistic will be normal only if the sample size is large enough.

Therefore we ensured that our random sampling was large enough to achieve this theorem.

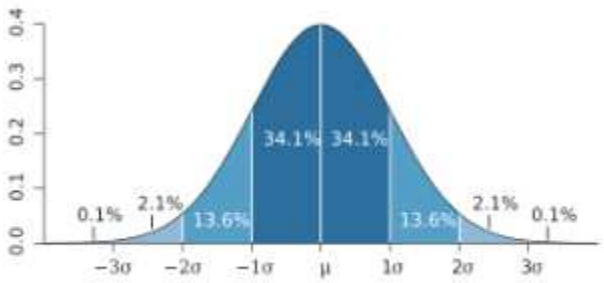

Figure 3.3 – Displays the central theorem graph (Fong, 2008)

3.9 A brief description of the survey

We decided to create two different surveys in order to clearly dissociate the two target groups we wanted to hear from; Raising Food Allergy Awareness from the Customers' perspective and Raising Food Allergy Awareness from the Caterers' point of view.

The first survey, aimed at the customers, has a series of 16 different questions, 9 of which will not be presented to customers not suffering from any food allergies, in order to avoid skewing our data and wasting the participant's time.

Through our carefully chosen questions, we wanted to investigate the following points (amongst others):

- What is the level of awareness regarding the recent EU legislation about Food Allergies?
- Get a feel about trust customers give to restaurant regarding the menus' information
- Is there a market need for a service, which would help identifying dietary allergens?
- What type of technology would customer prefer using to inform him or herself?
- What would the impact be in helping the customers that way? (Increase in restaurant visit frequency, saving time, increase of comfort)

The second survey aimed at the catering staff (anyone working in the catering business) has a series of 11 questions, which would help us understand the following points:

- Does the current lack of information inhibit staff from creating new dishes?
- How much time and effort is spending by listing and identifying allergens on a given menu?
- What systems are currently being used?
- How knowledgeable and careful is the staff regarding allergens?

We refrained from using open questions such as "Would you have any comments or suggestions?" due to the Ethics Committee's remarks.

We meticulously chose our questions ensuring that it would take no more than 5 minutes to fully read, understand and answer avoiding any misinterpretation for all of the available questions.

3.10 Survey distribution

Our surveys were conducted using SurveyMonkey® and distributed via social media and email. We hoped to acquire samples from our targeted demographics. In this regard customers were selected due to their nature of being a customer to the catering business.

Our sample demographic was the following:

- Who may be contacted by us during fieldwork/data collection, e.g. in seeking access to research population or a gatekeeper?
- How we will contact them?
- Our expected sample size and composition.

In relation to our expected sampling size, we determined the following would suffice:

- Customers, catering employees.
- TCD Group Mail, Social Medias (Facebook, Twitter, LinkedIn).
- 150 customers, 50 catering staff (chefs, service staff and owners).

Our surveys were estimated not to exceed 2 minutes in duration.

3.11 Best times to post on social media

We aimed to use social media to get the greatest amount of responses for our survey. To achieve the desired responses and reach the targeted profile we profiled our targeted audience based on their home and work commitments, mood, optimal days/times to contact them and various platforms they interact with. For example, people tend to use Facebook more when they are happy and as a result a 10% increase can be gauged in its usage. Furthermore, LinkedIn had the lowest engagement on Mondays and Fridays due to either people returning to work after the weekend or wrapping up their work before the weekend starts. (Kolowich, 2016)

Social Media	Place of Access	Best Time to Post
Facebook	Work and Home, Mobile & Desktop	Saturdays & Sundays: 12pm to 1pm Wednesdays: 3pm to 4pm Thursdays & Fridays: 1pm to 4pm
Twitter	Work and Home, Commutes & Breaks	Mondays Through Fridays: 12pm to 3pm Wednesdays: 5pm to 6pm
LinkedIn	Working hours	Tuesdays: 7:30am to 8:30am - 10am to 11am - 12pm - 5pm to 6pm Wednesdays: 7:30am to 8:30am - 12pm - 5pm to 6pm Thursdays: 7:30am to 8:30am - 12pm - 5pm to 6pm

Table 3.3 – Displays the best times to post matrix (Kolowich, 2016)

Although the research was based on United States audience, we saw a similarity in pattern in the behaviour of our target audience.

Due to the relatively low number of participants to our surveys we decided not to focus solely on the social media but also asking anyone by email and word of mouth to spread our surveys as much as possible. We asked the help of colleagues at work and classmates at Trinity College Dublin to help us disseminate our surveys. We also asked some of the following communities to share our survey around; Coeliac Society, Food Safety Authority of Ireland (FSAI), Restaurant Association of Ireland (RAI), HSE, Anaphylaxis Ireland, Irish Hotel Federation and Irish Vintners Association (IVA).

3.12 Timeline of the Ethical Approval

06/11/2016 (Sunday): 1st Submission to Ethical Committee

09/11/2016 (Wednesday): REC Admin Amendments Required: The committee refused the submission due to the form being “incomplete”. Indeed it was missing Howard’s signature.

25/11/2016 (Friday): 2nd Submission to Ethical Committee

06/12/2016 (Tuesday): REC Admin Amendments Required: On the same day as the second submission, we received an email from Una O’Malley asking us to clarify if we were part of the “School of Computer Science” hinting at the fact that we may have used the wrong form. We lost a few days explaining that the application had to be cancelled on the portal in order for us to be able to re-issue it. We also assumed that no consent form had to be filled in as we would not be surveying minors.

07/12/2016 (Wednesday): 3rd Submission to Ethical Committee

14/12/2016 (Wednesday): REC Amendments Required: Some issues remained on our form such as:

- We had ticked that we would not be making recordings while we later on wrote that we would.

- We stated that the identity of the participants to the interview will remain anonymous and later on in the proposal indicated that we would make sure that any results will be anonymised. This causes some confusion in the committee but our intention was to clearly highlight the fact that there would be no way in identifying any participants.
- The committee questioned the fact that the questions of the interviews will be identical to the ones of the survey with a special attention regarding the "Any Comments / Opinions box". They also questioned how we would select people to be interviewed.
- The initial mention of reviewing an Application had not been removed from our proposal, which created confusion.
- The informed consent form was missing the mention that "the results will be published in a final year project report".
- They questioned how we would gain access to the contacts of the likes of the doctors, HSE, FSAI.
- The "<>" symbols in the inform consent form were not necessary.

16/12/2016 (Friday): 4th Submission to Ethical Committee

06/01/2017 (Friday): REC Amendments Required: The committee felt that we did not address correctly the points 2, 3 and 6 of the previous submission. They also advised us to highlight the changes made in the future submissions for ease of assessing it. We also decided to include the first page with our comments regarding the points made by the committee in order to explain our thoughts. We also decided not to interview the likes of the Doctors, HSE and FSAI.

07/01/2017 (Saturday): 5th Submission to Ethical Committee

11/01/2017 (Wednesday): REC Amendments Required: Although the 3 previous points had been addressed, the committee felt that we included some new aspects which required clarity. The committee misread that "the interviews will take place at the interviewer's convenience", but this was not written in our proposal. The committee was also wary regarding our "door-to-door" recruiting technique for the interview. We then decided to abandon the interviews section in our application in order to have it accepted faster. We also had to include the links to the surveys.

12/01/2017 (Thursday): 6th Submission to Ethical Committee

20/01/2017 (Friday): Approved: All issues had been addressed, but some changes needed to be made in the survey, such as making all questions optional and adding a sentence saying all questions are optional which should appear on the screen of the questionnaire.

From the first submission date to the approval date, this process took 75 days, or 55 working days, or just under 11 weeks or 2 months and a half to be approved. This proved to be a very frustrating experience as from one submission to another, there was no deep reviewing or feedback made by the committee. The committee took respectively: 3, 11, 7, 21, 4 and 8 days to answer each of our submissions. We strived to answer the committee as fast as possible in order not to delay the process except for our first re-submission which took us 16 days to understand what the issue actually was. Our four other re-submissions took much less time with respectively: 1, 2, 1 and 1 day to resubmit our proposal following the amendments requested by the Committee.

Lessons learned from the ethical committee:

Going forward we felt it necessary to include lessons learned in respect of our struggle with the ethical committee. As a team and for other teams in the future we felt perhaps more attention to detail on our part was required. We fully understood the standards and quality that the ethical committee in Trinity College Dublin must uphold and it was for this reason we came away from the situation with a positive outlook.

3.13 Tools used

We decided to use the same tools as in our second-year project due to their effectiveness and the lessons learned.

The following is a list of the tools we used to produce our thesis:

- Slack: Although our primary means of communication was via team meetings we also used the Slack collaborative software. Slack was our main point of communication when we were not having our team meetings. What was unique about Slack was its ability to create different channels that were specific to elements of the thesis such as introduction and literature review. We found it very beneficial and user friendly to operate.
- Email (Gmail): To communicate with each other as well as with our supervisor.
- Google Drive / One Drive: Cloud storage application which allowed us to work on documents collaboratively.
- SurveyMonkey®: For gathering the responses of our survey.
- MS Excel: for the analysis of our dataset.
- MS Word: for the redaction of our thesis.

3.14 Limits of methodology

Following a recommendation from the Ethical Approval Committee we had to turn each of the questions of the surveys from Mandatory to Non-Mandatory. This change had a knock-on effect on the Customer survey question number 2: “Are you suffering from any food allergies?” When selecting “yes” to this question the user would then be redirected to a second page where more questions specific to allergies would be asked. By changing this specific question to non-mandatory resulted in a bug on our survey at SurveyMonkey® that led the user who had answered “No” or “Unsure” to respond to questions that were meant for the food allergy sufferers. This led us to discard the first 24 responses due to lack of relevance.

We also noted half way through the survey that SurveyMonkey® offered the option to create multiple hyperlinks (URLs) leading to the same survey. This way we could have created a different URL to be shared on each of the different Social Medias that would have been helpful in understanding which social media had the highest impact on reaching the participants.

In an effort to amplify our participants we asked the Secretary’s office of Trinity College Dublin to distribute our survey to the whole of the college, however, we realised we had not used the right channel. This led to the issuing of a formal apology our actual intentions. Following this misunderstanding, we decided not to insist on this course of distribution and avoided the distribution of our surveys to the whole of Trinity College Dublin.

3.15 Conclusion

Our research background on the question asked led us to use a survey (SurveyMonkey®) and mixed approach (deductive and inductive) when analysing our data. We felt that the questions asked during the survey would aid us in answering our research question but we would also have to analyse the answers specific to customer and chef. This was one limitation.

Our research team had to gather as much literature as possible and refine it so it supported our examination into our research question. We needed to examine current and future technologies to determine if they were both effective and proactive in creating awareness for food allergy sufferers. In other words, we needed to justify our research.

Our decision was to use only online surveys to gather our data. We did not use interviews. The online surveys were designed to answer our research question.

Chapter 4 Analysis and findings

4.1 Introduction

During the planning phase of our thesis, our research team had decided that the best way to infer that technology could increase awareness would be by addressing the public. We felt that in order to achieve this goal and gather our primary data would be through the use of an online survey or questionnaire. During the research methodology phase of our thesis we drafted and published our online survey using social media.

The primary objective of an online survey is to extract data from a targeted audience whose opinions matter to the research. This is precisely what we set out to do and precisely what transpired. We also needed to extract what was relevant to our study and omitted what was not. This was done through extensive analysis of our data once we had closed the survey.

When we were drafting the questions for the survey we decided on creating two separate sets of questions, one for the customer and the other for the caterer. We felt that this was necessary due to the complexity of opinion that might occur between the caterer as a service and a member of the public as a customer, i.e. creating the dish rather than just eating it. As a team, we decided on a two-survey approach and implemented it going forward.

4.2 Results – Data Cleansing

After we cleansed the data we had a total of 163 valid votes. We had to delete 1 result due to it being spoilt with insufficient data and being incomplete. We also had to process our dataset to ensure that all answers were accurate and made common sense, i.e. no outliers. For example, we deleted any record if the answer was “If so, how much? (Monthly)” and if the participant answered “No” to the question, “Would you be willing to pay for a service that would aid you in identifying dietary allergens?” Lastly, we deleted any answer if the user answered “No” or “Unsure” to the question “Are you suffering from any food allergies?” Furthermore, we had to ensure the Ethical Committee’s request to set each question to non-mandatory as it resulted in a bug on our survey at SurveyMonkey® that led to disabling certain questions if the user had answered “No” or “Unsure”. However, this resulted in us collecting responses focused on food allergy sufferers.

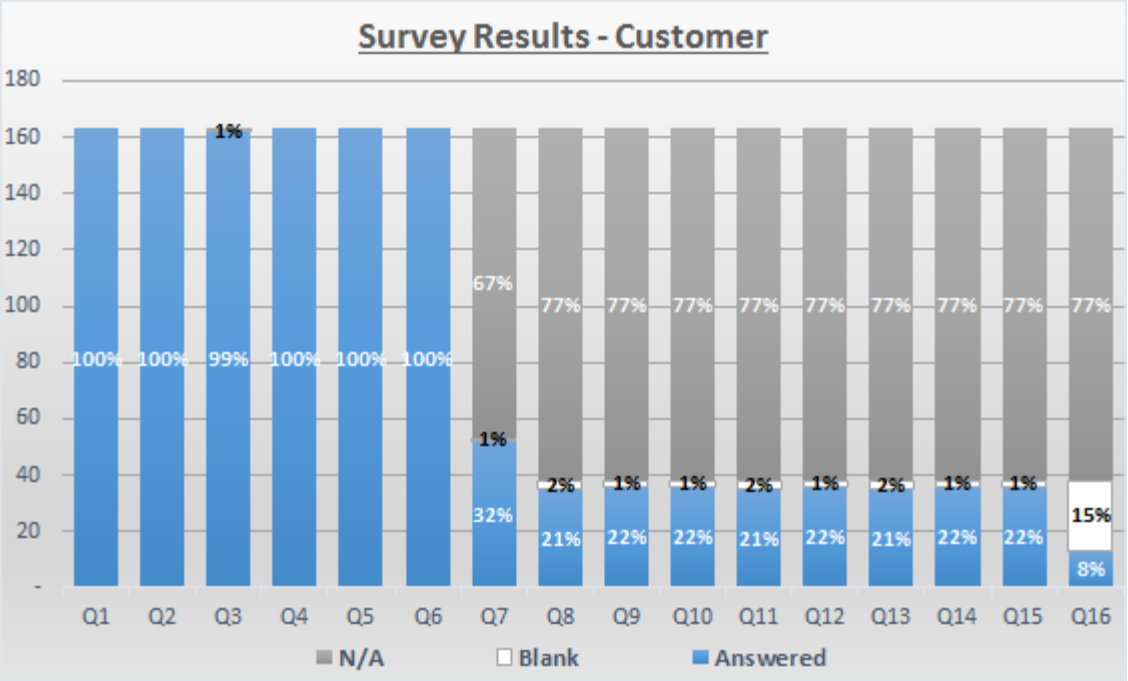

Figure 4.1 – Chart Customer Results

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	TOTAL
Answered	163	163	162	163	163	163	52	35	36	36	35	36	35	36	36	13	**1,327**
Blank	-	-	1	-	-	-	1	3	2	2	3	2	3	2	2	25	**46**
N/A	-	-	-	-	-	-	110	125	125	125	125	125	125	125	125	125	**1,235**
TOTAL	**163**	**163**	**163**	**163**	**163**	**163**	**163**	**163**	**163**	**163**	**163**	**163**	**163**	**163**	**163**	**163**	**2,608**

Table 4.1 – Customer Results Table

4.3 Results – Customers

Confidence Level and Margin of Error for the survey

In July 2016, the population of Ireland was approximately 4,952,473 (CIA World Factbook, 2016). Furthermore, in Ireland there were 5% of children and 3% of adults that were affected by food allergies (Hyland, 2012). This gave us an estimated number of food allergy sufferers in Ireland, which is of 170,000.

If we take this number as our size of the population and 163 surveyed as our target size, we have 8 % as a margin of error with 95% likelihood that our sample accurately reflects attitudes of those surveyed.

1) Are you aware of the EU food allergy regulation effective since Dec 2014?

