

Food Wastage in the Region of Waterloo, Ontario

by

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Abstract

Much discussion on alleviating hunger and shaping more sustainable food production practices has focused on the production of food. More recently, an emerging body of literature has begun to focus on food wastage. Food wastage has direct and indirect environmental impacts, ranging from the unnecessary waste of inputs to produce food that will never be eaten, to the environmental impacts of the disposal of wasted food. In industrialized countries like Canada, an estimated 40 percent of food available for human consumption is discarded – half of it from households. In spite of these numbers, only a handful of studies have begun to study food wastage in Canada. A better understanding of the mechanisms that drive up the food wastage levels in Canada is the first step needed to create targeted food wastage reduction strategies.

This study aims to answer the question: What factors drive Canadian households to waste food? A combination of online surveys, case study household food wastage collections, and case study interviews are used to gain a better understanding of the behaviours and socio-economic factors that shape household food wastage in Canada.

This study confirms many of the findings from other food waste research, but also emphasizes the role of food environments (e.g. retail environments and access to grocery stores) and environmental triggers (e.g. time constraints) in household food wastage. These findings highlight the complexity of the issue of food wastage, and the need for strategies that go beyond targeting household behaviours.

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1. Introduction

Globally, it is estimated that approximately 40 percent of food available for human consumption is wasted, valued at over CAN\$ 27 billion, out of which a staggering 51 percent of food wasted in Canada is discarded at the household level (Gooch, Felfel, & Marenick, 2010). However, few studies have addressed food wastage in Canada. Given the nascent state of literature on food wastage in Canada, and the considerable proportion of food wastage produced by households in Canada, this research aims to gain a better understanding of the reasons that household food wastage occurs. Specifically, as suggested by a review of the literature of household food wastage, this project studies the socio-economic and behavioural factors that contribute to high levels of household food wastage in developed countries. Within the context of abundant food and low food prices relative to income, this study asks the question: What factors drive Canadian households to waste food?

Specifically, the objectives of this study are to understand the behaviours that lead to household food wastage, and the relationship between select socio-economic factors and food wastage patterns. In particular, household food wastage from urban homes in the Region of Waterloo was examined in order to do the following:

- Identify and test select socio-economic factors and behaviours, and their relation to household food wastage levels
- Identify behaviours and habits that contribute to household food wastage levels, by comparing these levels across different types of food-related behaviours
- Identify sectors of the population who are more (or less) likely to waste food, by comparing food wastage levels across different types of food-related behaviours and demographic groups

These objectives were achieved through a mixed methods approach using an online survey, household food wastage collection, and interviews. This study found that many of the behaviours linked to higher household food wastage in other studies were also relevant in the context of Canadian households. Additionally, findings suggested the need to consider food environments and environmental factors, such as time scarcity, as central drivers of household food wastage.

Chapter 2 presents a literature review on food wastage. First, an overview of the issue of food wastage is studied. Secondly, literature on household food wastage is reviewed. Finally, the review examines literature of food wastage in Canada. Chapter 3 presents the methods chosen for this study, based on a literature review of other studies of household food wastage. Chapter 4 lays out an overview of the data collected for this study. Chapter 5 presents a discussion of the data and the findings of this study. Study data is compared to the literature review to highlight differences and similarities between this study's findings and literature review findings. Finally, the study's findings and limitations are examined.

2. Literature Review

2.1. Part 1: Food Wastage

Food wastage is intimately linked to food security. Current agricultural systems produce more than enough food for everyone to consume adequate caloric intake, yet the problem of hunger persists (FAO, IFAD, & WFP, 2013). Between 30 percent and 50 percent of foods intended for human consumption are wasted (Gustavsson, Cederberg, Sonesson, van Otterdijk, & Meybeck, 2011; Institution of Mechanical Engineers, 2013), and at the same time, 842 million of people were undernourished in 2011–2013 (FAO et al., 2013). While some push for technological fixes to increase agricultural productivity based on the assumption that we need to produce more food both to feed the world now and the world's growing population in the future (Pingali, 2012), others argue that *access* to food must be the focus of efforts (Godfray et al., 2010; Kerr, 2012), given that we consistently produce more than enough food, even before factoring in the large percentage of food that is wasted.

2.1.1. Relevance: Impacts of food wastage

Food systems present us with a seemingly contradictory situation in which there is a higher availability of calories per capita, yet diets are nutritionally deficient, and hunger and malnourishment persist alongside the rise of obesity and high levels of food wastage. For example, dietary energy supply (DES) in the EU jumped from 2930 kcal/person/day to 3530 kcal/person/day between the early 1960s and early 2000s (Schmidhuber, 2007), while in developing countries, DES has increased from 1950 kcal/person/day to 2680 kcal/person/day within the same time period (Schmidhuber & Shetty, 2005). Although increases in DES are positive overall in their contribution to decreasing hunger, Schmidhuber (2007) suggests that DES availability beyond 3000 kcal/person/day is wasted.

Globally, the food system is responsible for between 19 percent and 29 percent of all anthropogenic GHG emissions (Vermeulen, Campbell, & Ingram, 2012). Food wastage has a range of indirect environmental impacts, ranging from the unnecessary waste of resources and the environmental impacts associated with producing food that will never be eaten, to the direct environmental impacts related to the disposal of wasted food.

The newly published FAO report on the environmental impacts of food wastage calculated that if food wastage was a country, it would rank third in global GHG emissions, after the US and China (FAO, 2013a), producing approximately 3.3 Gtonnes CO₂e/year. Current food system is responsible for between 19 percent and 29 percent of all anthropogenic GHG emissions (Vermeulen et al., 2012). This number includes both direct emissions (such as those related to producing the inputs necessary for food production, transportation and storage, the energy used to create farm inputs) and indirect inputs (such as the land-cover change that results from expanding or converting land to farmland (Garnett, 2011; Vermeulen et al., 2012)). Food wastage that is disposed of through landfills produces methane from anaerobic decomposition of food (Buzby, Hyman, Stewart, & Wells, 2011; Lundqvist, Fraiturew, & Molden, 2008). Food wastage in landfills also contributes to the production of leachate (a mixture of various substances, including by-products of organic degradation), which pollutes groundwater.

In 2003, the production of food that was wasted used approximately 300 million barrels of oil and 25 percent of the total freshwater used in the USA (Buzby et al., 2011). In the USA, it is estimated that avoidable postproduction food wastage alone contributes more than 113 MtCO₂e/year (Vermeulen et al., 2012). Agriculture represents the largest human use of water (Lundqvist et al., 2008), including a high rate of 'consumptive use' of water – water that cannot be re-used until it returns in the form of precipitation. In 2008, global consumptive use of water for agriculture totalled 7000 km³ (Lundqvist et al., 2008).

Food that is wasted uses approximately 30 percent of the world's agricultural land area (FAO, 2013a), or 23 percent of cropland area (Kummu et al., 2012). Kummu et al. note that currently, the land that is best suited to crop cultivation is already in use for food production, and so the conversion of new land to food production has contributed to environmental degradation. This conversion of land to agricultural purposes causes degradation and loss of habitat and environmental pollution from the use of fertilizers and pesticides. Habitat degradation and loss contribute to the loss of biodiversity. For example, studies have linked expansion of soybean and oil crops in Brazil and Southeast Asia, respectively, to deforestation and habitat degradation (Alexandratos et al., 2006). Fishing activities have also led to the loss of biodiversity, through both overfishing and through the loss and alteration of aquatic habitat (FAO, 2013a). These impacts are the result of current industrial fishing activities, which result in wastage of the by-catch of non-target species, but also because of water pollution from fish farming activities.

While these impacts are serious enough in and of themselves, they gain gravity by noting that they are a result of food that is wasted. The incongruence of aiming to increase agricultural productivity when so much waste occurs is food for thought.

2.1.2. Defining "food wastage"

This study uses the FAO definition of food wastage. The FAO defines food wastage as the deterioration or loss of food produced for human consumption (FAO, 2013a, 2013b). This definition encompasses both "food loss" and "food waste," terms that are often used to describe the loss of food throughout the food supply chain. These terms are sometimes used interchangeably (Oelofse & Nahman, 2013). The term "food loss" is often used to refer to the decrease of the economic, nutritional, or qualitative value of foods (Buzby et al., 2011; De Lucia & Assennato, 1994; FAO, 2013a, 2013b). Food waste is used to refer to edible foods that are discarded instead of being consumed (Buzby et al., 2011; FAO, 2013a, 2013b).

2.1.3. How does food wastage occur?

A recent report by the FAO estimates that approximately 1.3 billion tonnes of food produced for human consumption is wasted annually. This represents about 30 percent of all food produced (Gustavsson et al., 2011).

The causes of food wastage vary between countries, and by the part of the food chain where the losses occur. In developed countries 40 percent of wasted food is lost at the retail and consumer level, whereas in developing countries, 40 percent of waste occurs at the "post-harvest and processing" stages, after foods are harvested

(Gustavsson et al., 2011). Most of the food wastage in developing countries occurs earlier in the food chain, either on-farm or during transportation, storage or processing stages. Godfray et al. (2010) estimate that in developing countries over 75 percent of food wastage occurs pre-retail.

2.1.4. Differences in food wastage between developing and developed countries

2.1.4.1. Developing countries

In developing countries, the majority of food wastage occurs at the earlier stages of the food chain, and is due to inefficient harvesting, inadequate transportation, and poor infrastructure – namely, because of food being handled and stored incorrectly (Institution of Mechanical Engineers, 2013), as described in the following paragraphs:

Farmers may be pressured to harvest food products prematurely due to the immediate need for income. Premature harvesting can cause inferior product quality and food wastage if the foods are harvested before they are edible (Gustavsson et al., 2011).

Significant food wastage occurs during the storage phase of the food chain in developing countries. Traditional storage methods are used despite the existence of modern food storage methods. Such technologies often include ground storage, drying foods on surfaces to dry them in the sunlight, 'aerial storage' (hanging food from ceilings or other elevated structures,) and using containers such as baskets, jars, pots, and gourds to store foods (Mhlanga, Seidler, Njie, & Gallat, 2010; Tefera, 2012). These traditional storage methods expose foods to microorganisms, rodents, and insects. Wet, humid, or cloudy weather can impede proper drying of foods when they are laid on surfaces food storage by not allowing foods to dry properly when they are laid on surfaces in the sun (Zorya, Morgan, & Diaz Rios, 2011). Some humidity levels and temperatures can create conditions that favour the development of bacteria and fungus that attack foods. These pests not only consume stored foods, but also decrease the quality of food products, or render them inedible through contamination; e.g., inadequate storage conditions favour the development of fungi that are linked to mycotoxin contamination of foods (Tefera, 2012). Further losses can arise from storage barriers when 'bumper harvests' occur, increasing food supplies and causing a strain on the ability of farmers and other actors to adequately store the excess food (Tefera, 2012).