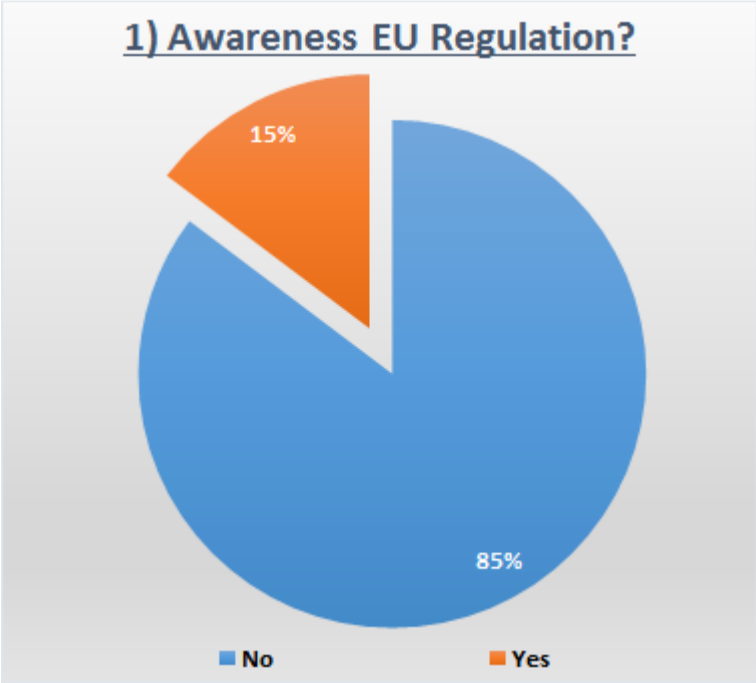

Figure 4.2 – Awareness pie chart

Are you aware of the EU food allergy regulation effective since Dec 2014?	
No	139
Yes	24
TOTAL	**163**

Table 4.2 – Awareness table

Only 24 respondents claimed to be aware of the EU food allergy regulation effective since December 2014. This represented only 15% or about 1 in 7 people responding positively to this question.

The level of awareness regarding this EU regulation increased from 15 to 29% where the respondents clicked "Yes" to the question "Are you suffering from any food allergies?" This indicates that food allergy sufferers were better-informed regarding food allergies in menus possibly due to their condition. Even though the regulation was enacted in December 2014, 85% is a huge number of people who are unaware of their right to be informed about legislations. The food laws should be advertised more so that consumers are made more aware of their legal rights. This spread of information should also help the consumers in the catering sector in ensuring that their consumer's rights are not being violated.

2) Are you suffering from any food allergies?

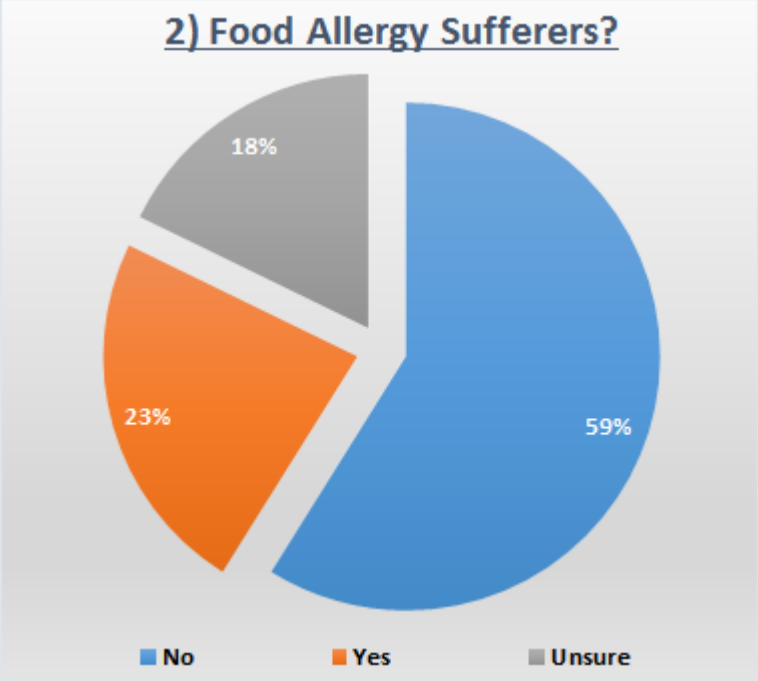

Figure 4.3 – Pie-chart of food allergy sufferers

Are you suffering from any food allergies?	
No	96
Yes	38
Unsure	29
TOTAL	**163**

Table 4.3 – Table displaying food allergy sufferers

While nearly 1 in 4 people who responded to our survey claimed to be suffering from a food allergy, it was interesting to note that only 1 in 5 people were unsure if they were suffering from food allergy.

Although there was roughly 3% of the adult Irish population suffering from food allergies (Hyland, 2012) at the time of writing this report, our sample had 23% suffering from food allergies due to our targeted efforts to reach as many food allergy sufferers as possible. It seemed that the food allergy sufferers felt more concerned to answer this survey as they felt it was relevant to them and they wanted to have their voices heard.

This highlighted the fact that there was a real concern about the level of awareness regarding allergies as well as the bonus of finding some effective and expedient techniques to diagnose the condition.

In order to raise awareness regarding food allergies, “unsure” population should consult a doctor to receive an exact diagnosis about their condition.

This “unsure” population could be worth further investigation.

3) Are you concerned about the accuracy of information on a menu regarding dietary allergens?

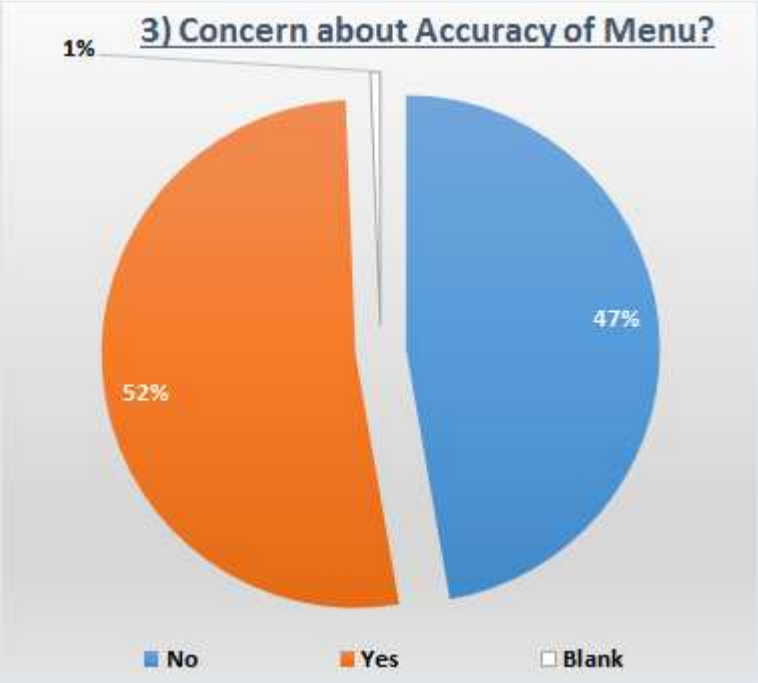

Figure 4.4 – Pie-chart displaying accuracy concern

Are you concerned about the accuracy of information on a menu regarding dietary allergens?	
No	77
Yes	85
Blank	1
TOTAL	**163**

Table 4.4 – Table displaying accuracy data

A little over half of our surveyed population was concerned with the accuracy of information regarding allergens on the menu. However, when narrowing this question down to the food allergy sufferers the percentage of concerned people goes from 52% to 79%. The population that was unsure about their allergies answered positively to this question by 48% and the non-allergic population answered positively by 43%.

In our opinion, these statistics showed that people with food allergies take the information about food very seriously. It could be a personal choice as it is a matter of life and death for them. However, the lack of concern among people who were not allergic is worrying. As a society, we should be able to receive information regardless of our medical condition.

4) Whose responsibility, do you think it is to inform about allergies?

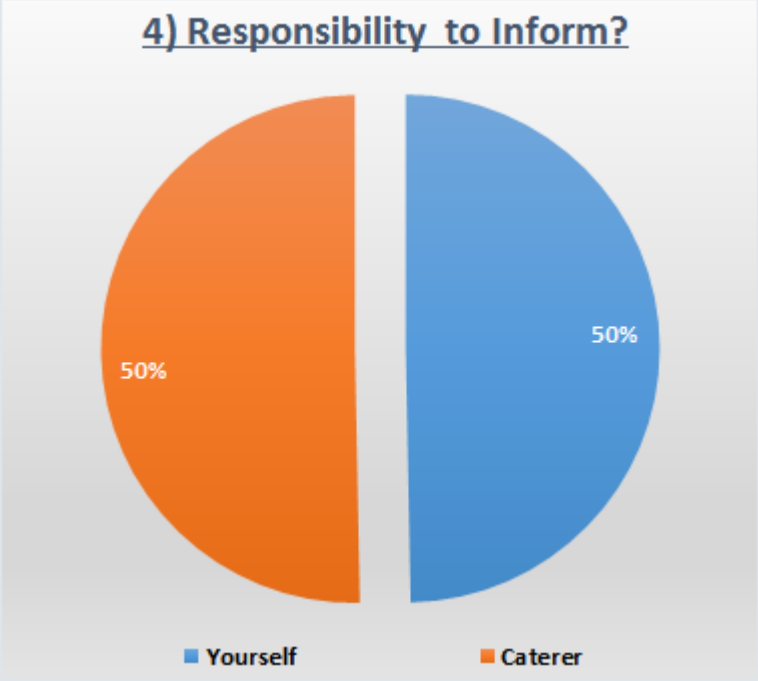

Figure 4.5 – Pie-chart displaying responsibility

Whose responsibility, do you think it is to inform about allergies?	
Yourself	81
Caterer	82
TOTAL	**163**

Table 4.5 – Table displaying responsibility

The responsibility to inform appeared to be residing equally on the both the respondent and the caterer. However, when taking into account only the food allergy sufferers the responsibility increased towards "Yourself" by 53%. 62% of the respondents who answered "Unsure" believed that it is the caterer's responsibility to inform about allergies. 55% of non-food allergy sufferers believed that it was up to the sufferers themselves to be aware of the allergens on a menu.

Even though there is legislation since 2014 which states that the caterer is responsible for imparting this information, there is no consensus among the public regarding who should be responsible for providing information about food allergies.

5) How frequently do you eat out (per week)?

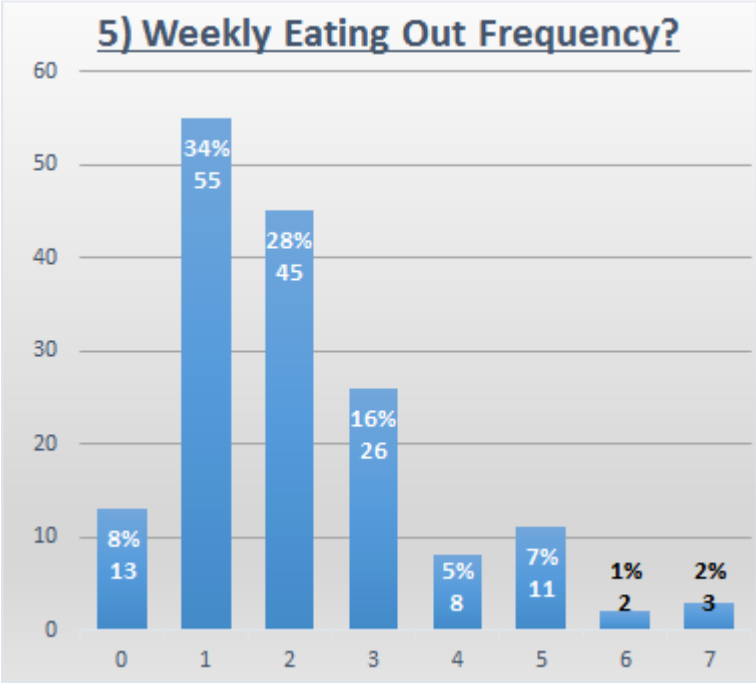

Figure 4.6 – Bar chart displaying frequency of eating out

How frequently do you eat out (per week)?	
0	13
1	55
2	45
3	26
4	8
5	11
6	2
7	3
TOTAL	**163**

Table 4.6 – Table displaying the results of eating out

According to our results, 92% of our sample eat-out at least once a week with over one-third of them eating out only once a week. Considering the food allergy sufferers from those surveyed, the trend followed the same pattern with 5% never eating out, 39% once a week, 29% twice a week and 21% three times per week. The average eating out frequency of all the respondents was 2.1 times per week.

This led us to believe that the frequency of eating out does not decrease even if people are suffering from food allergy as thought previously.

6) Would you be willing to pay for a service that would aid you in identifying dietary allergens?

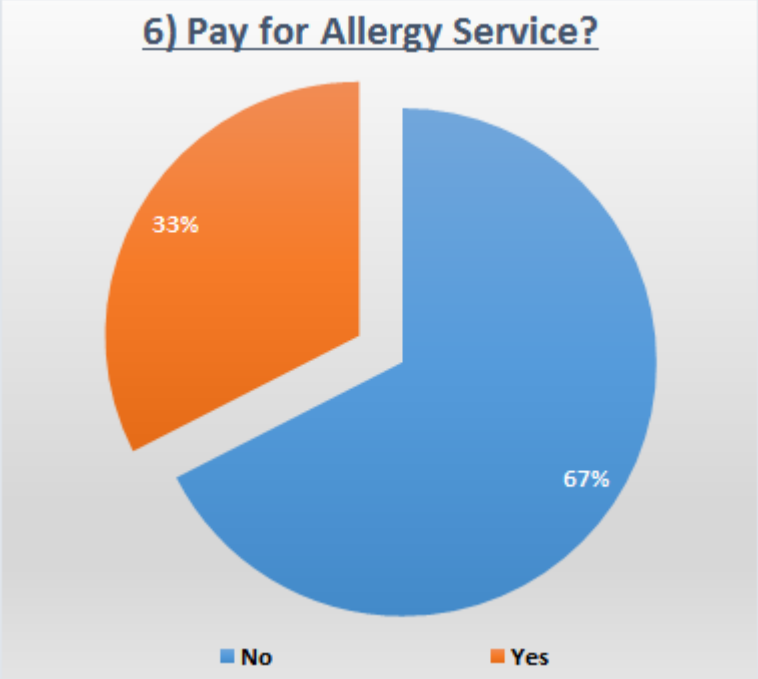

Figure 4.7 – Pie-chart displaying the responses to Q6

Would you be willing to pay for a service that would aid you in identifying dietary allergens?	
No	110
Yes	53
TOTAL	**163**

Table 4.7 – Table displaying the data

Only one third of the surveyed population would be willing to pay for a service that would aid in identifying dietary allergens. However, this number increased to 55% when only considering the responses of the food allergy sufferers. An interesting finding was that about 25% of the non-food allergy sufferers would be willing to pay for such a service with 28% for the unsure population.

As 59% of the respondents from our survey did not suffer from dietary allergens this indicated that willingness to pay was affected by the mutual interest of the person and whether he/she suffered food allergies.

Few other reasons could be:

- They receive enough information from websites and other forms of media.
- Their willingness to pay nothing.

7) If so, how much? (Monthly)

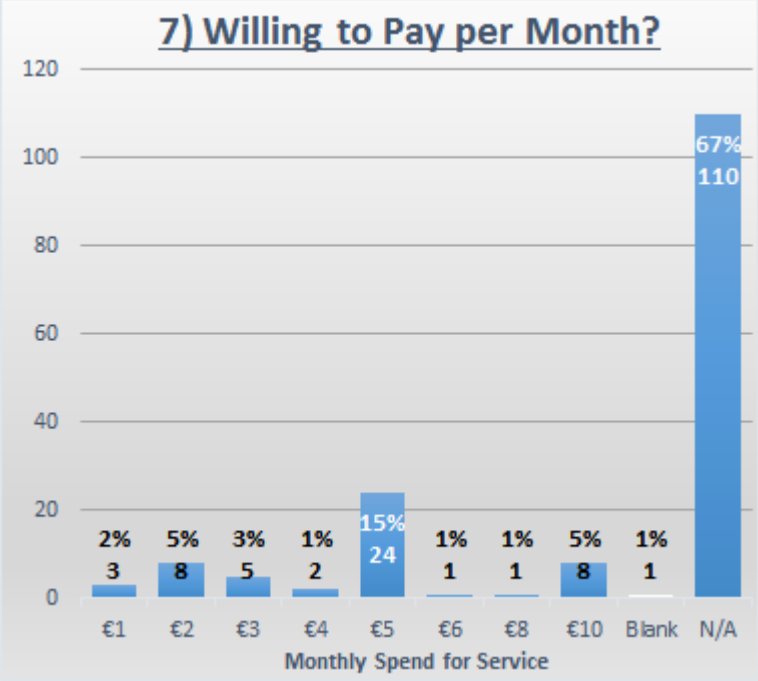

Figure 4.8 – Bar chart displaying monthly pay

If so, how much? (Monthly)	
1	3
2	8
3	5
4	2
5	24
6	1
8	1
10	8
Blank	1
N/A	110
TOTAL	**163**

Table 4.8 – Table displaying the data

15% of the participants surveyed were willing to pay €5.00 for a service that would be able to provide more information about allergies. The average monthly pay of all the answers was €4.92.