Transportation inefficiencies can cause waste if farmers lack the necessary infrastructure to move fresh foods before they deteriorate and spoil. Rough and bumpy terrain (Tefera, 2012), together with inadequate packing, or lack of refrigeration over long distances (broken cold chains (Gustavsson et al., 2011)) can also lead to food wastage.

Food wastage in the processing sector in developing countries can stem from the lack of capacity to handle and preserve fresh foods, particularly seasonal products, because of the scale of the investment needed to expand processing facilities (Gustavsson et al., 2011).

Barriers to achieving adequate and effective storage and transportation include lack of information, but also the lack of tools and equipment necessary to implement appropriate technologies (Kitinoja, Saran, Roy, & Kader, 2011).

2.1.4.2. Developed countries

In developed countries, more effective infrastructure allows for a greater proportion of food products to reach consumers (Institution of Mechanical Engineers, 2013). Post-harvest supply chains are more efficient and competitive, and the food processing is equipped to handle larger volumes of food. Parfitt, Barthel, & Macnaughton (2010) suggest that the most promising opportunities for food wastage reduction in developed countries are related to retailers, food services and consumers.

High aesthetic standards and stringent quality standards throughout the food chain result in food wastage every time foods change hands. Food products that decay quickly or that are susceptible to bruising are more liable to becoming waste. A recent FAO report states that fresh fruits and vegetables constitute a food group that “dominates” food wastage in the industrialized regions studied, mostly because of product grading related to retail quality standards (Gustavsson et al., 2011). For example, in Sweden, fresh foods are rejected by retailers due to “non-compliance with quality requirements” (Eriksson, Strid, & Hansson, 2012). Globally, up to 1.6 million tonnes of food are wasted by retailers every year because of not meeting aesthetic standards (Institution of Mechanical Engineers, 2013). The amount of waste is exacerbated by the small size of markets for ‘sub-standard’ products (both commercial and charity outlets) such that disposing of these food products is cheaper and easier than re-using or redistributing them (Institution of Mechanical Engineers, 2013).

Abundance, and commercial outlets' practices of displaying large quantities and carrying a wide range of products and brands of food can lead to food wastage (Gustavsson et al., 2011). Retailers are able to afford putting more food on display than will likely be sold; the appearance of abundance in stores can help sales (by keeping customers from feeling they are getting the last pick of foods). Overstocking in retail settings is further encouraged by ‘take-back clauses’ in contracts, which allow retailers to return products to suppliers after a specified ‘residual shelf-life’ has been reached (Parfitt et al., 2010). Foods are sometimes thrown out before they reach their ‘sell-by’ dates to make room for newer or fresher products that are more likely to be sold.

Market pressure and market mechanisms contribute to food wastage by promoting situations in which premature harvesting and overproduction are favoured. Supply agreements for food often favour buyers, and include penalties for not being able to fulfill orders; the low cost of disposing of food, together with such penalties, encourages the growth of excess crops as insurance against unpredictable factors (such as weather variations or pest attacks) that may decrease yields (Institution of Mechanical Engineers, 2013). Low demand for highly perishable crops during peak season can result in products not being harvested, causing losses for farmers (Beretta, Stoessel, Baier, & Hellweg, 2013).

Household and consumer waste are the biggest contributors to food wastage in developed countries (Gustavsson et al., 2011; Institution of Mechanical Engineers, 2013). Abundance and consumer attitudes make food affordable, readily available, and almost a disposable good to some of the population. The causes behind household and consumer waste will be discussed in Section 2.2.

In Canada in particular, food wastage is weighted heavily towards the last stages of the food chain; however, a recent report suggests that Canada's production wastage levels from agricultural production might be comparable to wastage from consumption (FAO, 2013a).

2.2 Factors Influencing Consumer Food Wastage

This section examines the behaviours and socio-economic factors that influence consumer food wastage levels.

Consumer behaviours, such as food purchasing behaviours and food preparation and storage behaviours, are influenced by access to food, personal values and social norms, and by environmental factors (Stern, 1999, 2000; Thøgersen, 1999). The environments in which food products are procured, such as grocery stores, and other retail spaces reinforce certain behaviours that are conducive to waste, such as buying bigger volumes of food, and impulse shopping. At the same time, retailers are clearly not solely responsible for coercing consumers into purchasing food beyond their ability to consume, or all customers of the same grocery store would waste the same amount of food. Thus, life history, cultural roots, and beliefs (which affect people's relationship with food) must also affect the way food is disposed of. Specifically, the relationship between modern consumers and food has changed.

2.2.1. The changing relationship between modern consumers and food

Changes in the food system have brought about changes in trends in food availability, reshaping the relationship between consumers and food. The commodification of crops and subsidies of a small group of crops in richer countries have created an abundance of cheap, high calorie, low nutrient, highly processed, low cost foods, and made these foods more attractive to consumers because of lower prices, putting products such as fruits and vegetables at a competitive disadvantage (Neff, Palmer, McKenzie, & Lawrence, 2009). Some countries have benefitted more than others from technological advances in farming; EU countries have been able to meet and exceed recommended minimum intake levels of fruits and vegetables, yet in other parts of the world – for instance, in some countries in sub-Saharan Africa – these advances “have not even started to yield a meaningful impact” (Schmidhuber, 2007) . Disparities brought on by unequal access to healthy foods and balanced diets are not limited to developing countries, but are also present in low income communities in developed nations (Lang, 2009). Lang writes that rising obesity numbers show that the normalization of unbalanced and unhealthy diets are becoming a global phenomenon, and is no longer limited to developed countries (Lang, 2009).

In general, the percentage of income spent on food has declined as foods have become more accessible (Barnard, 2010). Rapid urbanization in the last century has changed the role of people in procuring food. As households shifted from being producers and growers of food to buyers of food, the venues for food procurement have expanded. Supermarkets have become powerful actors in food supply chains, and are expected to become “the dominant food suppliers around the world (Traill, 2006).” Trade liberalisation has allowed for the creation of global supermarket chains, and allowed consumers to gain exposure and access to a wider variety of foods. Because of the imports, consumers in northern developed countries, such as Canada, have access to fresh fruit and vegetable products all year round.

There has also been a shift towards foods that require reduced or no preparation time – particularly food from commercial settings, such as fast foods – as women joined the work force in the twentieth century (Bowers, 2000). Technological advances have transformed households, in particular kitchens (Bowers, 2000). Modern kitchens are equipped with appliances that have changed household food preparation and food storage. Refrigerators replaced the ice boxes that were used for household refrigeration. Since the first household refrigerator in the US was sold in 1925, refrigerators have become more efficient and larger: fridge sizes in the US increased by almost 160 percent between 1947 and 2008 (Boustani, Sahni, Gutowski, & Graves, 2010).

This changing food culture and environment provides the context for some of the factors that affect household food wastage.

2.2.2. Behaviours that contribute to household food wastage

Analysis performed by the Waste & Resources Action Programme (WRAP) in the UK (Cox & Downing, 2007) divides behaviours conducive to food wastage into four categories: Shopping, food storage, food preparation, and eating/lifestyle behaviours. These four categories are used to frame this literature review. I examine studies from the last 20 years that focus on consumer food wastage and either attempt to measure it or relate it to behaviours conducive to waste, and that included some source of primary data. Table 1 summarizes the literature review findings on behaviours conducive to food wastage using WRAP's four categories, and Appendix 1 provides a detailed overview of all the studies reviewed.

Table 1: Summary of behavioural factors that have been found to contribute to food wastage, by category.

	Behaviour
<i>Shopping</i>	<ul style="list-style-type: none"> • Buying too much food because of store promotions • Buying too much food because of large package sizes • Buying too much food because of spontaneous shopping by other household members
<i>Storing food</i>	<ul style="list-style-type: none"> • Top-up shopping • Not eating older foods first
<i>Food preparation</i>	<ul style="list-style-type: none"> • Perceptions of food quality – e.g. 'high' standards • Perceptions of food safety – e.g. 'high' standards • Confusion over on-pack dates
<i>Eating food and lifestyles</i>	<ul style="list-style-type: none"> • Cultural influences on perceptions of acceptable thresholds/behaviours when discarding foods • Behaviours related to eating/re-using leftovers (e.g. not eating/re-using leftovers) • Behaviours related to eating/re-using unprepared foods (e.g. preparing more food/eating out instead of eating foods already purchased) • Transition to healthier and/or more varied diets that include many perishable items, and lack of food literacy

- *Shopping – excessive in-store purchasing*

Purchasing too much food has been found to be one of the main causes of self-reported food wastage (Cox & Downing, 2007; Stefan, 2011; WRAP, 2007). Excessive purchases lead to food going bad because it is not used in time or because too much food is prepared. Purchasing more perishable foods (for example, fresh fruit and vegetables) can also set up households to generate more waste (WRAP, 2007), likely because perishables spoil more quickly than lower priced processed, packaged foods.

Good deals on multipacks and bulk food or because of buy-one, get-one-free promotions or other store sales push shoppers to buy more food than needed (Buzby et al., 2011; Glanz, 2008; Williams, Wikström, Otterbring, Löfgren, & Gustafsson, 2012). Grocery store layouts, decisions about which products are displayed on which shelves, and in-store ads and signs are designed to encourage customers to purchase more food (Koch, 2012). The appearance of grocery stores is the result of retailers' efforts to minimize losses from waste, make space for new products, and get rid of excess stock, thus offsetting some of their losses from food wastage to consumers.

Large package and portion sizes contribute to customers buying too much food, creating higher potential for food wastage to occur. A UK study on consumer behaviour and packaging found that a third of respondents felt that portion sizes for commonly eaten packaged foods such as ham, salad, pasta sauce and bread are too large for their needs (Brook Lyndhurst, 2008), while a US study that examined the monetary value of wasted produce noted that "consumers have increased their expectations of serving sizes and are often encouraged to buy more than they need, increasing the potential for food wastage (Buzby et al., 2011).

- *Storing food – food management and planning ahead*

Consumers may shop without knowing what food they already have (i.e. pre-shopping planning) (Cox & Downing, 2007), therefore older foods that are stored at home may be forgotten or ignored. This was more likely to happen with higher incomes, as found in a study in Norwich (UK), where 38 percent participants with higher incomes cited "not eating the food that needs to be eaten first" and "leaving it too long and the food went off" as the main reason for food wastage, compared to only 21.2 percent of lower income participants (Pham, 2011).

Additionally, 'top-up' and 'spontaneous' shopping patterns may lead to prioritizing eating what one wants instead of what is available at home (citation). In particular, Koch (2012) suggests that less experienced shoppers may play a bigger role in contributing to household 'top-up' and 'spontaneous' shopping (more so than households' main shoppers), and may be more easily coerced by store sales, or might fail to purchase household staples and instead just purchase impulse items.

However 'top-up' shopping was not a good predictor of consumer-reported food wastage for Romanian consumers. Instead, a higher frequency

of 'main shopping trips' was linked to lower rates of reported food wastage (Stefan, 2011).

- *Food preparation*

Customers decide whether a product will be eaten based on their (1) perception of product quality and (2) perception of product safety (Brook Lyndhurst, 2008). In particular, dates on products seem to play an important role in customers' perceptions of quality and safety. In a study in the Oita, Japan, the majority of respondents reported throwing food away because it has passed its expiry date (41 percent), or gone bad (17 percent) (Morisaki, 2011).

In the UK, studies have shown customer confusion over on-pack dates (like 'best-before' and 'freeze by' dates) of packaged foods may lead to food wastage (Brook Lyndhurst, 2008; WRAP, 2007). In an experiment (UK), researchers presented customers with packaged foods, and found that almost three quarters of the customers rely heavily on the use of on-pack dates to decide if a food should be consumed. The study also noted that there was some understanding of the difference between 'sell-by', 'display until', 'use by' and 'best before', but that they were used interchangeably by study participants (Brook Lyndhurst, 2008). In addition to misunderstandings of differences in the way products are dated, this could lead to food wastage, since it could contribute to a difference between a customer's perception of quality and safety, compared to the actual quality and safety of a product. Stefan (2011) found that Romanian consumers who eat foods passed their expiration report wasting *more* food than those who don't. She explains that these consumers are less likely to check the expiration dates of the foods when shopping, and do not eat all the expired products purchased, thus generating more waste.

- *Eating food and lifestyles*

Food wastage may be caused either by individuals (a) preparing too much food, or (b) being dissatisfied with how their cooked foods turn out. The latter is a big contributor to waste in households with young children (Cox & Downing, 2007). Stefan found that a higher ability to "predict, buy and cook exactly the amount of food needed in the household" is correlated with lower rates of food wastage (Stefan, 2011).

Cultural factors also play a big role in determining food-related behaviours. Mexican households in the US have been found to waste less than Anglo-American households, perhaps because many Mexican dishes are cooked using different combinations and preparations of the same staple ingredients that are re-stocked regularly. This also makes it easier to incorporate leftovers into subsequent meals (Glanz, 2008; Rathje & Murphy, 1992). It is interesting to note how different types of cuisines have incorporated leftovers of staple ingredients into traditional dishes, avoiding waste: French toast (or 'pain perdu,' meaning 'lost bread' in French) is best with old, dry bread; in China, fried rice is a way to use leftover rice from the

day before; Mexican cuisine has many dishes, like chilaquiles, that call for dry or old tortillas.

Rathje and Murphy (Rathje & Murphy, 1992) present what they call 'the first principle of food waste' in a book about a modern landfill archaeological study: *The more repetitive your diet – the more you eat the same things day after day – the less food you waste*. For example, they note that common square loaves of bread are wasted less than “specialty breads” (such as hotdog and hamburger buns, or bagels). As was noted for the case of Mexican households in the US, it is easier to manage and cook with a smaller set of staple ingredients. This is supported by observations from Glanz (Glanz, 2008); he notes that items that are not used regularly for meals, but needed once or twice for a specific recipe are usually only partially used, and the rest goes to waste.

2.2.3. The intent not to waste food: How we feel about wasting food

Cultural factors not only influence practices that lead to wastage; they also affect food disposal behaviours. Evans notes that food wastage can occur when even though household members have noticed that they have too much food at home, the foods are 'allowed' to go bad instead of being redistributed; foods are stored with the – sometimes unrealistic – hope that somehow they will be consumed in the future, and no effort is made to redistribute surplus foods to friends, families, or neighbours because of the belief that the foods are not 'good enough' to share with others (Evans, 2012). Evans illustrates through case studies how participants argue that foods cannot be gifted because they might reflect badly on the household and expose households to judgment because foods are of bad quality; e.g., too cheap or too unhealthy.

In general, household members feel bothered by the idea of wasting food, although not everyone feels so for the same reasons. However, it is not clear whether the intent to not waste food – and feelings of guilt associated with waste – play an influential role in the amount of food wastage produced (Clive, Richard, & David, 2005; Cox & Downing, 2007; Stefan, 2011). In the UK, WRAP surveys indicate that consumers feel bad about generating food wastage because they perceive it to be a waste of money, and link throwing away good food to feelings of guilt (Cox & Downing, 2007). At the same time, perhaps because wasting food is associated with negative feelings, households tend to underestimate the amount of food wastage that they produce (Clive et al., 2005; Rathje & Murphy, 1992). This poses a problem when trying to estimate the amount of consumer waste generated by relying on self-reported amounts to measure food wastage. For example, studies by the Australian Food and Grocery Council in 2003 found that households in Australia, on average, under-reported their waste by over 40 percent: 4.6 billion AUD worth of food wastage was reported, yet audits found that the actual figure might be closer to 8 billion AUD (Clive et al., 2005). Moreover, although aversion to the idea of food going to waste is felt by the majority, being troubled by food wastage is not universal (Clive et al., 2005; Cox & Downing, 2007; Mikkelsen, 2012).

Interestingly, the reasons that consumers in the UK felt bad about wasting food varied depending on whether they reported wasting greater or smaller amounts of food: WRAP studies found that 44 percent of their survey respondents did *not* feel bothered by the idea of food wastage, possibly due to a lack of awareness and interest, or the belief that they personally were not wasteful (Cox & Downing, 2007). Among

participants in WRAP's studies in the UK, the belief that they, personally, do not throw away much food, was the main reason that survey respondents reported not feeling bothered by food wastage. Some reported being aware of the environmental impact of food wastage, but do not feel that wasting food is as big an issue as, for example, wasted packaging, because food wastage is "natural and biodegradable" (Cox & Downing, 2007). Other reasons cited among those who admitted to throwing away more food included preferring waste to food poisoning, and not worrying about waste because it is unavoidable. Evans suggests we deal with feelings of guilt by avoiding wasting food in acceptable states. For example, instead we let it go bad, and dispose of it when we rediscover it and notice it has gone bad (Evans, 2012).

2.2.4. Who wastes more food? Socio-economic factors

This literature review has found varied results from different studies about the importance (or lack thereof) of socio-economic factors in relation to consumer food wastage. In particular, age, household size and composition, and income were found to be related to higher or lower levels of food wastage. These variations might be due in part to cultural differences between the samples studied, but also to differences between the goals of these different projects. See Table 2 for a summary of the literature review findings on socio-economic factors and household food wastage, and Appendix 2 for an overview table of the articles reviewed.

Table 2: Summary of socio-economic factors that have been found to contribute to food wastage, by category.

	Behaviour
<i>Age</i>	<ul style="list-style-type: none"> • Older primary shoppers/household-management • Average age of household
<i>Household composition</i>	<ul style="list-style-type: none"> • Number and age of household member • Presence of children
<i>Employment and income</i>	<ul style="list-style-type: none"> • Income
<i>Tenancy</i>	<ul style="list-style-type: none"> • Tenancy

- *Age*

Some studies show that older consumers tend to waste less food than their younger counterparts: the largest demographic group that reported not wasting any food in a study in Japan was participants over 70 (Morisaki, 2011) and studies in the UK and Australia have found that younger working people and young families are more likely to waste food than other age groups (Clive et al., 2005; Cox & Downing, 2007; WRAP, 2007). Other studies show that age has no effect on food wastage per capita (Stefan, 2011); but that the average age of households and the age of the main shopper in a household (Ventour, 2008) are linked to lower levels of food wastage.

A consumer food wastage study carried out in Australia in 2005 reads: "wasteful consumption of food, for instance, falls sharply as age increases" (Clive et al., 2005). The authors note that it would be interesting to know whether possible differences in waste and consumption behaviours between age groups are due to different life stages or if they are due to life history. This could predict future patterns in levels of food wastage if current trends continue; if behaviours

conducive to food wastage are due to life history, then current generations, who have not experienced food scarcity to the extent that previous generations have, will not stop wasting food as they age.

- *Household size*

In general, larger households have been found to produce more waste than smaller households, but members of larger households produce less waste per capita. These results hold for studies in the UK (Pham, 2011; Ventour, 2008; WRAP, 2007), but other projects have found no correlation between household size and food wastage (Stefan, 2011). One rationalization of the effect of household size on food wastage is that perhaps cost of feeding large households disincentivizes food wastage, as the added extra expense of wasted food might be more noticeable than in smaller homes.

- *Household composition*

No consensus was found in the literature about the effect of children on household food wastage. Studies in the UK and Romania (Pham, 2011; Stefan, 2011) have found no correlation between food wastage and the presence of children in a home; in Japan, the presence of children has been found to reduce the amount of food wastage (Morisaki, 2011). (It is suggested that, because growing children need large amounts of food, their presence in households contributes to lower levels of meal leftovers). WRAP studies in the UK, in the US, and Australia show that families with young children throw out more food, particularly more fresh foods, than households without young children (Clive et al., 2005; Parfitt et al., 2010; Ventour, 2008).

WRAP reports from the UK suggest that families with children may prefer to over-stock food rather than run the risk of running out of food, and might be more alert to food safety issues and throw away food in dubious states more easily for the sake of protecting children from unsafe foods (WRAP, 2007). Shopping with children can also promote behaviours that have been linked to higher rates of food wastage (Koch, 2012). A Finnish study from 2012 (Koivupuro et al., 2012) found that if the primary shopper of a household is a woman (as opposed to shared responsibility for shopping, or a male primary shopper) then more food is wasted. The Finnish study also found that among all household compositions examined, households consisting of a single woman wasted more food than those of single men, however their sample did not allow them to conclude a significant difference between genders for single households.

- *Employment and income*

A relationship between higher incomes and higher household food wastage was confirmed in some studies, but not in others. Higher incomes have been found to be linked to higher household waste levels in Vietnam and Australia (Clive et al., 2005; Thanh, Matsui, & Fujiwara, 2010). In Japan and the UK, individuals who do not work and who are dependent on the state were found to waste less food (Morisaki, 2011; WRAP, 2007). Some suggest that when households have higher incomes and a smaller part of earnings are spent on food,

the economic incentives not to waste food become weaker (WRAP, 2007). However, other studies have found no correlation between income and food wastage (Koivupuro et al., 2012; Pekcan, Koksal, Kucukerdonmez, & Ozel, 2006; Pham, 2011; Stefan, 2011), and a study in the UK has shown that households in which the main earner works in a “professional or higher-managerial capacity,” perhaps earning a higher income than other households (Ventour, 2008).