This figure was interesting because most of the technology we researched was free.

Of the respondents who had food allergy 55% would be willing to pay for a service which would help them identify allergens on a menu. 8% of these would be willing to pay €10 per month while 32% would pay €5 per month.

Of our entire sample, 110 were labelled N/A due to these respondents answering "No" to the question number 6. As we continued with our analysis it was noted that the remaining results were from people who answered 'yes' to suffering from food allergy. As the majority of technology, we reviewed was free, it would appear that there is a market for a paid service to provide information about food allergies.

8) Do you always carry medication for your allergy?

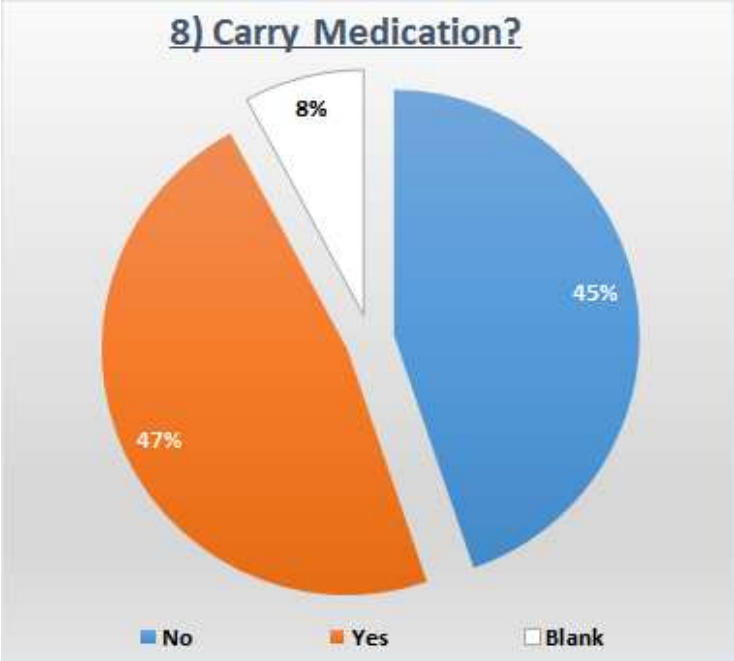

Figure 4.9 – Pie-chart displaying the responses to Q8

Do you always carry medication for your allergy?	
No	17
Yes	18
Blank	3
N/A	125
TOTAL	**163**

Table 4.9 –Table displaying the data

According to our results, there was an equal split between those who carry medication and those who do not. 47% of those who replied to the survey always carried medication for their condition. Surprisingly 45% did not carry any medication for their condition. We felt that this figure highlighted the purpose of our study in a positive light. Awareness of medication needs to increase in order to avoid a repeat of the tragic story of Emma Sloan. On December 18th 2013, Emma died on the streets of Dublin after suffering allergic reaction from peanuts (O'Keeffe, 2013).

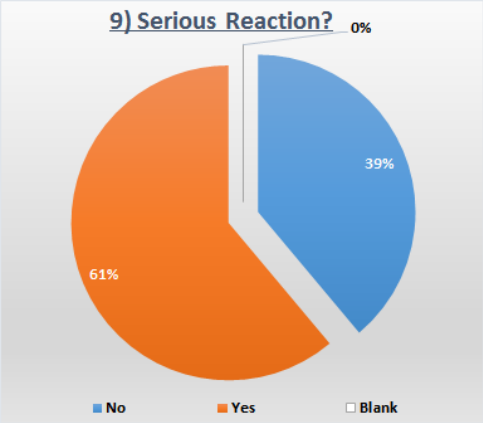

Figure 4.10 – Pie-chart displaying the responses to a serious reaction (Q8)

When focusing on the respondents who always carried medication, we found that nearly two-thirds (61%) of them had already suffered a serious dietary allergic reaction. Hence, people are more prudent about carrying medication with them after suffering a serious reaction.

9) Have you ever had a serious reaction (that needs attention) while eating out?

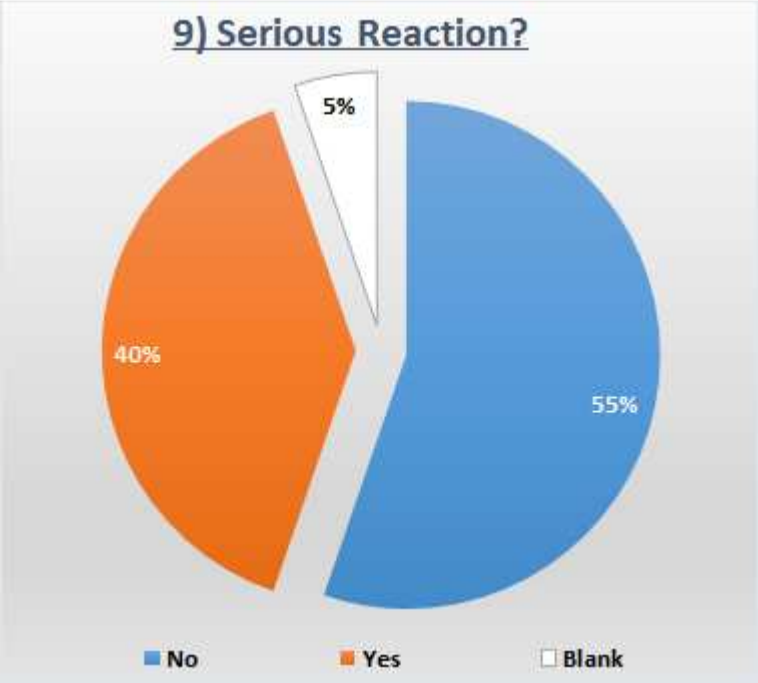

Figure 4.11 –Pie-chart displaying the responses to Q9

Have you ever had a serious reaction (that needs attention) while eating out?	
No	21
Yes	15
Blank	2
N/A	125
TOTAL	**163**

Table 4.10 –Table displaying the data

Of our surveyed sample who suffer from food allergy, 55% never had a serious reaction. However, 39% of the respondents had to receive medical attention due to a serious reaction. We noted that this figure was quite high and in respect of our literature review. We also noted that most of the people are self-diagnosed for food allergy and are also unable to differentiate between food intolerances and allergic reaction. Perhaps there should be a criterion to measure the seriousness of the reaction?

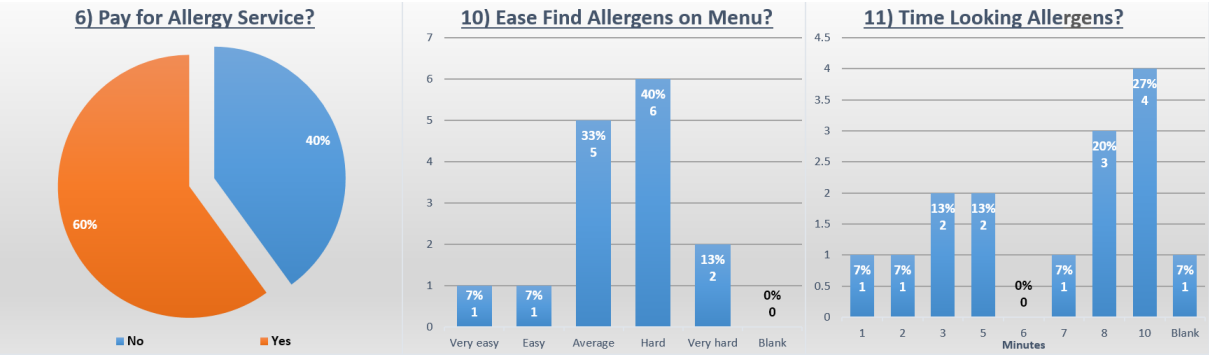

Figure 4.12 – Displays our cross-correlated data of three questions asked and their results.

When analysing the answers of those who already suffered a serious allergic reaction while eating out, we found that they are more likely to pay for a service that would help them identify allergens on a menu. This can be highlighted by the fact that they find it harder to find the information they are looking for on a menu, as nearly 50 of them spend over 8 minutes searching for allergens.

This will ultimately have a negative effect on their eating out experience. *See figure 4.12.*

10) <u>On a scale from 1-5, how easy do you find it to check for your allergies on a restaurant menu?</u>

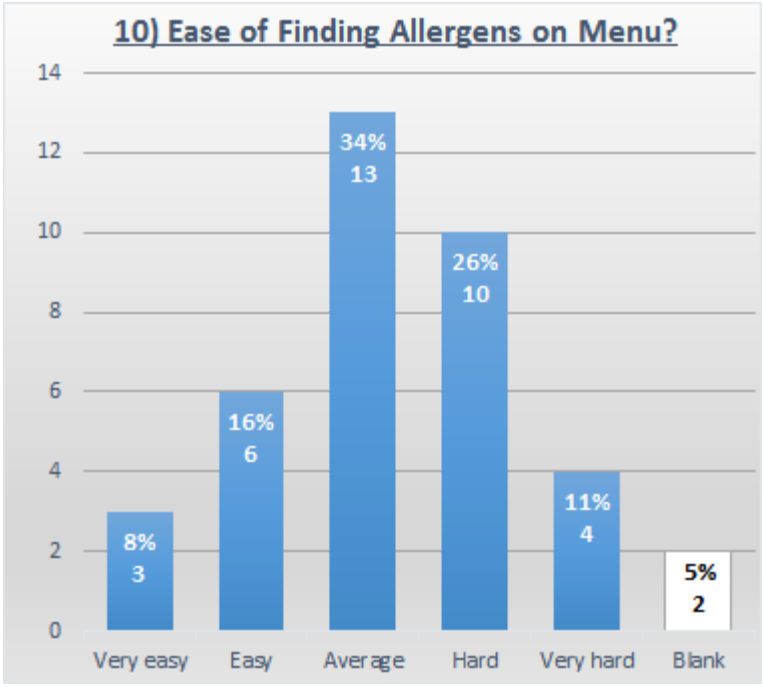

Figure 4.13 – Bar chart displaying the responses

On a scale from 1-5, how easy do you find it to check for your allergies on a restaurant menu?	
Very easy	3
Easy	6
Average	13
Hard	10
Very hard	4
Blank	2
N/A	125
TOTAL	**163**

Table 4.11 – Table displaying the data

Most of the food allergy sufferers from our survey used little effort when searching for dietary allergies, as it may not concern them. The difference between those who found it hard and very hard was 26% and 11% respectively. We were surprised at the number of sufferers who found allergies listed on the menu ranging from “easy” to “very easy” (~25%).

Six participants responded “Easy” to the question, only three responded “very easy” and almost the same number, a total of 4 responded “very hard”. The majority of the participants chose the option “average” and second majority chose “hard” a total of 10 participants believed that finding allergens in a menu was difficult and therefore we felt that technology should consider this waste of time. A possible feature in future applications and technology.

On a scale from 1 to 5, from very easy to very hard, the average answer was 3.2, which meant that generally it was harder than average to find allergens on a menu. Based on the answers from the caterer, the changes on the menu was not frequent, hence the catering sector should find more time to make it easier for their customers to find allergens. In our opinion, this is where technology can help both customers and caterers to communicate efficiently and effectively.

11) How much time on average do you spend searching for allergens on a menu?

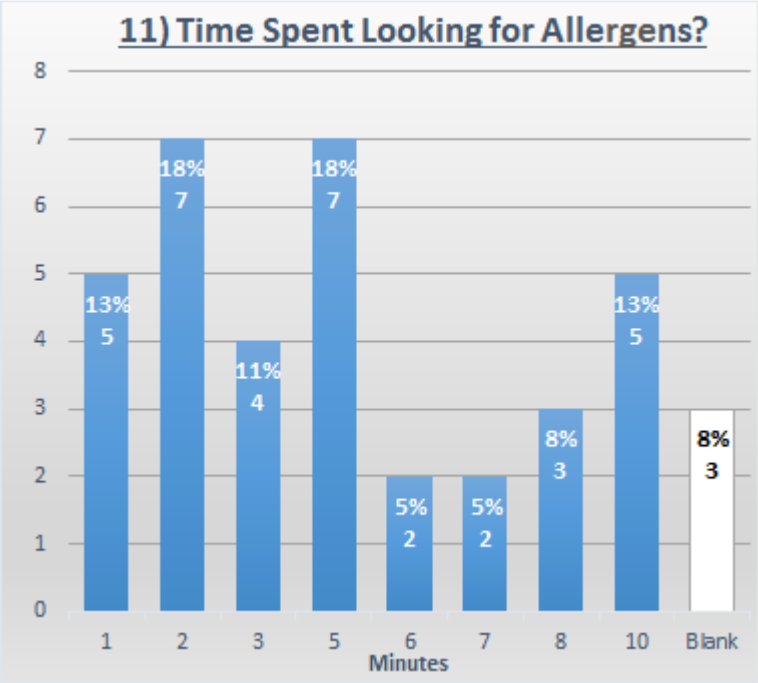

Figure 4.14 – Bar-chart displaying the responses to searching for allergens

How much time on average do you spend searching for allergens on a menu?	
1	5
2	7
3	4
5	7
6	2
7	2
8	3
10	5
Blank	3
N/A	125
TOTAL	**163**

Table 4.12 – Table displaying the data

The results for this question were well dispersed. Many participants responded 2 minutes and 5 minutes for time spent searching for allergens.

The average time spent searching for allergens is on the lower scale at 4.74 minutes. Most of the customers took very little time to find allergens on the menu. This was in contradiction with the previous question (10). We were expecting consumers finding it hard to find information to spend a lot of time looking for allergens on the menu. It could be due to the fact that they have been accustomed to what to look for in a menu or size of the menu.

12) Do you think websites currently provide enough information?

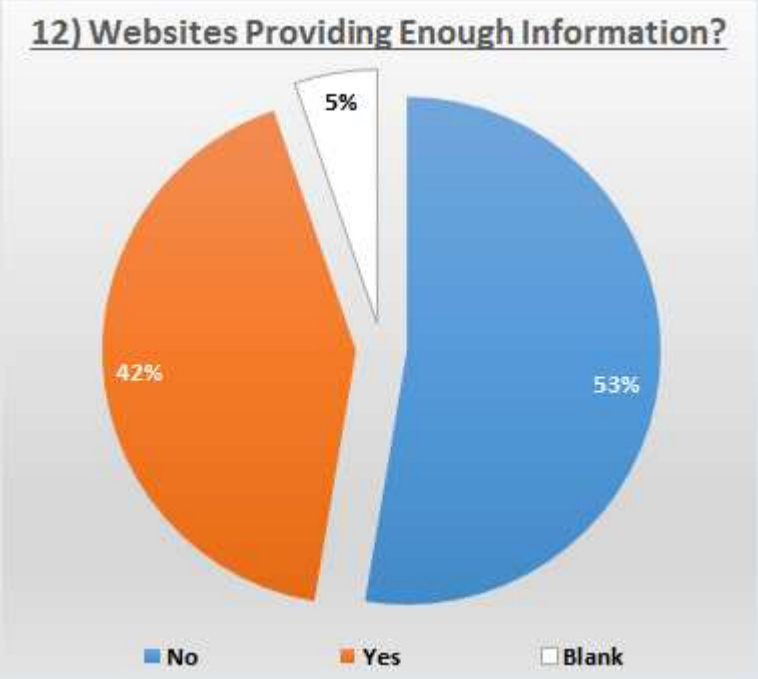

Figure 4.15 – Pie-chart displaying the responses to Q12

Do you think websites currently provide enough information regarding dietary allergens?	
No	20
Yes	16
Blank	2
N/A	125
TOTAL	**163**

Table 4.13 – Table displaying the data

Although the participants found it easy to gather the allergen details from the menu, when it came to the use of technology such as website, it was noted that there were more "no" than "yes" recorded. 53% of the participants found that websites did not provide enough information regarding allergens compared to 42% who said they did. This meant that most customers when ordering online were unable to get enough information regarding allergens. In addition, the fact that they found it easy to get information in the restaurants told us that the service staff communicated these potential allergens to the sufferers or non-sufferers. Is online information lacking and if so why?

Possibly due to the expense of hosting the websites and perhaps the websites themselves are not being updated with real-time relevant information.

When focusing on the results of "Yes", we found that the respondents eat-out more often. However, they are less aware (25%) about the EU Regulation (1st question) which leads us to believe that the concerns about their condition is minor.

13) What technology would you prefer?

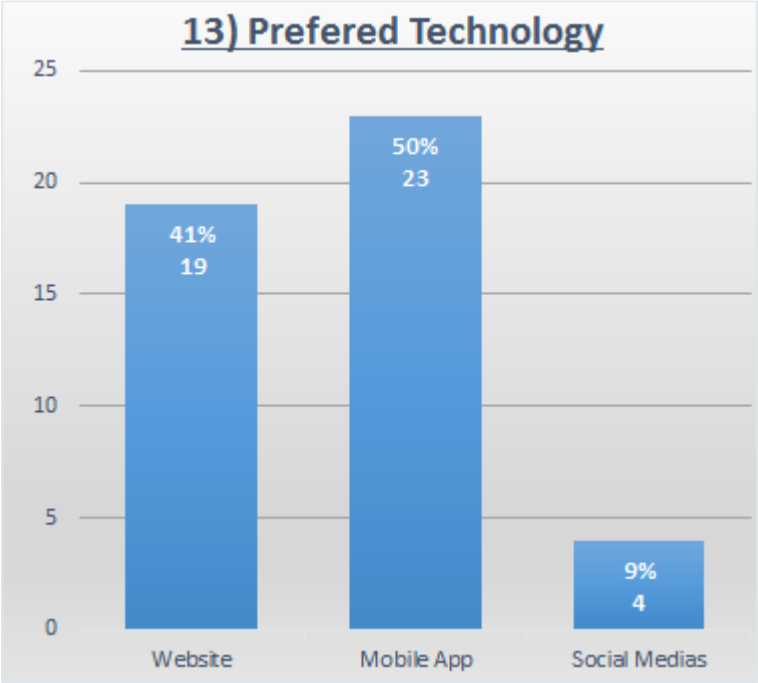

Figure 4.16 – Bar chart displaying the responses to technology preference

What technology would you prefer?					
Website	19	Mobile App	23	Social Medias	4
Blank	19	Blank	15	Blank	34
N/A	125	N/A	125	N/A	125
TOTAL	**163**	**TOTAL**	**163**	**TOTAL**	**163**

Table 4.14 – Table displaying the data

The majority of respondents surveyed preferred a website or a mobile app. Strangely enough advertising on social media was still not an accurate method for consumers to gather information regarding dietary allergens. This was down to the fact that with social media, a person needs to follow a restaurant initially and perhaps some people do not follow the same restaurant or perhaps some people just do not check their social media feeds. Could it be that the speed at which certain information is consumed is too dynamic? Perhaps the public prefers a static form of information.

When selecting the results that favoured the websites as their preferred technology, we noticed that only 32% of the respondents found that the websites provided enough information regarding dietary allergens.

We felt that this is a missed opportunity in the catering sector to better inform their customers regarding dietary allergens. This could also represent a loss of business as websites appear to be the most prevalent source of information.

14) Would your eating-out frequency increase with more awareness of a menu?

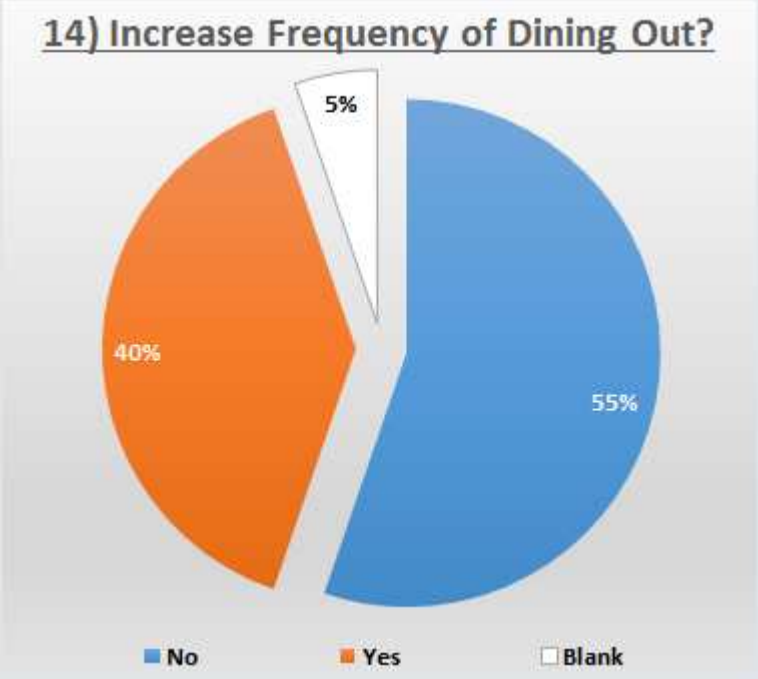

Figure 4.17 – Pie-chart displaying the responses to Q14

Would your eating-out frequency increase with more awareness of a menu?	
No	21
Yes	15
Blank	2
N/A	125
TOTAL	**163**

Table 4.15 – Table displaying the data

The number of respondents who answered "No" to the question "would your eating-out frequency increase with more awareness" resulted in 55%, with 40 % selecting "yes". It was interesting to see how many times these sufferers were still eating-out. It could be because of financial reasons as well. Furthermore, a survey by Food Allergy Training Consultancy (FATC) showed that due to increased information there was an increase of 54% in consumers with food allergies eating out (Thomson, 2017).

40% surveyed saying "yes" meant that with increased information in the catering sector, an increase in their revenues could also be possible. As of July 2016, the estimated population in Ireland was 4,952,473 people. Out of that, 21.51% ranged between 0-14 years of age (CIA World Factbook, 2016). Knowing that 5% of the children, and 3% for the adults in Ireland have food allergies, we can estimate that the total number of food allergy sufferers in Ireland is roughly 170,000 people. With a 40% of the surveys answering yes, we can quantify that the catering sector could see an increase of 68,000 customers to their business should they increase the awareness of food allergens on their menus.

In our opinion, this approach of reward is an incentive to enforce the law which, when broken, can attract a fine or even prosecute.

15) Does your allergy affect your social life?

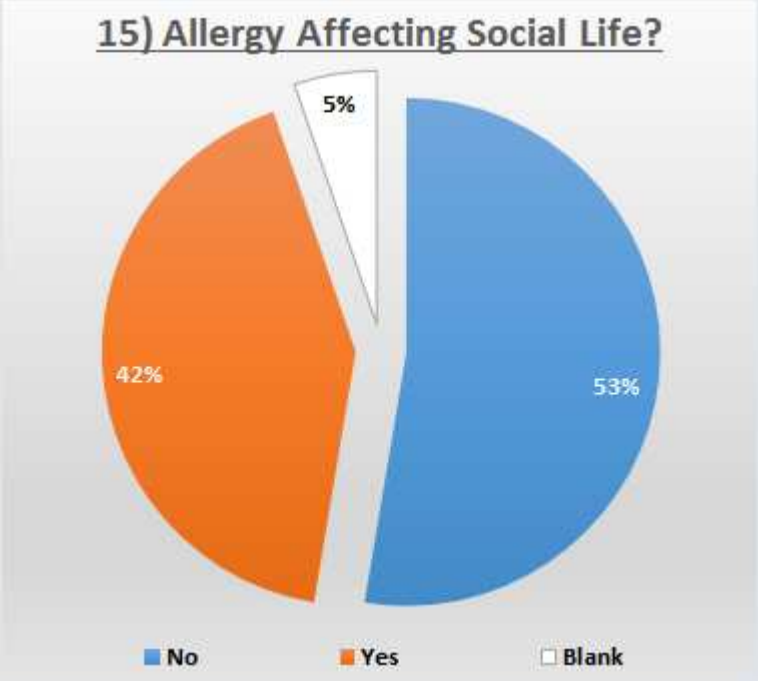

Figure 4.18 – Pie-chart displaying the responses to Q15

Does your allergy affect your social life?	
No	20
Yes	16
Blank	2
N/A	125
TOTAL	**163**

Table 4.16 – Table displaying the data

53% of the respondents said that suffering from a food allergy does not affect their social life with 42% saying yes. It is a surprising amount of people whose life is affected by allergies. It would be interesting to see what else can be done to improve these people's social life. It would be interesting to find out more about how their food allergy manifests itself that has such a negative impact on their social life, i.e. skin reaction or swelling. There could be good market for an application or technology to target these customers and help alleviate this.

In our opinion, it is a significant number of participants whose social life is affected due to lack of information provided by caterers. The quality of life for these respondents can be helped by technology. Technology can help by providing information on catering establishments that are food allergy-friendly.

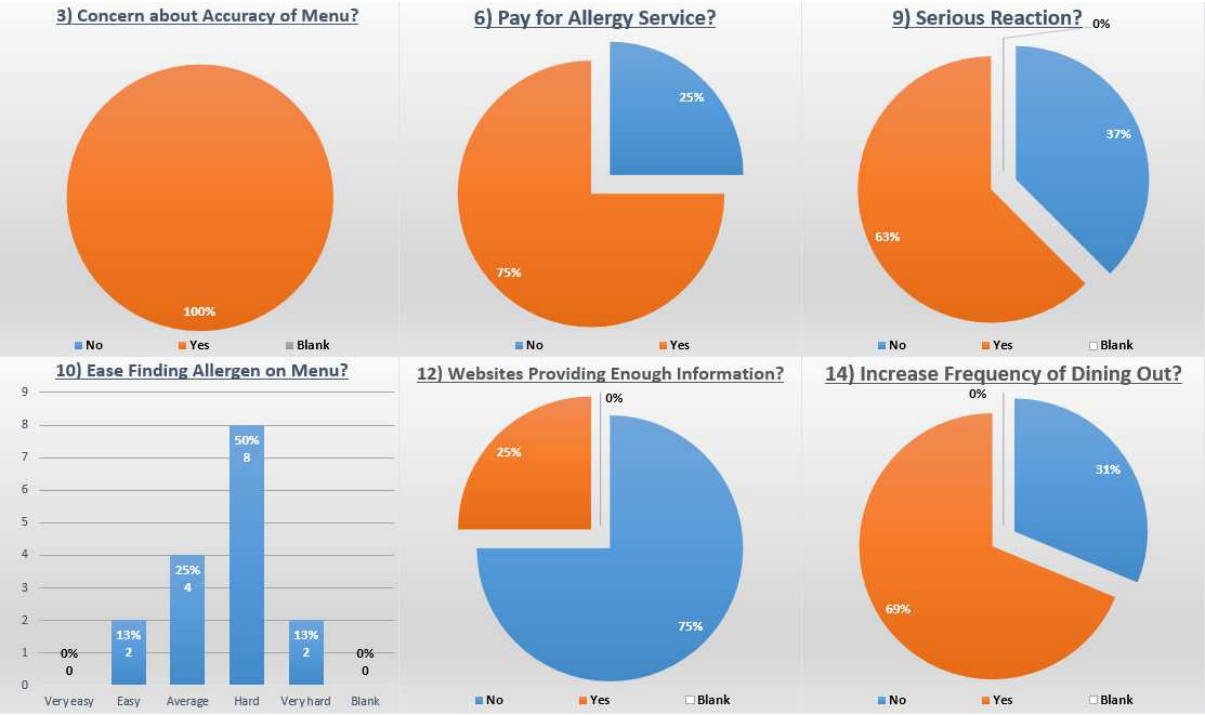

Figure 4.19 – Pie-chart and bar chart displaying a cross-correlation of responses from the survey

For a technology to help the food allergy sufferers, there are certain features which should make them an ideal target market. We took 100% of the participants who are concerned for the accuracy for the information provided on the menu. We found that 75% of those surveyed were willing to pay for the service. 63% of these respondents had a serious reaction and usually find it very difficult to find allergens on the menu. 75% felt that websites do not provide enough information and 69% felt that they would increase the frequency of eating out if there was enough information.

We believe there is scope to commercialise such technology that provides better information regarding labelling of allergens and should also be made widely accessible.

4.4 Results – Caterers

Confidence Level and Margin of Error for the survey

According to a Failte Ireland report there were estimated 16,501 tourism and hospitality enterprises in Ireland (Failte Ireland, 2012). We took this as the size of our population and set 49 as our sample surveyed to get 14 % as margin of error with a confidence level of 95%. We had to delete 1 entry due to not having sufficient information. We also processed our dataset to ensure that all answers were accurate and made common sense.

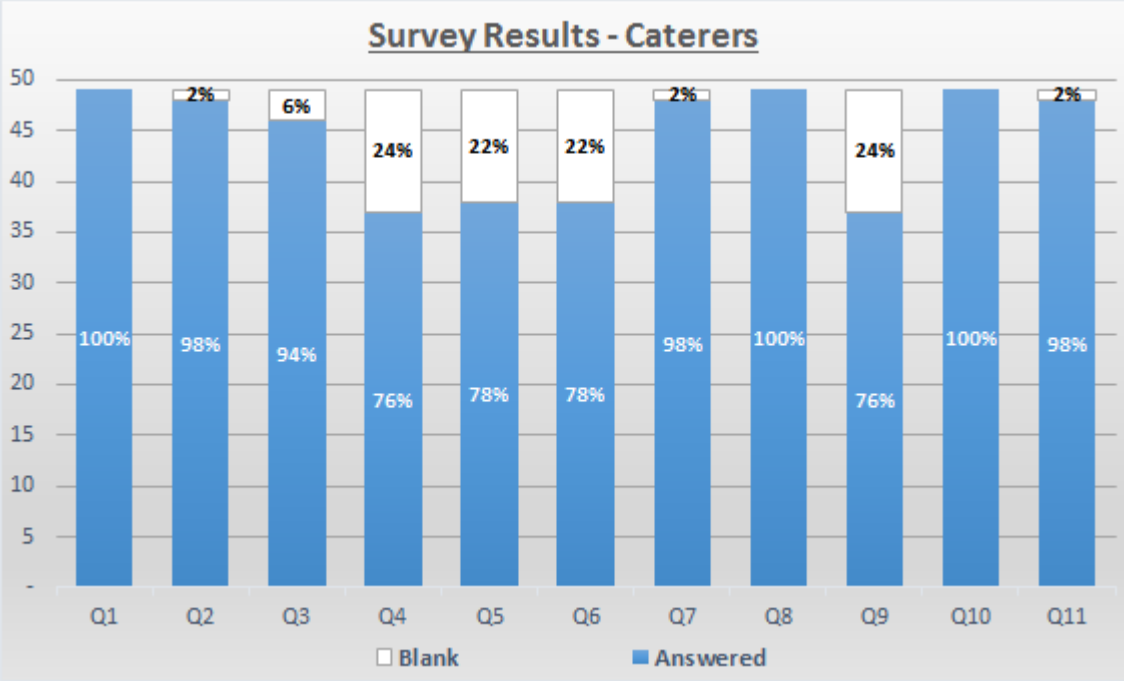

Figure 4.20 – Displays the overall survey results

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	TOTAL
Answered	49	48	46	37	38	38	48	49	37	49	48	**487**
Blank	-	1	3	12	11	11	1	-	12	-	1	**52**
N/A	-	-	-	-	-	-	-	-	-	-	-	**-**
TOTAL	**49**	**49**	**49**	**49**	**49**	**49**	**49**	**49**	**49**	**49**	**49**	**539**

Table 4.17 – Table displaying the data of overall survey results

1) Are you aware of the EU food allergy regulation effective since Dec 2014?

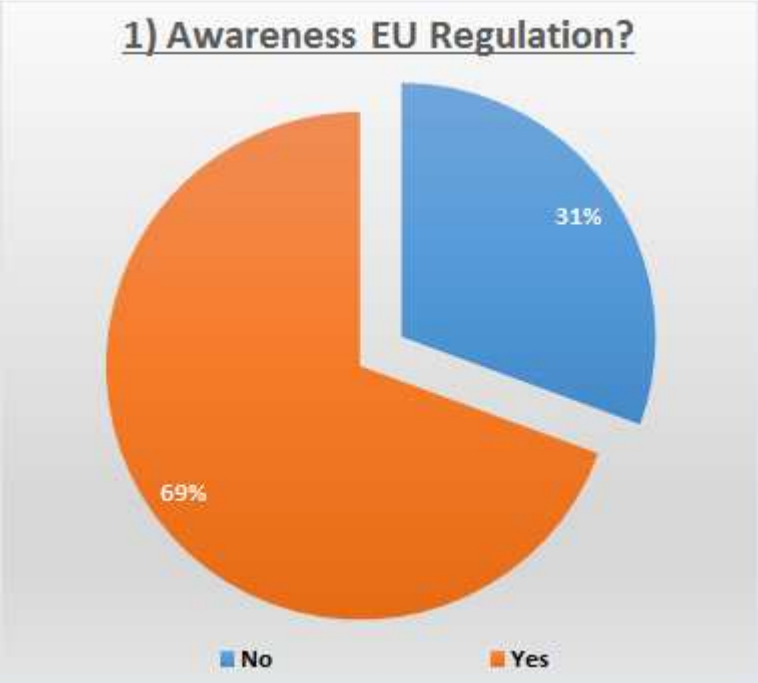

Figure 4.21 – Pie-chart displaying the responses to Q1

Are you aware of the EU food allergy regulation effective since Dec 2014?	
No	15
Yes	34
TOTAL	**49**

Table 4.18 – Table displaying the data to Q1

The catering sector's awareness of the legislation was at 69%. Surprisingly 31% were unaware of the legislation despite being enacted since the 13th December 2014.