Studies have also found differences between the *types* of foods thrown out by households, depending on their reported income. A WRAP report in the UK reported that household with higher incomes throw out more vegetable waste than households with lower incomes (WRAP, 2007), maybe due to higher access to fresh fruit and vegetables, which are foods that spoil more easily.

- *Tenancy status*

Studies in the UK (Cox & Downing, 2007; Ventour, 2008) have found that those living in private rented homes are more likely to waste food than those with other living accommodations. Cox and Downing note that perhaps this is due to interaction of tenancy status with other socio-economic factors, such as income and age; renters may be, on average, younger than non-renters – e.g., young families or young professionals (Cox & Downing, 2007).

2.3. Food Wastage In Canada

A small number of studies have focused on food wastage in Canada: a non-academic report (Gooch et al., 2010) from Value Chain Management International Inc. (VCM), a company based in Ontario, Canada, and an academic article¹ (Abdulla, Martin, Gooch, & Jovel, 2013). The few figures available indicate that in Canada the amount of food wastage per capita has increased, and that consumer food wastage makes up a large proportion (about 50 percent, see Figure 1) of the total food lost in Canada.

These studies have found that, in Canada, roughly 40 percent of food – valued at over \$27 billion – is wasted (Gooch et al., 2010), similar to the 40 percent that is wasted in the United States (Gunders, 2012). In 2007, the amount of solid food that was lost was estimated at over 6 million tonnes between retail level and the plate (not including losses at production or processing stages) – the equivalent of 183 kg per person. Another 2.8 billion litres of liquids, such as milk products and other beverages, were also wasted (Statistics Canada, 2009).

¹ Abdulla et al. (2013) found that waste per person in Canada was estimated to be 1.65 lb. per day (0.75 kg) or 49.69 lb. (22.54 kg) per month; this corresponds to roughly 40 percent of food available for human consumption. These results were found by calculating the ratio of food available for human consumption, before and after adjusting for waste, and then adjusted to calculate total waste per person, per day. Secondary data from 2002 and 2009 Food Statistics reports were adjusted for waste using USDA "food loss" estimates.

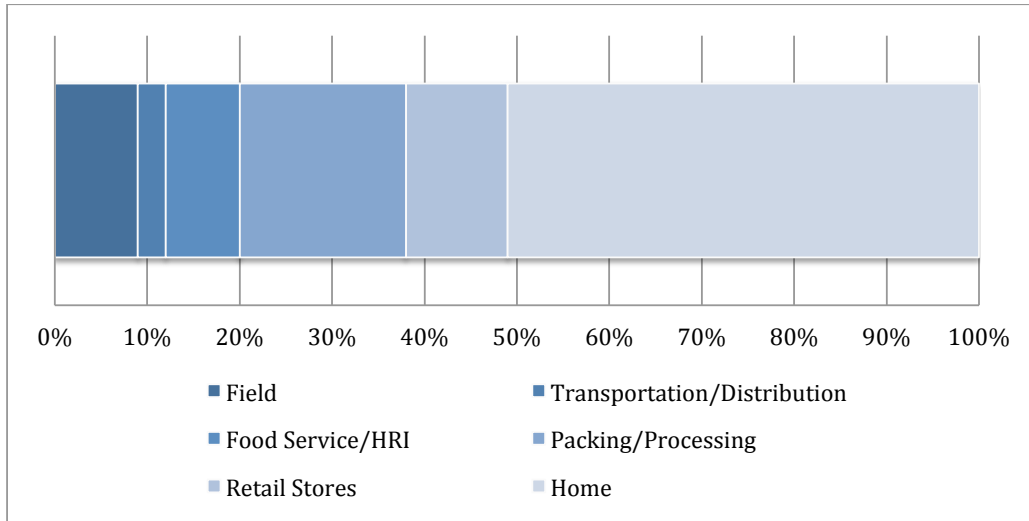


Figure 1: Percentage of food waste throughout the food chain (field to home) in Canada from Gooch et al., 2010: Fields – 9%; Transportation/Distribution – 3%; Food Service/Hotels/Restaurants/Institutional Food Outlets – 8%; Packaging/Processing – 18%; Retail Stores – 11%; and Homes – 51%.

The most recent Canadian Municipal Waste report estimates that 40 percent of residential waste is organic waste – this includes yard waste *and* food waste, and that the amount of food waste is fairly constant year round, but on average urban food waste is higher than rural food waste. This report also estimates that as much as half of waste sent to landfills is organic in municipalities without source-separation organics programs (Environment Canada, 2013).

2.3.1. The Canadian consumer profile

This section examines how the socio-economic and behavioural profiles discussed in the previous section might or might not be predominant in Canadian consumers, and how they might affect household food waste levels. These profiles provide the first clues on why consumer food waste in Canada is so pronounced, relative to waste from other parts of the food supply chain. Canadian consumers have followed international trends, changing the way households shop, store, cook and eat food; a modern relationship with food may be part of the reason that household food waste figures in Canada are increasing, as shown in Figure 2.

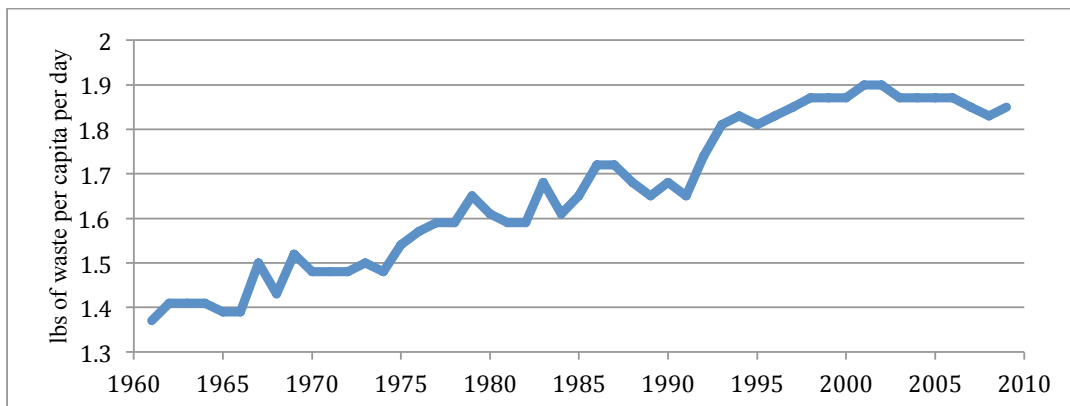


Figure 2: Food waste (lbs per capita per day) in Canada between 1961 and 2009; data from Abdulla et al., 2013.

- *Shopping patterns*

A report by Agriculture and Agri-Food Canada on Canadian consumers from 2010 (Agriculture and Agri-Food Canada, 2010) found a growing adoption of more "efficient" and flexible shopping patterns such as having large shopping trips, combined with many small top-up trips (Agriculture and Agri-Food Canada, 2010). These shopping patterns have been shown to be linked to higher levels of household food wastage (Cox & Downing, 2007; Stefan, 2011). The 2010 Canadian study also found that the most important factor in determining how consumers' 'food dollars' were spent was their perceived 'value-for-money' (Agriculture and Agri-food Canada, 2010). This could lead Canadian consumers to be more easily swayed to make unplanned food purchases by retail sales and promotional offers.

- *Food choices and lifestyle*

It has been suggested that varied diets may be related to increased levels of household food wastage, as fresh fruit and vegetables are among the foods that are most often discarded (Abdulla et al., 2013).

Improvements in the efficiency of food transportation and greater demands for fresh fruits and vegetables – in part reflecting the ethnic diversity of Canadians – have brought an increased consumption of fruit and vegetables among Canadians; between 1990 and 2010 alone vegetable consumption in Canada increased by 10.9 percent (Agriculture and Agri-food Canada, 2010). Abdulla et al. (2013) suggest that healthy dietary trends, including increased consumption of fresh fruit and vegetables – foods that spoil easily – may be linked to higher levels of food wastage.

Canadians have embraced more varied diets through new types of foods and the introduction of international cuisines (Agriculture and Agri-Food Canada, 2010). As some studies noted, changes towards more varied diets might lead to more household food wastage because it is harder to shop, cook, store, and manage a greater number of types of foods than a small variety of familiar ingredients (Glanz, 2008; Rathje & Murphy, 1992).

- *High quality standards*

A Canadian government consumer survey found that shoppers are very concerned about the quality of food, determined by the freshness, safety, and appearance of foods (Agriculture and Agri-food Canada, 2010). Concern over freshness and appearance of foods may lead to very high standards when purchasing foods, or low tolerance for less-than-perfect fruits and vegetables, not only when purchasing foods at retail outlets, but also at home when deciding whether or not a food item should be discarded.

- *Income and food expenditure*

The literature review revealed a link between higher incomes and higher levels of household food wastage.

Food has become cheaper and more accessible to Canadians than ever before: Canadians spend a much smaller percentage of household expenditure on food than in

the past. Studies report the percentage of Canadian household expenditure on food was 10 percent in 2007, down from 18.7 percent in the 1960s (Agriculture and Agri-food Canada, 2010). (See Figure 3 for a graph of increased spending on food and alcohol – a graph showing only food was not found). Yet there are clear differences in expenditure patterns between high and low income households: Canadian households with lower incomes spend less money on food than other households; lower income households were found to purchase significantly less milk, fruit and vegetables (foods that may be quicker to spoil and thus more likely to be wasted) than other types of households examined (Kirkpatrick & Tarasuk, 2007).