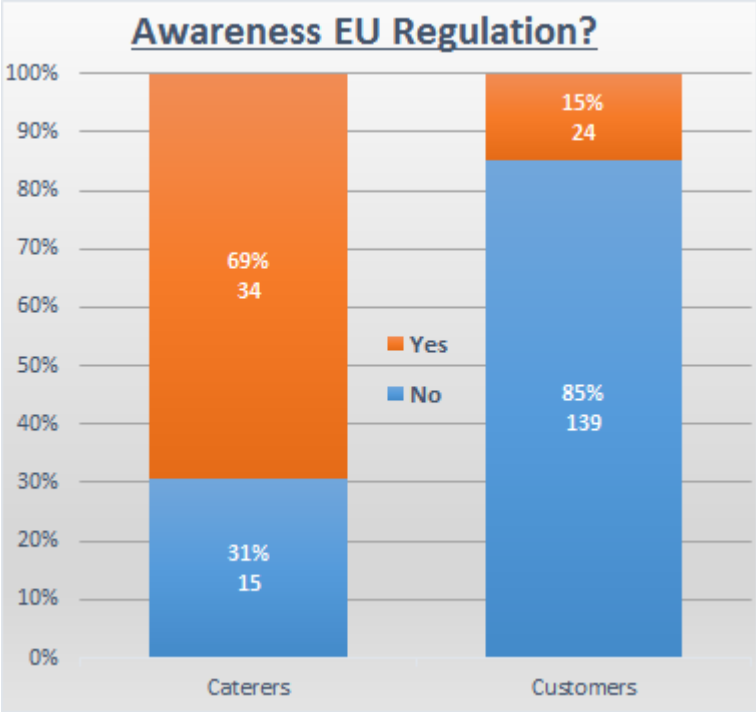

Figure 4.22 – Displays the responses to Q1 regarding customers and caterers

Compared to the customer's survey response, it was a complete opposite statistic. Among customers, the awareness was 15%, which indicates that caterers are more aware of the legislation because of their responsibility to provide information about allergens on the menu.

2) How often do you change your menu?

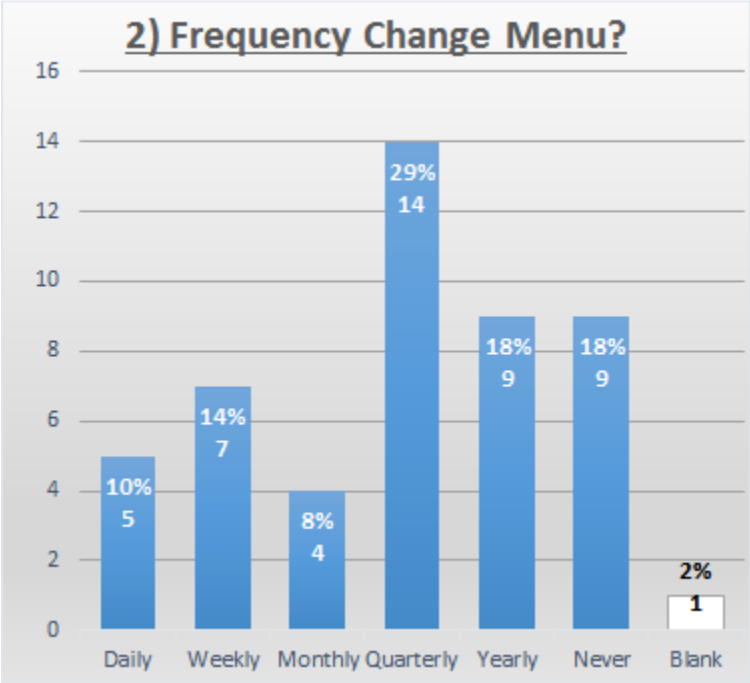

Figure 4.23 – Bar chart displaying the responses to Q2

How often do you change your menu?	
Daily	5
Weekly	7
Monthly	4
Quarterly	14
Yearly	9
Never	9
Blank	1
TOTAL	**49**

Table 4.19 – Table displaying the data to Q2

The catering establishments we surveyed who changed their menu were 29% quarterly, 10 % daily 14% weekly and 8% monthly. Surprisingly 18% never change their menu or 18% changed it on a yearly basis.

Many catering establishments changed their menus to adapt to the produce available during different seasons to create a variety in their dishes. Concerns regarding allergies did not dictate to the caterers as to when to create new dishes and change menus.

3) Does concern about allergies inhibit you from creating new dishes?

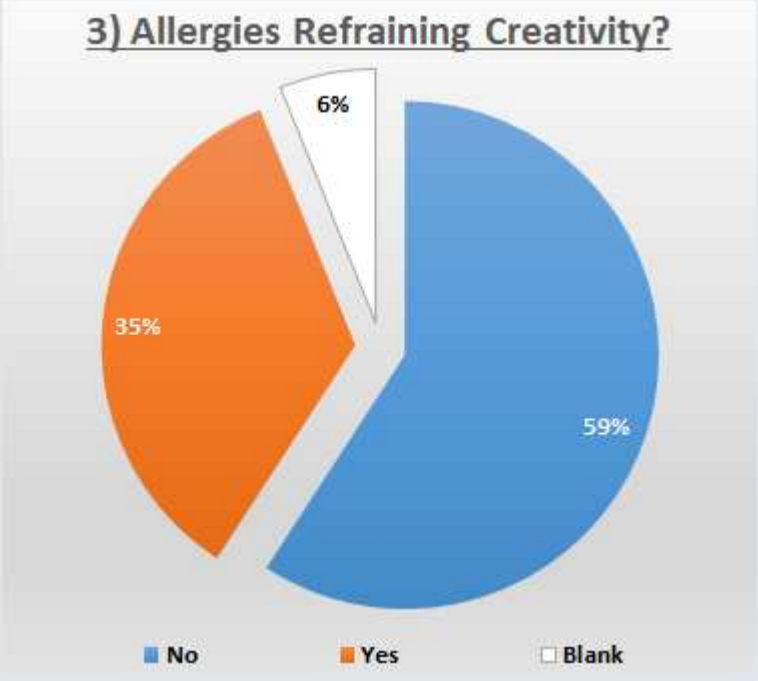

Figure 4.24 – Pie-chart displaying the responses to Q3

Does concern about allergies inhibit you from creating new dishes?	
No	29
Yes	17
Blank	3
TOTAL	**49**

Table 4.20 – Table displaying the data to Q3

Of those surveyed, 59% responded that allergens did not prevent them from creating new dishes while 35% experienced some concerns. This concern is consistent with the concerns of the top 100 UK chefs. These chefs warned that an EU rule could lead to considerable damages to catering industry (Dominiczak, 2015).

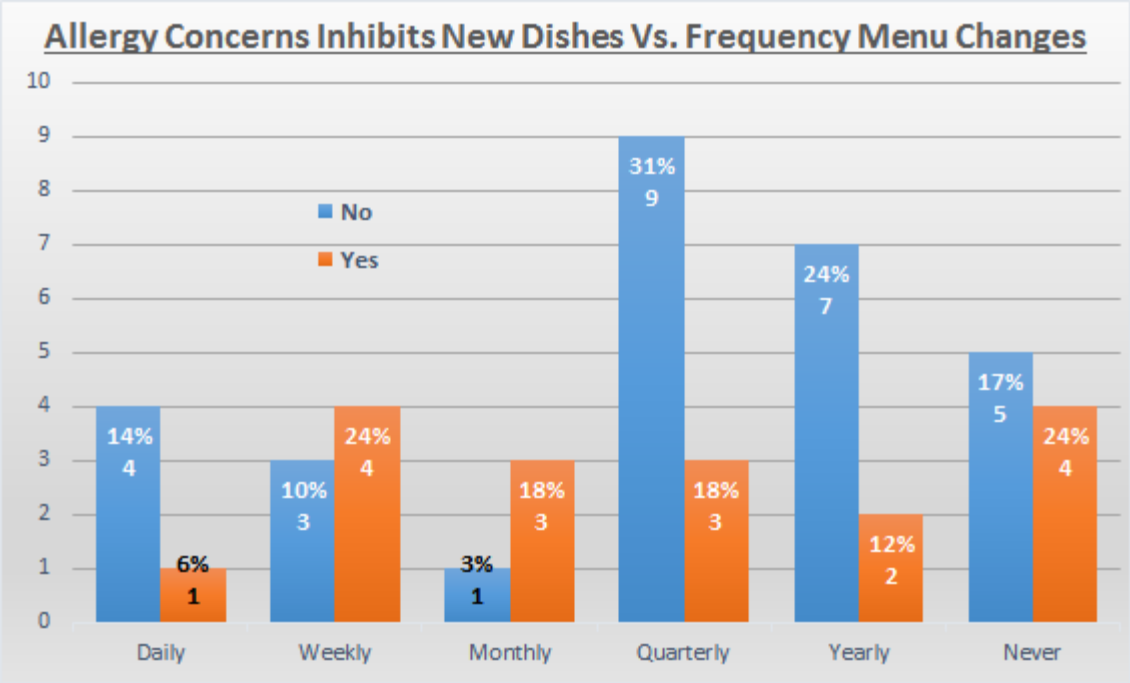

Figure 4.25 –Bar chart displaying the inhibition of new dishes versus menu changes

Does concern about allergies inhibit you from creating new dishes?	How often do you change your menu?	Total
No	Daily	4
	Weekly	3
	Monthly	1
	Quarterly	9
	Yearly	7
	Never	5
Yes	Daily	1
	Weekly	4
	Monthly	3
	Quarterly	3
	Yearly	2
	Never	4
TOTAL		**46**

Table 4.21 – Table displaying the data of the inhibition of new dishes versus menu changes

We found that 24% of the caterers changing their menu weekly and 24% of those who never changed their menu responded that food allergies did not prevent them from creating new dishes. In our opinion, food allergy concerns did not affect the menu change. The menu needs to be changed as per the customer's demands in order for a caterer to run a successful business and gain revenue. The total

is of 46 due to 3 blanks on the question "Does concern about allergies inhibit you from creating new dishes?"

4) How much time you spend listing allergens on a menu item?

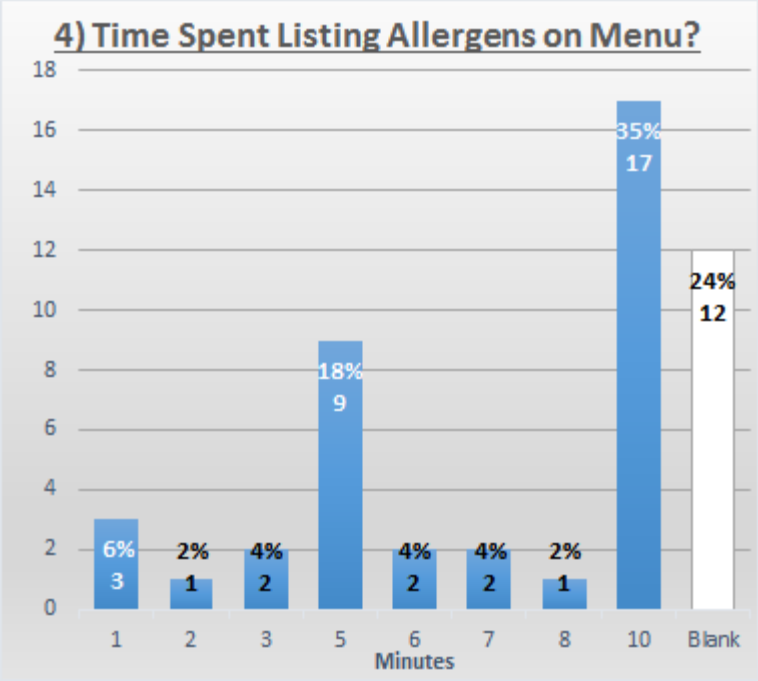

Figure 4.26 – Bar chart displaying the responses to Q4

How much time you spend listing allergens on a menu item?	
0	10
1	3
2	1
3	2
5	9
6	2
7	2
8	1
10	17
Blank	2
TOTAL	**49**

Table 4.22 – Displays the data to Q4

In this result 37% of the caterers spent 10 minutes listing allergens while 18% spent at least 5 minutes listing allergens on the menu. This is a considerable amount of time spent by the caterers to list the menu. However, the effort from the caterer's is not noticed by the customers. The survey conducted on the customers showed that customers spend less than 5 minutes finding allergens on the menu.

This time spent listing allergens can be saved if a suitable technological solution could be developed. An example of a viable solution could be a device equipped with a real time camera to analyse ingredients of a menu item and ultimately better inform the user.

5) What system do you use to list those allergens?

This question was an open question and as a result we found it quite hard to quantify. We received a large volume of answers for this question and due to this we were only able to form an assumption or deductive reasoning based on the general consensus of the results. From the data collected in this question we were able to ascertain that the majority of caterers had what is known as an allergy book that can be shown to customers on request. This majority begged the question as to why there were not just listed on the menu which came in as the second highest system of listing allergies. After further research we discovered that when printing menus most printing businesses charge by the word, hence listing allergens on the menu and using this as a system can prove to be costly, especially if you change your menu regularly.

6) Which techniques do your employees use to avoid cross-contamination of food?

This question was an open question and as a result we found it quite hard to quantify. We received a large volume of answers for this question and due to this we were only able to form an assumption or deductive reasoning based on the general consensus of the results.

Even though it was an open-ended question, there were a lot of similar responses. The majority of responses to this question were the use of separate food preparation areas but this also coincided with grouped answers relating to colour coded signs and labelling in food preparation areas. There were a number of outliers whose answers included the use of multiple knives and good hygiene. The second highest response grouping answered HACCP training as a technique to avoid cross-contamination. With reference to our literature review, i.e. cross-contamination, we were able to identify that almost all of the answers to this question related to HACCP techniques and therefore were able to conclude that most caterers used HACCP techniques to avoid cross-contamination.

7) Does the labelling on products provide you with enough information regarding allergens?

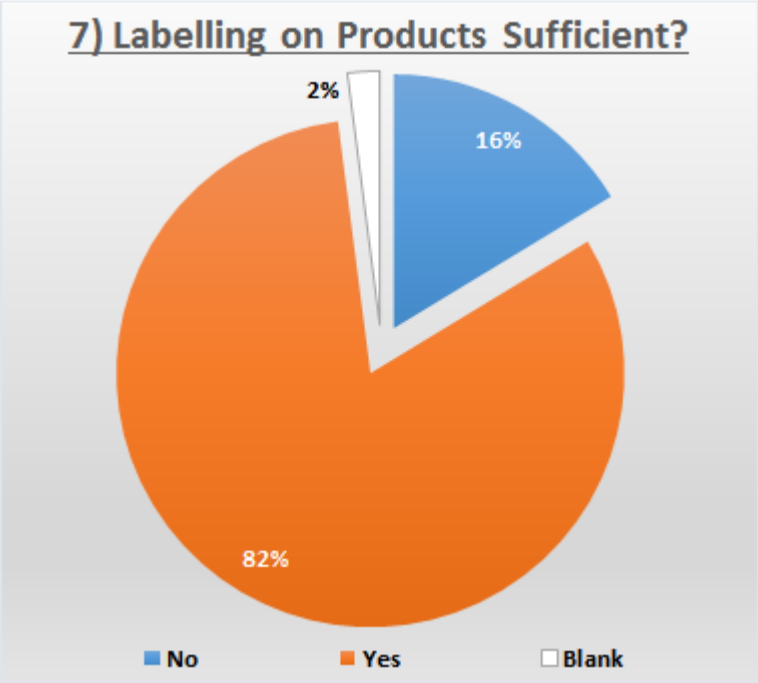

Figure 4.27 – Pie chart displaying the responses to Q7

Does the labelling on products provide you with enough information regarding allergens?	
No	8
Yes	40
Blank	1
TOTAL	**49**

Table 4.23 – Table displaying the data to Q7

The majority of participants were confident about the labelling on food products. 82% of those surveyed responded "Yes" to this question.

The reason for this was due to the strict enforcement of legislation on pre-packaged foods since 2003 (FSAI, 2015).

8) On a scale from 1-5, how educated are your staff/colleagues regarding allergens?

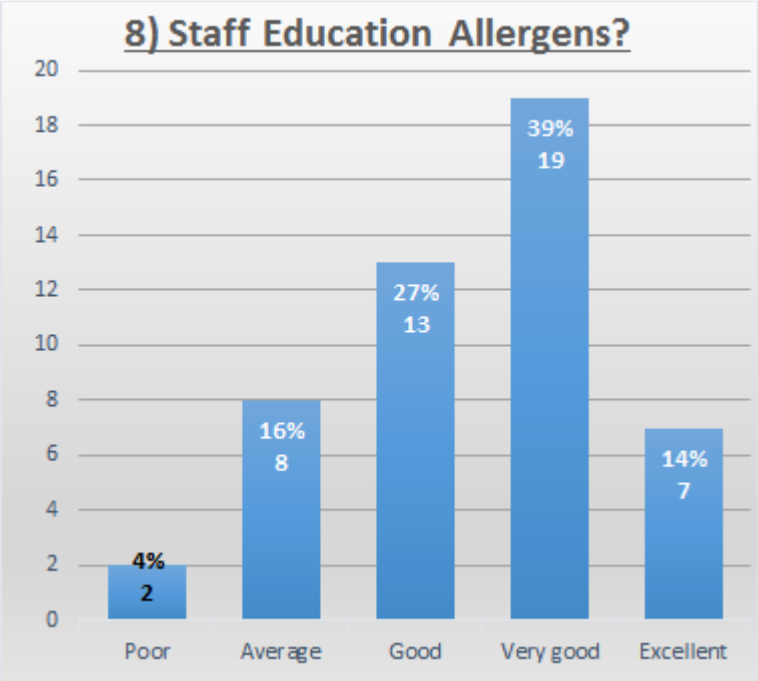

Figure 4.28 – Bar chart displaying the responses to Q8

On a scale from 1-5, how educated are your staff/colleagues regarding allergens?	
Poor	2
Average	8
Good	13
Very good	19
Excellent	7
TOTAL	**49**

Table 4.24 – Table displaying the data to Q8

The responses were very positive as the large majority chose "Very Good" with a total of 39% followed by "Good" with a total of 27%. This indicated that there is a positive attitude towards staff's education for food allergens. Surprisingly there was no consistent attitude for education provided to the staff. 4% of respondents answered that their staff/colleagues were educated poorly while 16% responded that their staff/collegues had an average education regarding food allergens. Therefore, this inconsistent staff education could provide harm to a customer's health.

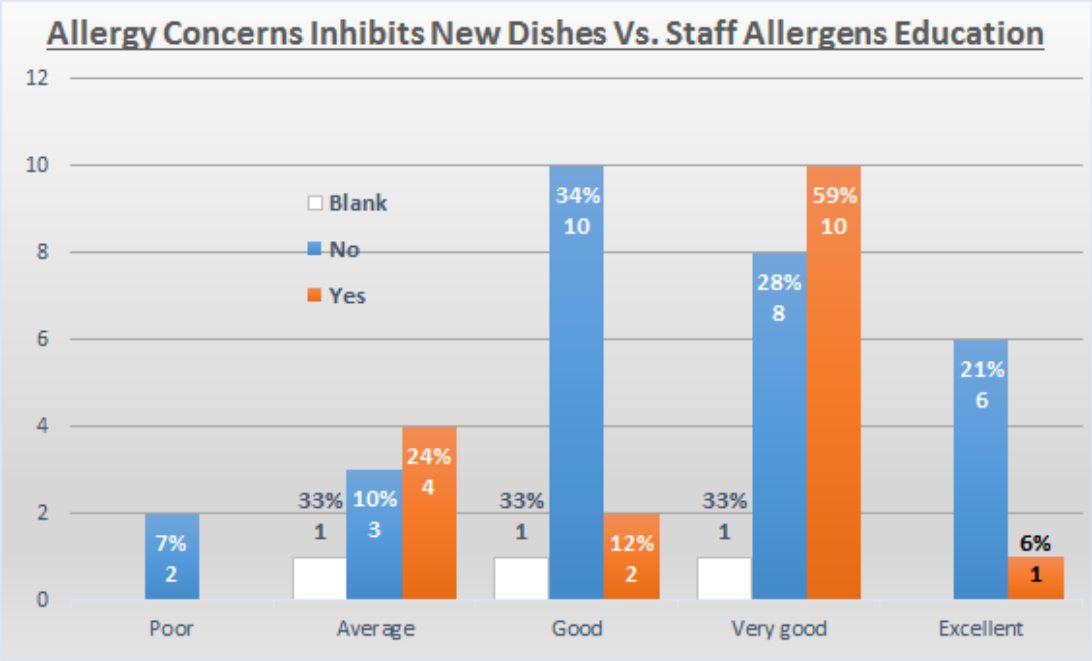

Figure 4.29 – Bar chart displaying the inhibition of new dishes versus allergens education

Does concern about allergies inhibit you from creating new dishes?	On a scale from 1-5, how educated are your staff/colleagues regarding allergens?	Total
Blank	Poor	-
	Average	1
	Good	1
	Very good	1
	Excellent	-
No	Poor	2
	Average	3
	Good	10
	Very good	8
	Excellent	6
Yes	Poor	-
	Average	4
	Good	2
	Very good	10
	Excellent	1
TOTAL		**49**

Table 4.25 – Table displaying the data of the inhibition of new dishes versus allergen education

When we compared staff education with concerns about creating new dishes, 24% of those who responded “very good” about their education were also concerned about allergens preventing them from creating new dishes. Therefore, employees who were concerned about food allergies affecting

their menus were better educated. It depicts that there is no consistent attitude towards staff education. Staff education is dependent on the concerns regarding food allergies.

As we discovered from our literature review, bad news about food allergies takes an exponential effect in the memory of the public, those catering establishment who take education seriously can be affected as well. We recommend that there should be a consistent level of education across the whole catering sector.

9) What kind of training do you receive regarding allergens?

This question was an open question and as a result we found it quite hard to quantify. We were only able to form an assumption based on the general consensus of the results.

The largest group response for this question was HACCP training. There were some outliers that answered HSE guidelines which also partners up with the FSAI and HACCP training so they could be further grouped to the majority. There was one answer that was a little bit disconcerting where a respondent suggested that they receive no training.

10) Does your menu currently provide sufficient information regarding dietary allergens?

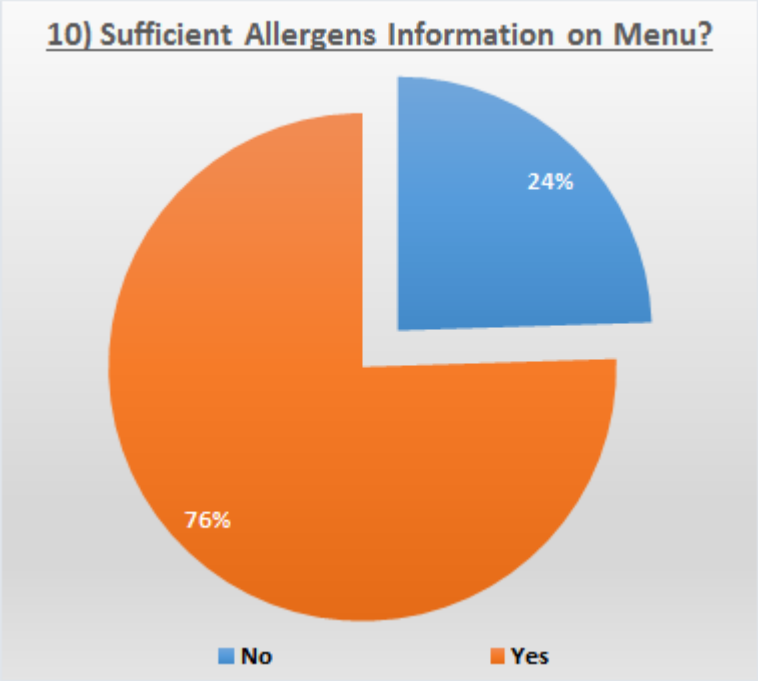

Figure 4.30 – Pie-chart displaying the responses to Q10

Does your menu currently provide sufficient information regarding dietary allergens?	
No	12
Yes	37
TOTAL	**49**

Table 4.26 – Table displaying the data to Q10

76% of the respondents felt confident about the information provided on their menus regarding allergens. However, a significant 24% of those surveyed believed there was not enough information on their menus. These 24% should be made aware of the legislation and the responsibilities they have towards their customers. We need to focus on this segment of not finding sufficient information on their menus for further research to find out the main reasons. Maybe technology can help caterers identify allergens in menus and display those allergens confidently on their menus.

11) <u>What existing technology can provide the best information to your customers regarding dietary allergens?</u>

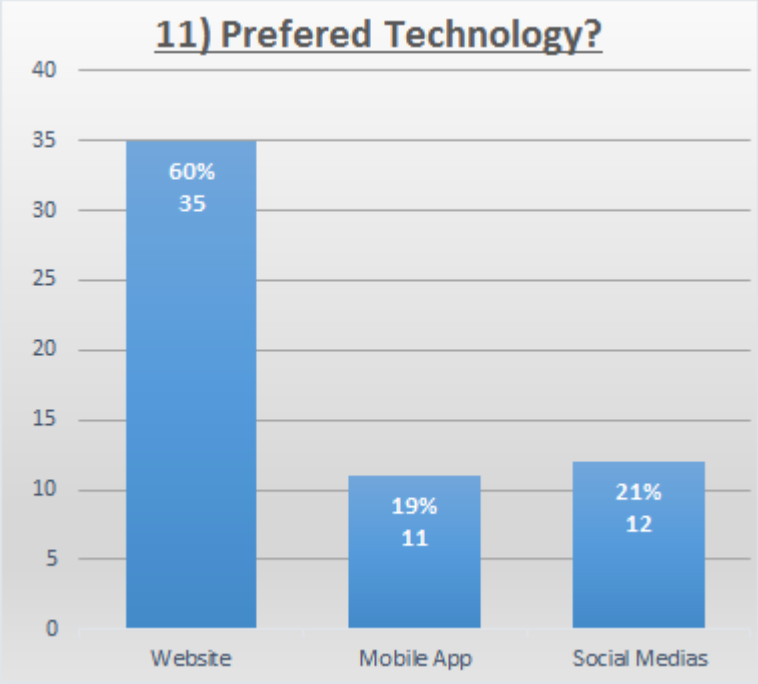

Figure 4.31 – Bar chart displaying the responses to Q11

What existing technology can provide the best information to your customers regarding dietary allergens?					
Website	35	Mobile App	11	Social Medias	12
Blank	14	Blank	38	Blank	37
TOTAL	**49**	**TOTAL**	**49**	**TOTAL**	**49**

Table 4.27 – Table displaying the data to Q11

There is a gap between how caterers want to give information and how customers want.

While in the customer's surveys, most participants answered to the "Mobile App" option, in this survey most answers were "Website" with a total of 60% of caterers believing that it is the best way to inform customers about allergens. The rest of the answers were 19% for "Mobile App" and 21% for "Social Medias". Website and social media had a high percentage to provide information. It could be down to cost factors. Social media and websites are cheaper technologies than mobile applications.

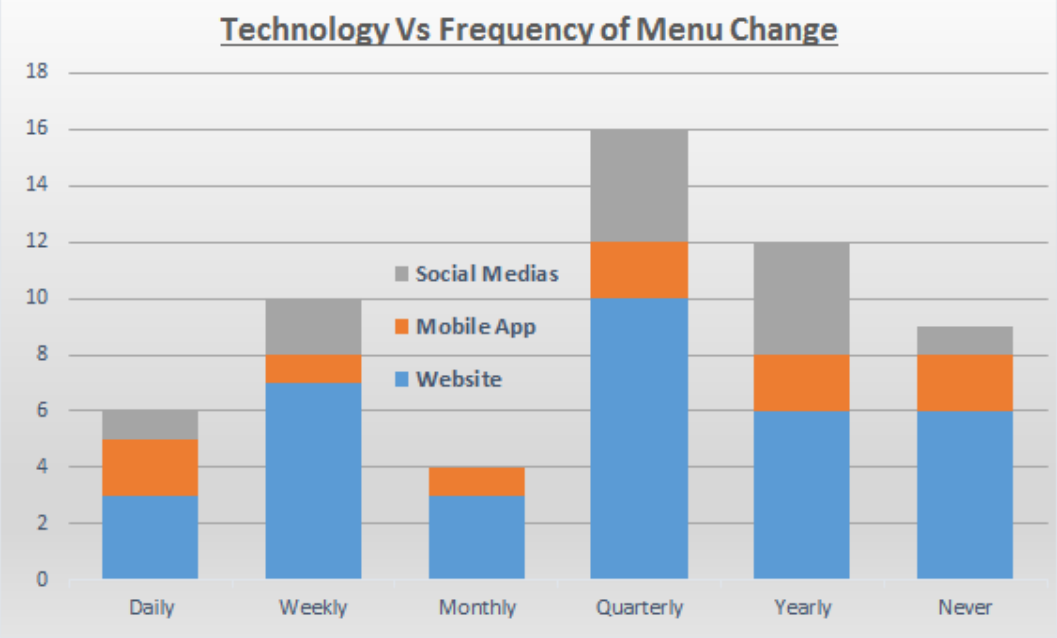

Figure 4.32 – Bar chart displaying technology versus menu change

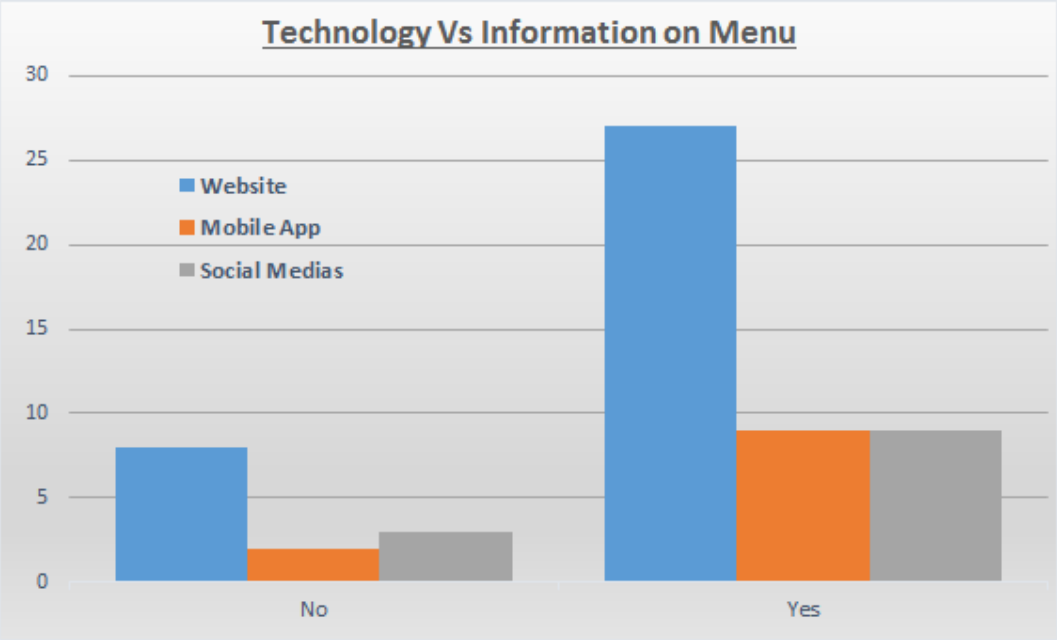

Figure 4.33 – Bar chart displaying technology versus menu information

We tried to find out if technology could help the caterers who change their menus frequently or alternatively, if the information from the menu could be replicated to the technology. We could not find any pattern (See Figure 4.32 & 4.33). This could be due to a small sample size or our survey and which could have been more targeted to certain types of establishments.