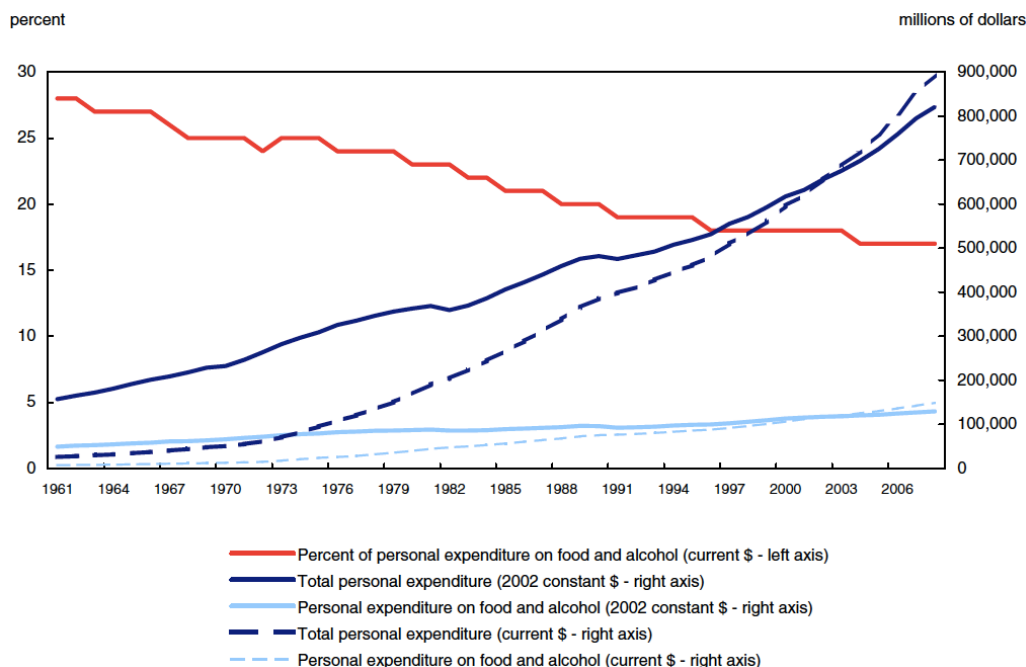


Figure 3: Personal spending in Canada on food and alcohol as a percent of total personal spending, 1961 to 2008 (Statistics Canada, 2009)

These trends would suggest that households in Canada probably follow patterns seen in other studies in which higher incomes have higher levels of food wastage than low-income households, due to bigger food purchases that include more perishable items.

- *Household composition*

The literature review identified that smaller households are associated to higher levels of food wastage per capita. Canadian households have been decreasing in size, and Canadian families have fewer children than before. As of 2006, 27 percent of households were 1-person households, and only 9 percent of households were made up of five or more members; the average family size has decreased to 2.5 members (Agriculture and Agri-food Canada, 2010). These smaller households might follow patterns found in other studies by generating higher levels of food wastage.

As Canadian families have decreased in size, so has the average number of children per household: Canadian families had 1.1 children, on average, in 2006 (Agriculture and Agri-food Canada, 2010). Some studies suggested (but lacked

evidence to conclusively show) that the presence of children led to more food wastage. It remains to be seen whether children and household size will have the effects (or lack thereof) on household food wastage levels that other studies have found.

2.3.2. Summary

Studies from other parts of the globe suggest that a combination of shopping patterns, food choices, cooking behaviours, and household characteristics can be linked to household food wastage. However, it is likely that cultural factors influence behaviour and socio-economic conditions, and these factors have not yet been studied sufficiently. In particular, Canada's household food wastage is poorly understood. Based on a knowledge of Canadians' socio-economic conditions, their relationship with changing food systems, and profiles of 'high-wasters' in other studies, there are some clues to possible factors behind the high levels of household food wastage in Canada. It can be hypothesized that greater access to fresh, varied, and healthy diets at lower financial costs, together with high quality standards, bulk packaging and retail promotions, have shaped an environment in which food is considered as disposable. Small households, and busy schedules may further contribute to generating higher levels of food wastage, as eating becomes an activity centered around convenience instead of thriftiness.

3. Methods

This section discusses methods used for other household food waste studies, and presents the methods chosen to collect and analyze the collected data for this study. First, I explore the definition and categorization of food wastage that was used for this study. Second, I present a literature review of methods that have been used by other studies to measure food waste. This literature review was primarily undertaken to find the methodology that was best suited to the objective of this study, understanding the behavioural and socio-economic factors that contribute to household food wastage. Additionally, this literature review provided a better understanding of the possible limitations of these different methods. Finally, I describe the chosen methods for this study and mention the limitations resulting from this choice.

3.1. More On The Definition Of Food Wastage

As was mentioned in the previous chapter, this study defines food wastage as *the deterioration or loss of food produced for human consumption*. The difficulty in conceptually defining food wastage lies in bounding which types of losses should be considered within this definition of wastage. By referring to the waste of food for "human consumption" foods that are consumed indirectly (such as livestock feed) are excluded and foods that we consider to be inedible (such as olive pits, banana peels, or bay leaves). However cultural factors may influence what is considered to be edible. For example different people may eat more or less of apple cores out of habit, or some parts of foods are eaten by some, but considered inedible by others, such as potato skins, carrot peels, beet greens, or kale stems. Additionally, people's perception of how much of a product is edible has changed; "nose to tail" eating has become less common as food has become more accessible (Sustainable Restaurant Association, 2010), as we have become free to pick and choose which parts of animal products and vegetables we want to eat. Thus, using the term "wastage" allows us to group all food wastage together, excluding any cultural or habitual variance in what is considered reasonable to waste (as what is clearly "waste" to one person may not be considered "waste" by another).

In order to distinguish between wastage of products that are clearly inedible and not clearly inedible some definitions of food wastage attempt to classify it according to the circumstances surrounding the wastage. These classifications take into consideration how avoidable the discarding of food is perceived to be. Most notably, WRAP proposes a classification of retail and household waste (Quested & Johnson, 2009; Quested & Parry, 2011) which has been adopted by other studies (Glanz, 2008; Lebersorger & Schneider, 2011; Parfitt et al., 2010; Pham, 2011):

- Avoidable – food that was edible at some point prior to disposal, e.g. foods that have gone bad.
- Possibly avoidable – food that some individuals eat, but others do not, e.g. potato peels, beet greens, bread crusts.
- Unavoidable – food that is not edible under normal circumstances, e.g. orange peels, bones, egg shells.

As previously mentioned, the classification of foods into these categories may depend on cultural factors, and what foods belong in each category may have changed

over time. Using these definitions, we can make the distinction between wastage from foods that were discarded because they went bad, and foods that are usually considered to be inedible. For example, consider two households that discard the same amount of kitchen scraps, where one household mostly throws out leftovers, and the other throws out orange rinds and chicken bones. With these categories it is possible to distinguish between such households.

3.2. Overview Of Methods Used For Other Studies

A small literature review was conducted to examine the data-collection methodologies used by other studies that measure household food waste. See Appendix 3 for a summary table of the studies reviewed. Appendix 3 includes (1) studies that use primary data on household food waste (2) that were published between 1993 and 2013. Other studies that measure food waste through primary data were omitted for the table in Appendix 3 and Table 3, but also examined.

Based on the studies found, methods for collecting primary data on household food waste roughly fell into three categories. See Table 3 for a summarized comparison of the advantages and disadvantages of each category.

Category 1: Face-to-face interviews

With this type of method, interviewers would conduct a face-to-face interviews collection with participants. This type of method allows for the collection of in-depth collection of qualitative data – e.g. in interviews the reasons behind throwing out a specific food item can be explored in depth – along with estimates of food waste.

Examples of studies that used this method included:

- Glanz (2008) used face to face interviews to study household food waste of foods in unopened packaging and partially used packages of food. Following an interview about socio-economic factors and behaviours, Glanz and study participants looked through households' food storage and identified items that had expired or would be thrown out.
- A government-commissioned study in Turkey by Pekcan et al. (2006) conducted face to face interviews with household members in which participants were asked to recall how much food was purchased and consumed by households in the last 24 hours, thus deducing the amount of food waste generated by households.

Category 2: Self-reported food waste

In self-reported food waste methods, researchers provide participating households with tools to record food waste levels – spreadsheets, food diaries/journals, or surveys – which participants complete, and return back to researchers.

The majority of studies examined used self-reported waste methods to gather data, perhaps because this method allows for bigger sample sizes: the work and time needed to gather waste data is offloaded to study participants. However researchers have less control over the consistency and reliability of data recorded by participants. Participants can under/over report waste for a number of reasons: the task of recording

data can be put off and forgotten, or participants could make a conscious decision not to record waste.

Examples that used this method include:

- Master's theses by Morisaki (2011) and Stefan (2011) used surveys to measure household food waste and relate it to socio-economic and behavioural factors.
- A Finnish study by Koivupuro et al (2012) and a Swedish study by Williams et al. (2012) used food diaries to collect information about household food waste.

Category 3: Measurements performed by researchers

In studies using researcher measurements, participating households are provided with containers – plastic buckets, sealable containers, or bags – in which they deposit household food waste. Researchers then collect and measure the waste households' containers to obtain an estimate of food waste per household.

This type of method requires the least amount of time from participants, and mimics the way that participants would usually throw away food waste if they use a curb side collection model to dispose of waste.

Table 3: Types of methods to collect data on household food waste and their limitations

Category 1: Face to face interviews (Glanz, 2008; Pekcan et al., 2006)	
Advantages	Limitations
<ul style="list-style-type: none"> • Rich information about what/why food is wasted 	<ul style="list-style-type: none"> • Small sample size • Requires considerable time from both parties • Reactive data (participants reacting to interviewer)
Category 2: Self-reported food waste (through surveys, food diaries, or spreadsheets (Clive et al., 2005; Koivupuro et al., 2012; Morisaki, 2011; Pham, 2011; Stefan, 2011; Williams et al., 2012)	
Advantages	Limitations
<ul style="list-style-type: none"> • Large sample size • Low time requirement from researcher per sample • Low cost • Participants do not react to a researcher 	<ul style="list-style-type: none"> • Data reliability: reporting subject to interpretation of participants • Higher demand of participants • Data collection may bring participant's attention to food waste (may alter behaviour) • Less control over the role of participants in their household's food management
Category 3: Measurements performed by researcher (Newton & Burger, 1994; Pham, 2011; Ventour, 2008)	
Advantages	Limitations
<ul style="list-style-type: none"> • Low time requirement from participants • For participants: most similar to normal behaviour (less reactive) • Subject to less inconsistency from 	<ul style="list-style-type: none"> • High time requirement from researcher • High cost for researcher (materials, transportation)

subjective interpretations, as measuring is not performed by individual participants

- Difficult to measure foods that are not usually disposed of through green bins/garbage (e.g. liquids)
-

- Smaller sample size

3.3. Overview Of Chosen Methods

For this study the sample needed to be large enough to compare the differences in reported food waste to behavioural and socio-economic factors. In order to have a sample that is large enough, an online survey with self-reported food waste levels was used to collect data. At the same time, in order to obtain a more reliable estimate of food waste levels and more complete picture of food-related behaviours, this project used a case study involving food waste collection and face-to-face interviews. Thus, this study used a combination of all three types of methodologies

This study was carried out through an online survey and 13 case study households in the Waterloo Region, in Ontario, Canada. The online survey asked for participant estimates of household food waste, and asked questions about food-related behaviours, and socio-economic data. The 13 households that participated in the case study were given a "food waste collection kit" (or kit) in which they collected one week's worth of household food waste, and then participated in a face-to-face interview. See Appendix 4 for a diagram of the methods. The chosen methods and corresponding recruitment materials were approved by the University of Waterloo Research Ethics Committee.