4.5 Caterers and Customer Survey Findings

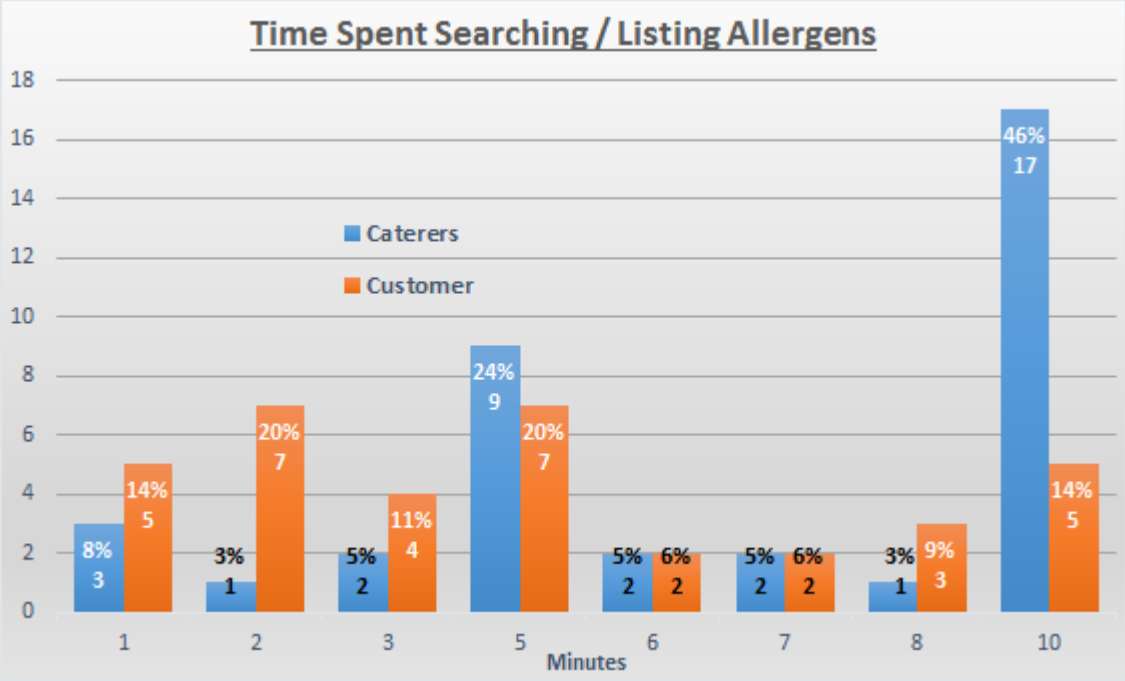

Figure 4.34 – Bar chart displaying searching and listing analysis

84% of caterers spent 5 minutes or more listing allergens on a menu while 65% of customers spent 5 minutes or less reading allergens on a menu. This shows a huge disparity between the two. This may result in lack of empathy between both caterers and customers regarding the effort put in by the caterer to ensure public safety. Therefore, technology can provide a solution to help bridge this gap by demonstrating the public and the regulators that the caterers took adequate precautions in case of an incident.

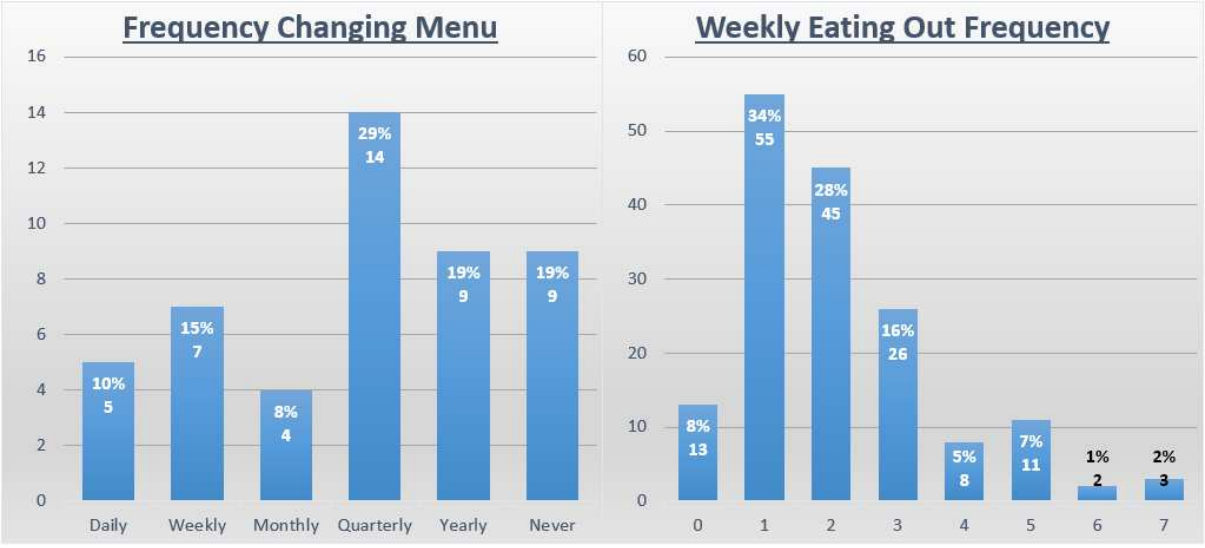

Figure 4.35 – Bar chart displaying menu change and eating out frequencies

Customers seemed to favour eating out at least once a week while caterers changed their menu less frequently. 91% of customers ate out less than 5 days a week. This statistic was against our assumption that most of the office staff working 5 days a week could be having a lunch outside their houses in a catering establishment. The reasons behind this are something we could study in the future.

In our opinion, this is a market where caterers can provide more information to customers about food to gain business. As most of the caterers do not change their menus often the cost involved to provide accurate information could be spread out. Following the regulations can also help caterers increase their business so that customers have the confidence to eat-out. All these measures will mean more revenue for the caterers.

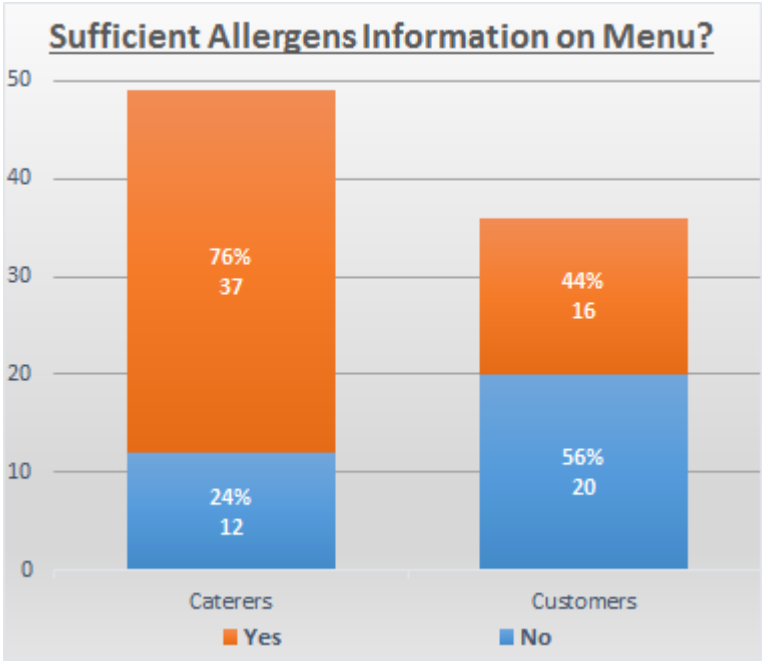

Figure 4.36 – Chart displaying allergen on menus sufficiency

Comparing the two opinions of caterers and customers, we again noticed a strong disassociation between caterers and customers. While the caterer at 76% responded that the menus provided sufficient information, customers responded with 56% negatively. There seems to be lack of communication between two sides. We found evidence of this in our literature review and it is one of the main causes of incidents of food allergy reactions. We feel technology can provide a real solution to this problem by increasing communication.

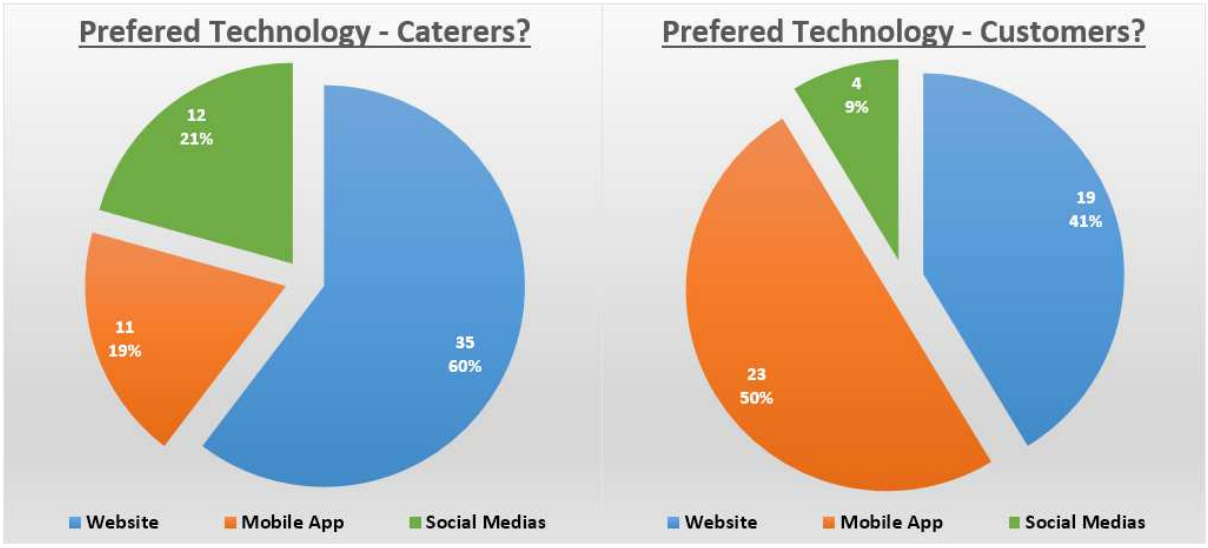

Figure 4.37 – Pie-charts comparing caterers and customers

The difference in the channels of communication is further highlighted by the Figure 4.37 above. While 60% of caterers preferred websites 50% of customers preferred a mobile application. Although 41% of customers preferred website the future of communication lies with mobile applications with advancement in smartphones and mobile technology. However, the cost of mobile applications could act as a hindrance for caterers to change from websites to mobile applications. There seems to be a disconnection between consumers and caterers regarding social media. Social media is a cheap source of sales and marketing channel for caterers but may not be the consumers' preferred platform for gathering information regarding allergens on the menu.

4.6 Conclusion

The questions we asked during our survey led to some interesting discoveries with regard to both customers and the catering industry. We constructed two surveys as we felt that in order to examine the impact dietary allergies have on the public we must look at their origins. The origins in this case were the creators of the dishes, i.e. the catering industry.

The fact that the surveys were broken down into two different surveys meant we could gain two different insights into allergens impact on society.

The customer survey was aimed at identifying the sufferers and their opinions on whether there is sufficient awareness available to them. We also wanted to know if technology was of benefit to them and if it was worth paying for.

The caterer's survey was aimed at the preparers of food and those who had the responsibility to expose the public to potential allergens. We needed to know if allergies were listed and identified easily for their customers. We also needed to know the types of techniques used in food preparation and if any type of formal training was taking place. We encountered an issue with the caterer's survey, which was a language barrier in one of the questions. This resulted in unclear answers and a weak response as they felt they were answering a different question. It was something we had not considered and in hindsight we could have made the question more concise and straightforward.

In today's society, those who have the responsibility of preparing food and those who eat the food are both enablers of allergens and share a common responsibility.

There were a couple of considerations we discussed when constructing the surveys. We understood going into this that some participants may feel uncomfortable about expressing the fact that they suffer from allergies.

We also had to consider that some members of the catering industry may feel they are being exposed and under the spotlight with our exploratory questions. One particular example could be when we received the response by one participant in the caterer survey that they did not receive any training when it came to food preparation. This highlighted the need for anonymity in our surveys as participants were more likely to be honest with their answers if they didn't run the risk of being identified as a food allergy sufferers or as having no training with regard to food preparation and working in the food industry. More importantly it highlighted why our study is so important. This showed a massive gap in the awareness and potential knock-on consequences this could have for the customer (medically) and the caterer (legally).

Chapter 5 Conclusion

5.1 Introduction

We began our research with the following question: "How can technology provide food allergy awareness to catering customers?"

Dietary allergens are part of everyday life. There is no quick fix to eliminate them from our diet. If a food allergy sufferer is unfortunate enough to be exposed to an allergen and a reaction begins they can be assisted. Awareness is the key to identifying, preventing and controlling dietary allergens and technology can act as an enabler towards helping to raise awareness.

We found a gap in awareness with regards to identifying an allergen on a menu that can eliminate the threat of exposure through prevention.

5.2 Conclusion

There is an abundance of information available regarding dietary allergies as this topic has been studied for thousands of years as discovered in our literature review. Furthermore, there is a lack of awareness to this vital and potentially lifesaving information. The use of technological solutions can bridge the gap between food allergies and awareness.

Our twin surveys identified interesting gaps in awareness that we felt needed to be addressed by both the customer and caterers.

We found that only 15% of our respondents who identified themselves as customers were aware of the EU legislation that protects customer's right to information when dining out. In contrast, respondents who identified themselves as caterers demonstrated a 69% awareness of the legislation. This presents a significant gap in awareness levels between customers and caterers at 85% and 31% respectively of those who are required by the legislation to be aware. Customers in particular, must understand that it remains their right as presented in the legislation to have allergens documented in available menus for licensed premises.

In our research 52% of the surveyed population were concerned about the accuracy of information regarding allergens. However, there was a difference in opinion regarding whose responsibility it is to inform about the allergens on a menu. 50% of the respondents whom identified themselves as customers felt that it is the responsibility of the caterers to inform about the allergens on the menu while the rest (50%) felt that it is their own responsibility to be self-informed. There is uncertainty about where the responsibility should lie.

According to EU legislation responsibility for providing this information lay with the caterers and the fact that nearly 70% of caterers who participated in the survey were aware of this legislation meant that they were aware of their accountability.

According to the results of our research just under half (47%) of customers who have food allergy carry their medication all the time. When focusing on those who carry medication 61% already had a serious reaction while dining out. The resulting information suggests that they were aware of the dangers involved in anaphylaxis. Furthermore, 39% of the respondents who had food allergy received medical attention due to a serious food allergy reaction. This fact shows how serious an anaphylaxis reaction can be. These situations could be avoided by raising awareness using technology among catering customers.

The most commonly used method of distributing information about allergies to the customer from a caterer was through the use of an allergy book which was shown on request. However, 26% of customers found it hard to find allergens on a menu while 11% found it very hard. This shows that the system is inadequate and a better solution is required.

We already established that customers would pay for a service but there was a difference in opinion in which form of technology the customer would like the information to be delivered (website, mobile application or social media). The answer according to our survey was that a mobile application would be the preferred technology solution as indicated by 50% of the customers who had food allergy followed by 41% for website based information. In contrast 60% of the caterers felt that website based information is the preferred technology to provide information to their customer regarding allergens. Surprisingly, only 19% of caterers were in favour of mobile application.

This was interesting considering "86% of Irish consumers own or has access to a smartphone" (McHugh, 2016). Hence, the majority of Irish people are already in possession of an information medium.

The Food Safety Association of Ireland (FSAI) has a large online allergen repository that can be accessed by its online application MenuCal. This is a good example of how a technology system can incorporate both preferred platforms (mobile application and website based information) of customers based on our survey results. It is clear from our research that technological solution with good user experience would result in increasing awareness.

42% of our respondents claimed that their allergies do impact their social life. The quality of life could be improved for those 42% of food allergy sufferers by simply increasing awareness of their allergies.

In addition, caterers that chose to display allergens on their menu could also be assisted by technology leading them to become a food allergy friendly establishment.

Our study has shown that there are technologies in existence today that can make the lives of dietary allergy sufferers better from both a social and medical perspective. The number one hindrance to these technologies is the lack of awareness. Our study has also shown that 69% of caterers are aware of the legislation that requires them to display all allergens in an appropriate manner. However, as the legislation is not enforced by auditing of licensed establishments the presentation of allergy information is of a lesser priority. In contrast, regular publications from the Food Safety Authority of Ireland in regards to restaurant closure notices for primarily hygienic reasons demonstrate that an avenue exists for the enforcement capability.

Furthermore, one of our case study described that failure to comply with the legislation and neglect customer's safety could lead to a prison sentence. Perhaps awareness of this serious consequence would alter their perspective on the importance of listing allergens.

33% of the respondents to our survey who identified themselves as customers felt that paying for a service that helped identify allergens would be acceptable. However, when the same question was answered by those respondents who were food allergy sufferers the figure rose to 60% willing to pay for such a service to help them identify allergens on a menu. We felt that this makes sense when we consider the risks involved in anaphylaxis as discussed in our literature review.

40% of the respondents who identified themselves as customers suffering from food allergy would be willing to increase the frequency of dining out if caterers increased the awareness of food allergens on their menus. This led to one of the most important findings in our research that the catering sector could benefit with a quantified increase of up to 68,000 customers in Ireland if they chose to list allergens on their menus.

When considering the potential impact this could have on the catering industry and their businesses it is apparent that there is an untapped resource of revenue that is being ignored. Being informed of

this discovery may alter the catering industry's view of displaying their allergens in order to promote revenue and will ultimately increase quality of service to their customers.

It is conceivably possible that in the future a technology will become available that allows the food allergy sufferer to identify, prevent and control their dietary allergies allowing a better quality of life and unburdening the catering industry. As demonstrated in our survey results, the availability of such a technology based solution would likely result in a high level of awareness.

A much needed and well overdue marketing campaign to highlight solutions for food allergy sufferers is crucial to increase awareness and educate both customers and caterers to their obligations. This solution would be further amplified by incorporating it into a user friendly and easily distributed technology in an effort to reach all levels of the market and society.

After extensive research and analysis in the area of food allergies and associated technologies we came to the conclusion that there are technologies available to customers suffering from food allergies such as Nima Gluten Tester and Allergy Eats. There are applications available to caterers such as MenuCal. These technologies provide awareness and facilitate the allergy sufferer by predicting, controlling and preventing from allergic reactions. However, we discovered that there is no technology or application available to link the catering industry and customers, specifically those suffering from food allergies. This represents a major gap in technological solutions raising awareness and also represents a significant market as quantified by our research. A technology that provides real-time information to both the customer and caterer simultaneously would help raise awareness. This would create a transparent and beneficial relationship between them and alleviate the potential threats such as exposure, anaphylaxis, legal action and even death. During our analysis we discovered that if the catering industry was to implement such a technology then they would potentially open their doors to an extra 68,000 allergy sufferers in Ireland. Furthermore, the caterers would benefit from increasing their revenue and ultimately having a positive impact on the social lives of food allergy sufferers.

5.3 Future Research

While the purpose of this thesis was to focus on a way to identify how we could raise awareness using technology we found certain areas which would benefit further research such as:

- People self-diagnosing their food allergies. Based on information discovered during our literature review we learned that a large volume of people suffering from food allergies have diagnosed themselves as food allergy sufferers without actually being diagnosed by a medical professional. If this was researched further perhaps it may reduce the figure of food allergy sufferers significantly.
- The inability to differentiate between food intolerances and allergic reaction. We also discovered that there is a fine line between an allergic reaction to food and a food intolerance. The fact that the former is an autoimmune response and the latter is a digestive system problem shows that they are similar in that they are caused by food but different in reality. With further study, perhaps a better awareness could be created to distinguish between them.
- Further research could be conducted on Artificial Intelligence enabled devices such as devices equipped with real-time camera to analyse ingredients of a menu item. This would add great value in areas such as time saved in listing allergens on a menu for the caterers and easier access to information for consumers.
- Based on the survey results there is a potential revenue generating opportunity as 15% of the respondents said they would pay up to €5 per month and 5% were willing to pay €10 per month. If we focus on respondents who identified themselves as customers and food allergy sufferers then 8% of these respondents would be willing to pay €10 per month while 32%

would pay €5 per month. Based on 170,000 food allergy sufferers in Ireland we can quantify that the total potential revenue that could be generated for a technological solution would be between €375,360 per month and €440,640 per month with 95% confidence level.
Further research is required to find out the reasons why respondents are willing to pay such an amount for a technological solution.

- Common shared platform gathering data and information regarding food allergies. Is there a concept already being developed or will it be one in a few years' time? Further research is required to examine how much progress has been made in this area.
- Also, as a further study we could find out more about the different kinds of catering establishments the respondents visited. Are there restaurants that serve more allergy friendly food than others by default, i.e. Chinese cuisine versus Indian cuisine?
- Marketing potential of listing allergens. We have proven through our survey and accompanying results that there is a potential for marketing by simply listing of allergens. Further research in this area could demonstrate the relationship between listing the allergens and an increase in revenue.

References and Bibliography

Adams, Francis. The Genuine Works of Hippocrates. Baltimore: Williams, 1939

Allercom, 2017. *Allergic reactions to food — a range of symptoms.* [Online]
Available at: http://allercom.com/allergic-reactions-to-food-a-range-of-symptoms/
[Accessed 10 02 2017].

Anon., 2015. *Learning Market.* [Online]
Available at: http://www.learnmarketing.net/smart.htm
[Accessed 19th March 2015].

Babbie, E., 2001. The practice of social research. In: s.l.:Wadsworth/Thomson Learning, p. 7.

Blackwell Publishing , 2012. *Introduction of Qualitative Research.* [Online]
Available at:
http://www.blackwellpublishing.com/content/BPL_Images/Content_store/Sample_chapter/9780632052844/001-025[1].pdf
[Accessed 10 March 2012].

Chapple, M., n.d. *About.com.* [Online]
Available at: http://databases.about.com/od/specificproducts/g/storedprocedure.htm
[Accessed 18th March 2015].

CIA World Factbook, 2016. *Ireland demographics profile 2016.* [Online]
Available at: http://www.indexmundi.com/ireland/demographics_profile.html
[Accessed 26 02 2017].

Coca, A. F., 1956. *The Pulse Test.* New York: Arco.

Cox, S. M., 2010. *Management of Innovation in Knowledge Intensive Businesses.* [Online]
Available at:
https://www.scss.tcd.ie/postgraduate/mscmis/Local/Sample%20Dissertations/2009_10/MISSeamus.Cox.pdf
[Accessed 12 02 2017].

Dominiczak, P., 2015. *Top chefs attack EU rules on allergens in food.* [Online]
Available at: http://www.telegraph.co.uk/news/11460125/Top-chefs-attack-EU-rules-on-allergens-in-food.html
[Accessed 03 03 2017].

EAACI, 2016. *Current EU legislation related to food allergen labelling.* [Online]
Available at: http://www.eaaci.org/628-updates/3964-4th-food-allergy-and-anaphylaxis-meeting-faam-world-leading-experts-in-food-allergy-and-anaphylaxis-gather-in-rome-to-discuss-new-research-findings-and-advancements-in-diagnosis-and-management.html
[Accessed 29 01 2017].

EatingWithFoodAllergies.com, 2017. *The Most Common Food Allergies (The Top 8).* [Online]
Available at: http://www.eatingwithfoodallergies.com/commonfoodallergies.html
[Accessed 14 02 2017].

Failte Ireland, 2012. *TOURISM EMPLOYMENT SURVEY.* [Online]
Available at:
http://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/3_General_SurveysReports/2010-Tourism-Employment-Survey.pdf?ext=.pdf
[Accessed 27 02 2017].

FARE, 2017. *Facts and Statistics.* [Online]
Available at: https://www.foodallergy.org/facts-and-stats
[Accessed 29 01 2017].

FDA, 2016. *Food Allergies: What You Need to Know.* [Online]
Available at: http://www.fda.gov/Food/ResourcesForYou/Consumers/ucm079311.htm
[Accessed 14 02 2017].

Fong, D., 2008. *On Outliers: What they represent, and why the Central Limit Theorem is Typically Off..* [Online]
Available at: https://daniellefong.com/2008/01/28/outliers-why-the-central-limit-theorem-is-typically-off/
[Accessed 17 02 2017].

Food Safety Authority of Ireland, 2014. *List of 14 Allergens.* [Online]
Available at: https://www.fsai.ie/legislation/food_legislation/food_information/14_allergens.html
[Accessed 06 01 2017].

Food Safety Authority of Ireland, 2015. *Allergen Labelling.* [Online]
Available at: https://www.fsai.ie/faq/allergens.html
[Accessed 06 01 2017].

Foolchand, P., 2006. *An investigation into the efficiency of the port/rail interface at the port of durban.* [Online]
Available at:
https://www.scss.tcd.ie/postgraduate/mscmis/Local/Sample%20Dissertations/2009_10/MISLane.Sean.pdf
[Accessed 10 Feb 2012 Cited by Sean Lane].

Forta, B., 2012. *Sams Teach Yourself SQL in 10 Minutes.* 4th ed. USA: Pearson Education Inc..

FSAI, 2015. *Allergen Labelling.* [Online]
Available at: https://www.fsai.ie/faq/allergens.html#prepacked
[Accessed 04 03 2017].

Galliers, R. J., 1991. Choosing Appropriate Information Systems Research Approaches: A Revised Taxonomy. In: *Information Systems Research: Contemporary Approaches & Emergent Traditions.* s.l.:s.n.

Gephart, R., 1999. *Paradigms and Research Methods. Research Methods Forum,* s.l.: Academy of Management.

Gray, D. E., 2009. *Doing Research in the Real World.* s.l.:SAGE.

Haeusermann, T., 2014. I can't eat that: The sociology behind the rise in food allergies and intolerances. *SAGE,* Volume 63(3) 369–386, p. 18.

Hare, F., 1905. *The Food Factor in Disease.* 2 ed. London: Longmans.

Hyland, P., 2012. *Food allergies are on rise in Ireland.* [Online]
Available at: http://www.thejournal.ie/food-allergy-contamination-conference-dublin-648425-Oct2012/
[Accessed 17 02 2017].

Jackson, M., 2006. *Allergy: The History of a Modern Malady.* First ed. London: Reaktion Books LTD..

Kaplan, B. & Maxwell, J., 1994. *Qualitative Research Methods for Evaluating Computer Information Systems..* [Online]
Available at: https://www.scss.tcd.ie/postgraduate/mscmis/Local/Sample%20Dissertations/2009_10/MISLane.Sean.pdf
[Accessed 10 Feb 2012 Cited by Sean Lane].

Kolowich, L., 2016. *The Best Times to Post on Facebook, Twitter, LinkedIn & Other Social Media Sites [Infographic].* [Online]
Available at: https://blog.hubspot.com/marketing/best-times-post-pin-tweet-social-media-infographic#sm.000001jpqpvda3e0nzpisf9m30zj6
[Accessed 31 01 2017].

Lee, C., 2014. *I had an asthma attack because of a slice of lemon': Food allergy epidemic that experts fear may be caused by pollen and modern diet.* [Online]
Available at: http://www.dailymail.co.uk/health/article-2875028/Food-allergy-epidemic-experts-fear-caused-pollen-modern-diet.html
[Accessed 31 01 2017].

Levin, D. M., 1988. *The opening of vision: Nihilism and the postmodern situation.* London: Routledge.

Lundy, L. A., 2007. *The Super Allergy Girl Cookbook.* New York: Self.

Mc Adam, S., 2013. *Research into attitudes concerning security and privacy when utilising geolocation technologies,* Dublin: Trinity College Dublin.

McHugh, R., 2016. *86% OF IRISH CONSUMERS OWN OR HAVE ACCESS TO A SMARTPHONE.* [Online]
Available at: https://www.businessworld.ie/article.php?alias=86-of-Irish-consumers-own-or-have-access-to-a-smartphone-566759
[Accessed 23 03 2017].

Mertens, D., 2005. *Research methods in education and psychology.* Calif: Thousand Oaks, Sage Publications.

Morgan, G., 1983. *Beyond Method: Strategies for Social Research..* Calif: Sage Publications.

Nicholson, C., 2015. *European Academy of Allergy and Clinical Immunology.* [Online]
Available at: http://docplayer.net/37737309-European-academy-of-allergy-and-clinical-immunology.html#show_full_text
[Accessed 06 12 2016].

O'Keeffe, A., 2013. *Mother's agony as teenage girl dies from peanut allergy on city street.* [Online]
Available at: http://www.independent.ie/irish-news/mothers-agony-as-teenage-girl-dies-from-peanut-allergy-on-city-street-29854519.html
[Accessed 27 02 2017].

Reich, M., 2012. *commonplaces.* [Online]
Available at: http://www.commonplaces.com/blog/agile-vs-waterfall-how-approach-your-web-development-project
[Accessed February 2015].

Rinkel, H. R. T. a. Z. M., 1951. *Food Allergy.* Springfield: Thomas: Thomas.

Rowe, A. H., 1931. *Food Allergy: Its Manifestation, Diagnosis, and Treatment.* Philadelphia: Lea & Febiger.

Saunders, M., Lewis, P. & Thornhill, A., 2009. *Research Methods for Business Students.* s.l.:Pearson Education Limited.

Saunders, M., Lewis, P. & Thornhill, A., 2009. *Research Methods for Business Students.* London: Pearson Education.

Shamaei, A. M., 2012. *Adoption of Information and Communications Technology (ICT) by Irish Credit Unions,* Dublin: Trinity College Dublin.

Strauss, A. & Corbin, J., 1990. *Basics of qualitative research: Grounded theory procedures and techniques..* [Online]
Available at:
https://www.scss.tcd.ie/postgraduate/mscmis/Local/Sample%20Dissertations/2009_10/MISLane.Sean.pdf
[Accessed 10 Feb 2012 Cited by Sean Lane].

The Guardian, 2016. *Restaurant owner jailed for six years over death of peanut allergy customer.* [Online]
Available at: https://www.theguardian.com/society/2016/may/23/restaurant-owner-mohammed-zaman-guilty-of-manslaughter-of-peanut-allergy-customer
[Accessed 20 01 2017].

Thomson Reuters, 2011. *EAACI: 17 million Europeans allergic to food; allergies in children doubled in the last 10 years.* [Online]
Available at: http://www.bolsamania.com/noticias-actualidad/notasDePrensa/EAACI-17-million-Europeans-allergic-to-food-allergies-in-children-doubled-in-the-last-10-years--HUG1490004--ad6eb2cd7221d9e5f78c7bcd1e41373b.html
[Accessed 29 01 2017].

Thomson, M., 2017. *Food allergens: the cost of inaccurate reporting.* [Online]
Available at: http://mobile.foodmanufacture.co.uk/Regulation/Food-allergens-the-cost-of-inaccurate-reporting
[Accessed 03 03 2017].

Tuckman, B., 2011. *Lincoln Interactive.* [Online]
Available at: http://www.lincolninteractive.org/samples/introduction-to-engineering/introduction-to-engineering-lesson-8
[Accessed February 2015].

Vaughan, W. T., 1941. *Strange Malady.* New York: Doubleday.

Von Pirquet, C. A., 1906. *Munch Med Wochenschr.* Unknown ed. Unknown: Self.

Wilson, J., 2010. Essentials of Business Research: A Guide to Doing Your Research Project. In: *Essentials of Business Research: A Guide to Doing Your Research Project.* s.l.:SAGE Publications, p. 7.

Annex A – Survey Questions

Customer: https://www.surveymonkey.com/r/EatAwareCustomer

1. Are you aware of the EU food allergy regulation effective since Dec 2014?
2. Are you suffering from any food allergies?
3. Are you concerned about the accuracy of information on a menu regarding dietary allergens?
4. Whose responsibility, do you think it is to inform you about allergies?
5. How frequently do you eat out (per week)?
6. Would you be willing to pay for a service that would aid you in identifying dietary allergens?
7. If so, how much? (Monthly)

The next questions will only be asked if the user has answered "Yes" to the question 2.

8. Do you always carry medication for your allergy?
9. Have you ever had a serious reaction (that needs medical attention) while eating out?
10. On a scale from 1-5, how easy do you find it to check for your allergies on a restaurant menu?
11. How much time on average do you spend searching for allergens on a menu?
12. Do you think websites currently provide enough information regarding dietary allergens?
13. What technology would you prefer to use?
14. Would your eating-out frequency increase with more awareness on a menu?
15. Does your allergy affect your social life?
16. If so, how does it affect you?

Caterers: https://www.surveymonkey.com/r/EatAwareRestaurant

1. Are you aware of the EU food allergy regulation effective since Dec 2014?
2. How often do you change your menu?
3. Does concern about allergies inhibit you from creating new dishes?
4. How much time you spend listing allergens on a menu item?
5. What type system do you use to list those allergens?
6. What technique does your employee use to avoid cross-contamination of food?
7. Does the labelling on products provide you with enough information regarding allergens?
8. On a scale from 1-5, how educated are your staff/colleagues regarding dietary allergens?
9. What kind of training do you receive regarding dietary allergens?
10. Does your menu currently provide sufficient information regarding dietary allergens?
11. What existing technology can provide the best information to your customers regarding dietary allergens?