3.3.1. Online Survey

The online survey was hosted on fluidsurvey.com. The survey took participants between 14 and 15 minutes to complete, on average. Seventy six participants completed the online survey, out of a total of 179 respondents who began the survey, between February and April, 2014. Respondents were recruited through posters at health food stores, churches, and restaurants in Kitchener-Waterloo. More participants were recruited through snowball sampling, as well as through posts on Twitter, Facebook, and the Waterloo Region Food System Roundtable website.

Survey questions were designed to collect socio-economic data about participants, as well as information about grocery shopping, cooking, and food consumption patterns and behaviours. (See Appendix 5 for the complete online survey). Based on the literature review, the following socio-economic factors were used as indicators:

- Age (average age of household, and age of survey respondent)
- Household composition (number of household members, presence of children)
- Income

Additionally, given the possible large influence of cultural factors of food-related behaviours, immigration to Canada was also considered:

- Immigration (immigrated to Canada as a child or adult, or born to parents who immigrated to Canada)

The food behaviour questions included questions about:

- Their shopping habits
- Whether they eat leftovers or not
- Whether they eat foods past their best-before dates or not
- How full their refrigerators are kept

Reported food wastage was collected by asking survey respondents to recall foods that had been discarded in the last week and foods that were usually thrown out over a period of one week. Participants could record wastage by weight, volume, or unit. The survey gave several examples of how to record food wastage. Additionally, participants were asked to record what percentage of purchased food is usually wasted in their household.

3.3.2. Case study households

Case study participants were recruited through posters in health food stores, churches, and restaurants in Kitchener-Waterloo, and through word of mouth. Other participants were found among respondents to the online survey, which had a question asking if they would be interested in further participating in the study. The case study was carried out between late February and early May 2014.

Meetings with participants were scheduled through email exchanges. On our first meeting I explained what their participation in the study would entail, and gave participants their food collection kits. Food collection kits consisted of a plastic bag with a food collection information pamphlet, two food waste diary sheets (see Appendix 6 and 7 for the pamphlet and diary sheets) and 21 numbered solid plastic containers of assorted sizes, and 7 resealable plastic bags. Participants were instructed to collect all kitchen scraps in the containers provided to them, and to make a quick note what was throw out in each container on their food diary sheets. The containers were collected once or twice throughout their collection week. After their food waste was recorded, a follow-up meeting was scheduled to conduct a follow-up face-to-face interview. The interviews were conducted either in participant's homes, on campus, and in one occasion in a café. The interviews were conducted in open conversation-style interviews based on a list of topics (Appendix 8) Interviews did not follow a predetermined thematic list or questions. Interviews began with questions about their experience participating in the study, or about what they noticed about the food they threw out in their collection kit. This usually led into conversations about whether or not they thought their sample was typical or atypical. To guide the conversation towards cooking or shopping behaviours, questions like "tell me about how you usually decide what to cook/buy" were used. To steer the conversation towards more waste oriented topics, participants were asked about particular items in their food waste collection sample. At the end of the interview, participants were asked why they thought food wastage in Canada is so high, and whose fault food wastage is. (Note that using the words "so high" and "fault" have introduced some bias and led participants, thus this question was left until the end of the interview so that it would not affect participants' other responses. This question was meant to lead participants to seek out causes and reflect on their experience participating in the collection study).

3.3.3. Data analysis

The collected data was analyzed using mixed methods, including statistical and thematic analysis. The face-to-face interviews were recorded and transcribed. First, interview transcriptions were coded to look for recurring themes, which are explored in the analysis Chapter 4. Secondly, the transcriptions were deconstructed and compared based on the themes from the list of topics for face-to-face interviews. The survey data was graphed and compared using box plots and comparing averages. Whenever applicable, survey results were compared to the themes that emerged in case study interviews.

3.3.4. Limitations

Both the case study and online surveys were limited in both sample size and lack of diversity of the households. Although fliers were distributed to households and posters were placed in public locations, the study had a very low response rate and the online survey had a very low completion rate. Due to the low response rate and lack of time to use alternative recruitment methods, additional participants were found through posts on food-related groups on Facebook, a blog post on the Waterloo Region Food System Roundtable website, and through snowball sampling with the help of colleagues and social media. As a result, many participants were likely to have previous interest in food or sustainability issues, which could affect their food-related behaviours. Additionally, the average age of the survey respondents was very young, and only one case study household was above the age of 50. Thus, a very narrow range of ages was examined.

As expected, some (but not all) case study participants indicated that collecting their kitchen scraps brought their attention to food wastage and likely influenced their behaviour and the amount of food they threw out during their collection week.

The data on self-reported food wastage from the online surveys was very imprecise and could not be used as intended. Respondents were asked to roughly estimate the amount of food thrown out in different food categories, by reporting the number of units (e.g., three apples), weight (e.g., 100 grams), or volume (e.g., half of a 500 ml container) of the foods they discarded. Many responses were recorded in ways that were ambiguous or impossible to estimate to an approximate amount of food. (For example, participants just answered "apples" or "meat" without indicating how much of the food was discarded). Additionally, participants were asked to estimate what percentage of (purchased) foods in each category was thrown out. This survey question was less ambiguous and more easily answered by participants. As the data on the quantity of reportedly wasted food items was unusable, the percentage of reported wastage was used for the analysis instead.

3.4. Description Of Study Samples

Households were recruited mostly through online resources on websites or groups related to food, and through word of mouth: 45 percent of respondents were referred to the survey through Facebook, both from the 'Food in the Waterloo Region' group, and from shared posts; 29 percent of respondents were referred through word of mouth from a link that was made available through emails and twitter; 12 percent of respondents were referred through a blog post on the Waterloo Region Food System Roundtable website; 14 percent of respondents were referred through the printed posters and pamphlets distributed to households and at churches and stores. Out of 179

individuals who began the online survey, only 76 completed it. Most respondents stopped answering the survey when they came to the part that asked them to recall what foods had been wasted in their households. Thus, it is probable that the low completion rate was due to the complexity of the survey. The online survey sample consisted of 76 participants between the ages of 18 and 62. Almost half of respondents (47 percent) of households were in Kitchener, followed by 40 percent household from Waterloo. The remaining households were in Cambridge, Wilmot, Guelph, and one household in Toronto. The ages of household members' spanned from newborns to age 65. Survey respondents averaged 32 years of age, and household members averaged 28 years of age. Roughly three quarters of survey respondents' households had no children, as can be observed in Figure 4. Households that responded ranged from one to six members, as can be seen in Figure 5; roughly a third of households consisted of two members, followed by about one quarter of households with three members, a fifth of households with one member, and a few households with four, five and six members.

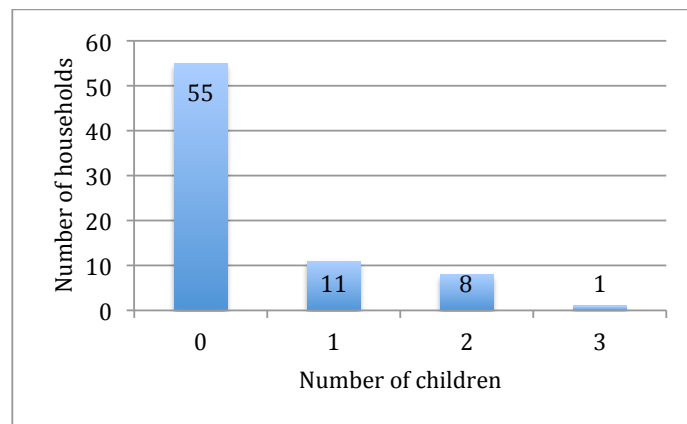


Figure 4: The number of children in households of survey respondents

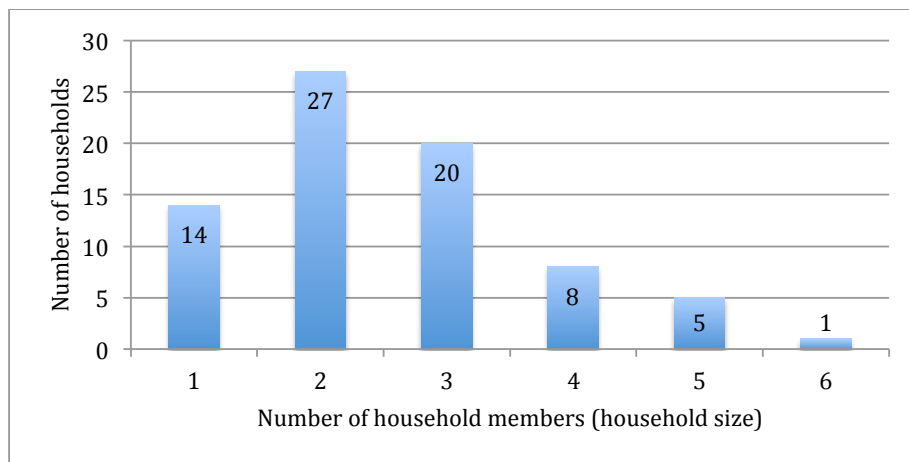


Figure 5: Household size of online survey sample

The case study sample was comprised of thirteen households. Households consisted of two families with two children each, six couples, and five single member households. The two families were one couple in their late thirties' and early forties' with children aged 10 and 6, and another couple in their early thirties with two two-year olds; the incomes of families with children ranged between about \$70,000 and \$110,000

per year. The couples ranged from late twenties to early forties', with one couple aged around 60. Incomes of couples ranged from \$25,000 to \$155,000 per year. The five single member households' ages ranged from early to late twenties. Their incomes ranged from zero (for an individual living off savings as he finished school) to \$35,000 per year. Two of the case study households (one of the families with children, and one of the single member households) were recruited through printed posters, and the rest of the participating households were recruited through word of mouth. Low participation rate is probably due to the large time and effort involved in participating in the study, as well as the challenge of showing one's waste to a stranger: one participant, who shared information about the study with friends who showed interest, mentioned her friends decided not to participate after learning that they would have to collect and show a researcher their kitchen waste. Additionally, some individuals who were initially interested in the study decided to not participate after being informed of the waste collection and interview components of the study.

4. Study Findings: Overview of data

This chapter presents the data collected in both the online survey and the case study components of this study, first laying out findings about the relationship between certain socio-economic factors and reported food waste levels, then noting the central themes that emerged from the interviews with case study participants. The socio-economic factors and interview themes are linked whenever possible. This process combs through the study data to find information that answers the research question: What factors drive Canadian households to waste food?

4.1. General Findings

On average, the case study households threw out 2223 grams of food during their collection week, and participants generated 1143 grams of food wastage per person², of which 498 grams were avoidable food wastage, 160 grams were possibly avoidable, and 486 grams were unavoidable (Figure 7). This is less food wastage than was reported in a study carried out in Guelph, Ontario, where households generated approximately 500 grams per day (or 3500 grams per week) (Massow & Martin, 2014).

The interquartile range of the amount of wastage generated per household lies between 821 and 1699 grams. One participant was a possible outlier: a young student from a single-person household who wasted almost no food during the collection week period (117 grams), possibly because he ate a very repetitive diet and often ate out. See Figure 6 for a boxplot of the distribution of food wastage in the case study samples³.

On average, close to half of the wastage from the households was avoidable and half was unavoidable (Figure 7). The composition of wastage varied according to shopping patterns and household composition, as will be explored further in this chapter.

Online survey participants reported the percentage of foods purchased that are wasted, as well as the reasons that foods were discarded. (Refer to Appendix 9 for a boxplot of the distribution of reported food wastage per food category, and Figure 8 to compare the average percentage of reported food wastage per food category). Fresh

² Calculated as the average of the wastage per household member. That is, the average of $\{a_i\}_n$ ($0 < i < n$) where n is the number of households, and a_i is the waste per capita of household i . This average is used so that each household in the case study is represented once in each graph, as opposed to weighting each household's contribution to the average by the size of the household. This approach reflects that the case study units for the quantitative results are the households and not the individual members of each household.

³ Boxplot images are presented as follows: The range of data is contained between the upper and lower whiskers in each boxplot, the bottom food of the whisker denoting the minimum data point, and the top of the whisker denoting the maximum data point. The interquartile range is represented by the green and red box: the bottom of the red box denotes the first quartile; the colour division between the red and green boxes denotes the median; the top of the green box denotes the third quartile. The averages are marked with an "x".

produce and leftover foods were reportedly wasted most, followed by baked goods, animal products, and finally, packaged foods. The main reasons participants reported discarding foods were because the foods had gone bad, or because the foods were old, as can be seen in Figure 9.

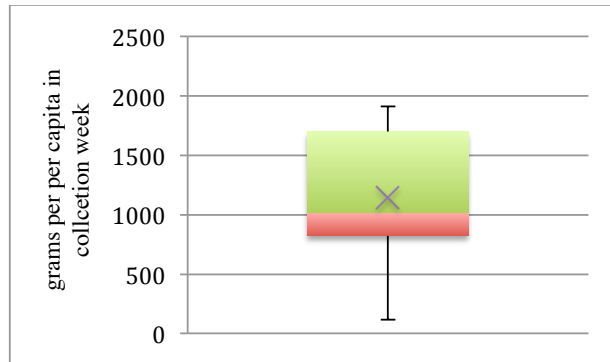


Figure 6: Distribution of food waste per person, per household, of case study participants

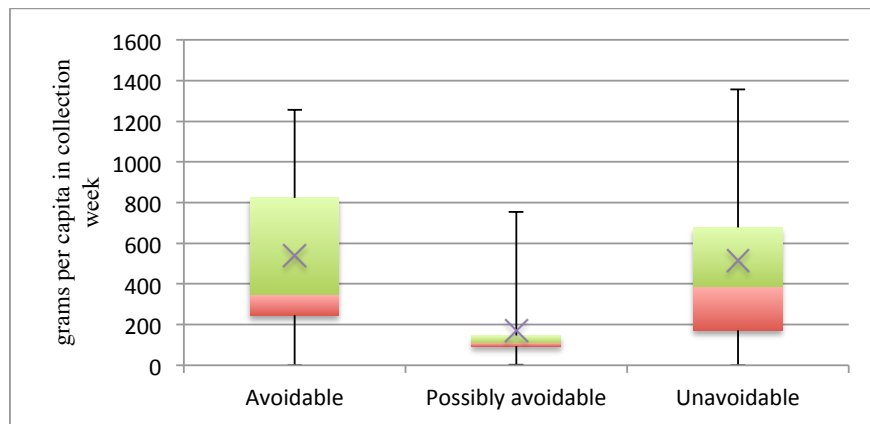


Figure 7: Distribution of food waste per household member, per household of case study participants by wastage type

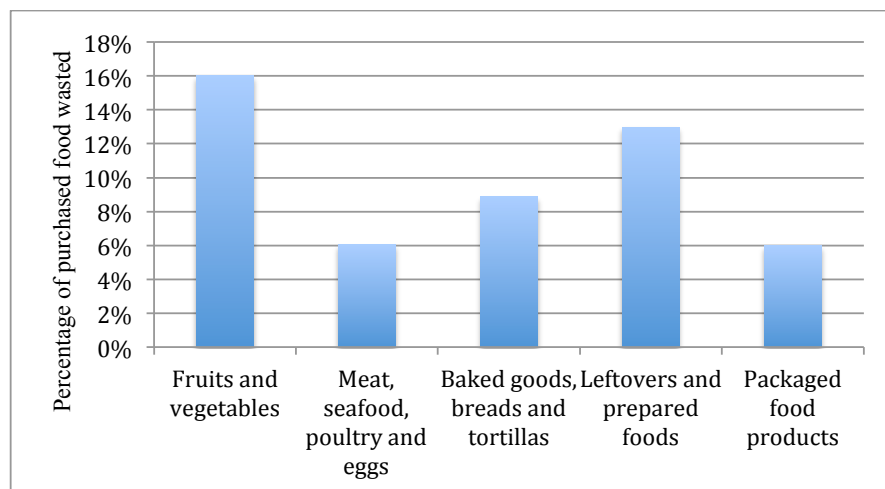


Figure 8: Average of reported food waste percentages for online survey participants

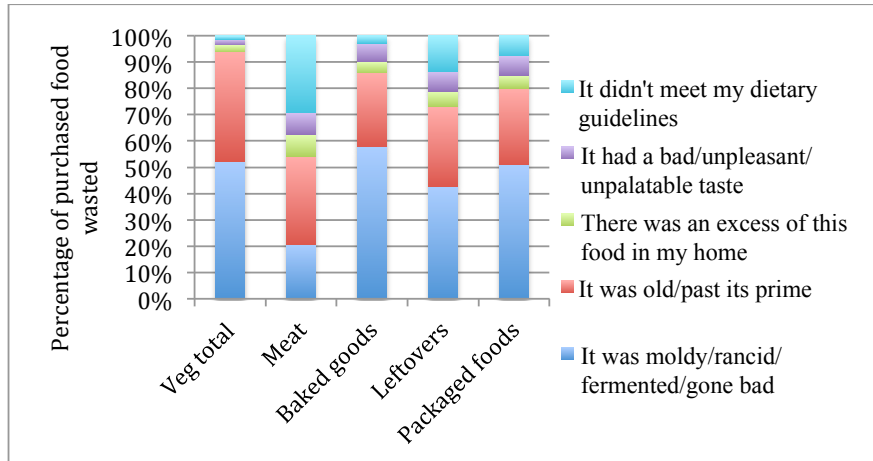


Figure 9: Self-reported motivation for discarding foods, by food type, for online survey participation

4.2. Socio-Economic Factors

4.2.1. Age

The survey data indicates that the wastage reported by households was similar across all average household age groups (Figure 10). However, households with an average household age under 25 reported a larger variation in the amount of wastage reported. Likewise, the wastage reported by households was similar across all households, grouped by the age of the survey respondent, although older respondents reported a slightly (almost negligibly) lower percentage of food wastage than younger respondents⁴ (see Figure 11). The case study data sample showed no evidence of a relationship between age and food wastage, probably because the sample was too small.

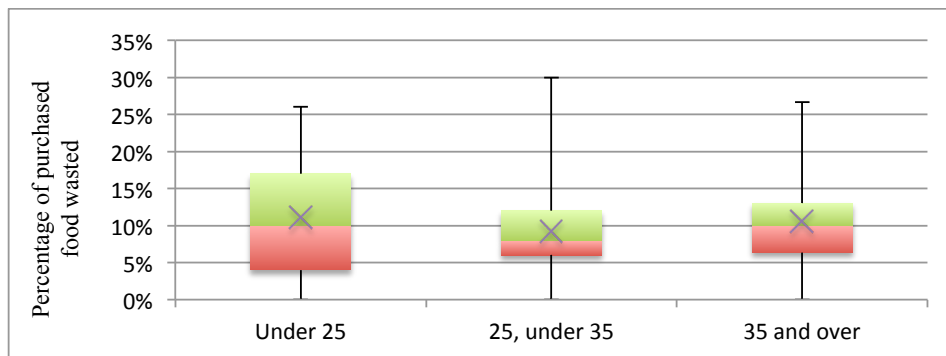


Figure 10: Distribution of reported food wastage per household member by average household age in online surveys

⁴ It should be noted that the low evidence of a link between age and food wastage might be due to the very small sample size and the small number of older participants in the case study. Participants were divided into three bins of roughly the same size (under 25, between 25 and 34, and over 35). In order for each bin have the same number of participants, the upper age group spanned 30 years. Thus, any age-related effects on food wastage among oldest households may not be appreciable as they cannot be separated from the younger households within the "over 35" category in this study. Unfortunately, the case study sample did not allow for this type of age-related effect to be studied.

The slight differences found in different average-aged groups might be due to the presence of children bringing down the average age⁴ and also affecting food wastage.

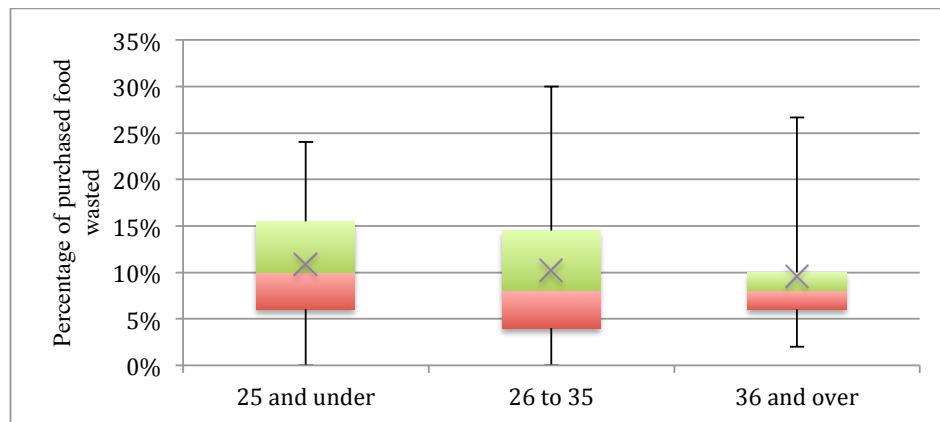


Figure 11: Distribution of reported food wastage per household member by age of survey respondent in online survey participants

4.2.2. Household composition

In the case study, wastage per household increased with household size, but wastage per capita remained similar across all household sizes (see Figure 12 and Figure 13). Similarly, the online surveys reported very similar percentages of food wasted across all household sizes (see Figure 14).

Investigating the effect of children on household food wastage produced mixed results. Survey participants from households with no children reported a slightly higher percentage of food wastage than those with children (see Figure 15), but there was no difference between the amount of wastage in household, with or without children in the case study (see Figure 12).

The case study households of more than two members were those with children. These households presented similar wastage per household member as that of the other households, but had a higher proportion of avoidable wastage (Figure 16). One case study participant mentioned noticing that a large proportion of what was thrown out was from her children. Several containers of food from their collection week included leftovers from the children's lunches. Another participant with children reported difficulties with his children's meals. In particular he recalled introducing burritos for the first time:

They couldn't figure out how to eat them and they got frustrated if something fell out. They'd want to put it back in, and they'd put the taco down and it would tip over and dump everything out. So one girl got too frustrated and just sat on the stairs crying for that meal. And the other one kept trying but was too sad by the end of it. So we're going to wait until they can control their hands a bit better, or at least figure out how to hold and then move. They're just too young, they were figuring it out, it was cute and frustrating. Just not a successful meal and we had no use for the ground beef after.

In the case study, the presence of children in households contributed to the generation of food waste indirectly by creating extra leftovers when food was prepared but not consumed. Leftovers are a key area that many of the case study participants struggle with. Behaviours related to leftovers are examined later in this chapter.

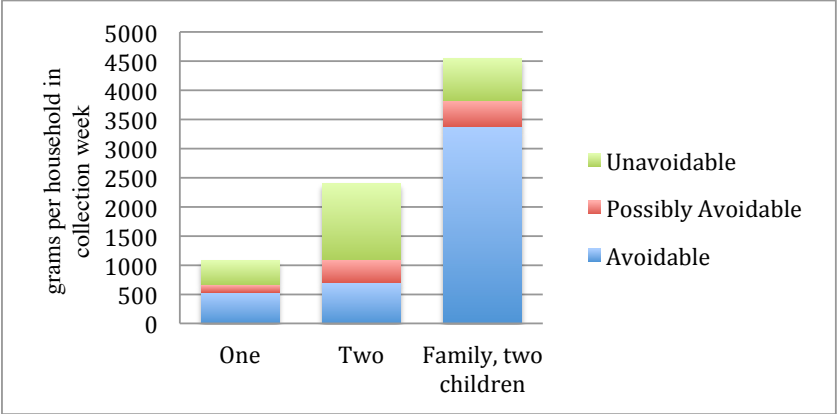


Figure 12: Food waste composition per household by household size in case study

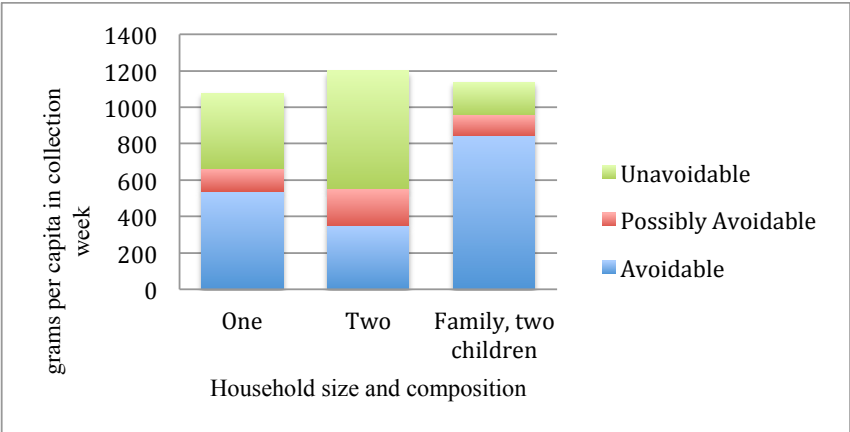


Figure 13: Food waste composition per household member by household size in case study

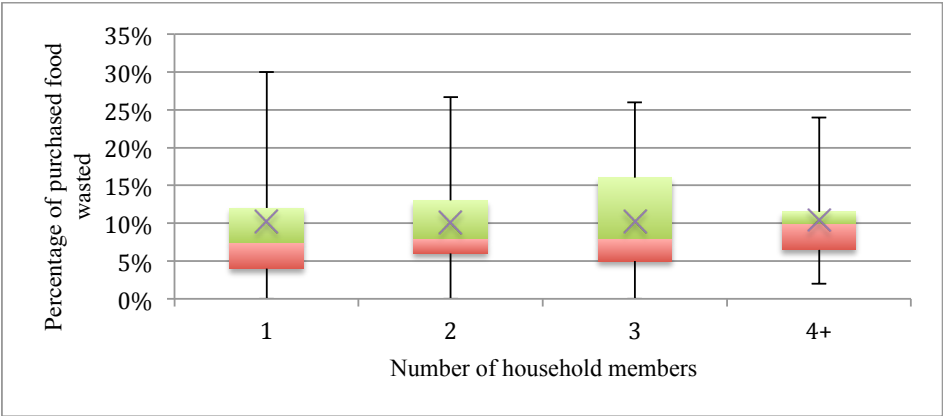


Figure 14: Distribution of reported food waste percentage per household by household size in online surveys

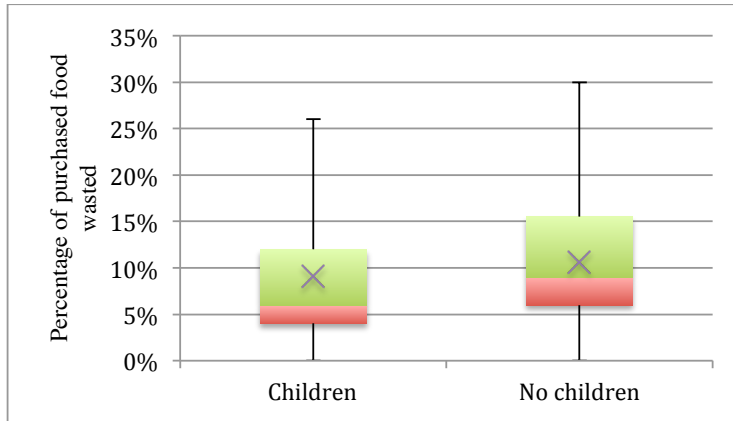


Figure 15: Distribution of reported food waste percentage of households with and without children in online surveys

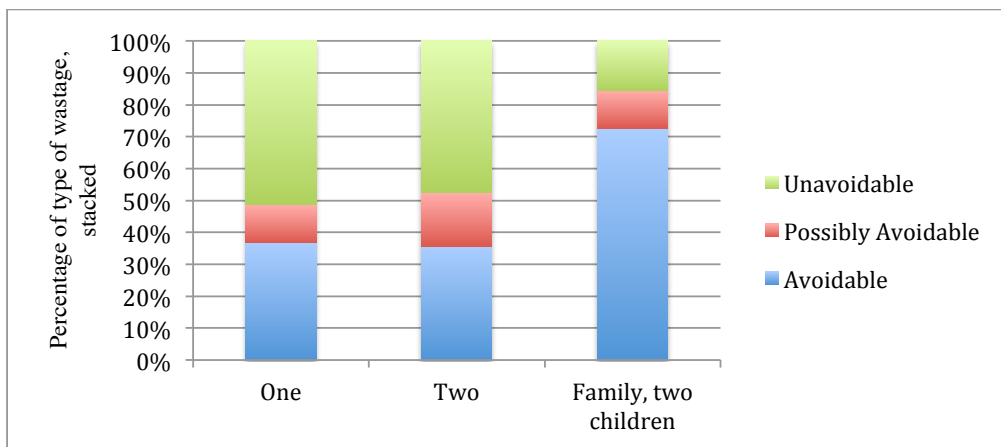


Figure 16: Composition of food waste per household by household size in case study

4.2.3. Income

The online survey and case study data pointed to different effects of income on food waste. Case study participants were divided into halves based on income. (One half reported income lower than \$70,000/year, and the other reported income above \$70,000/year). Comparing the distributions of the food waste generated by these two groups during their study collection week, the lower income household generated much less waste than the higher income households (see Figure 17). However when these groups are compared based on wastage per person in the households (instead of total household wastage), the food waste is very similar (see Figure 18). Finally, Figure 19 shows that food waste composition is similarly distributed between avoidable, possibly avoidable, and unavoidable. However, survey data showed no differences in food waste levels between different income levels (Figure 20).

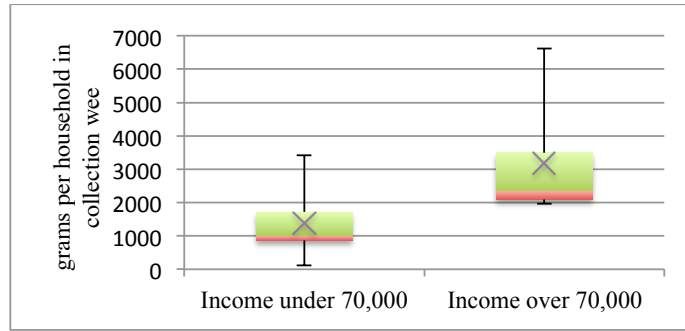


Figure 17: Distribution of food waste per household by household income in case study

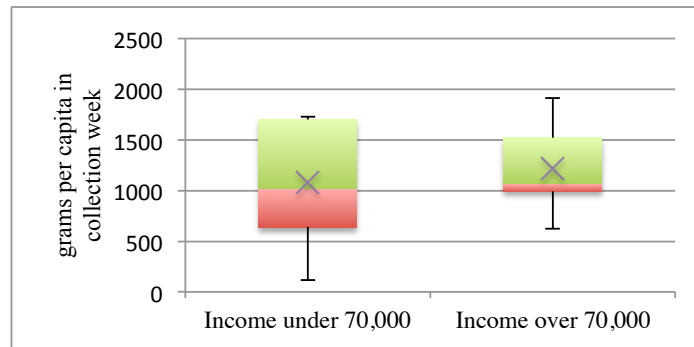


Figure 18: Distribution of food waste per household member by household income in case study

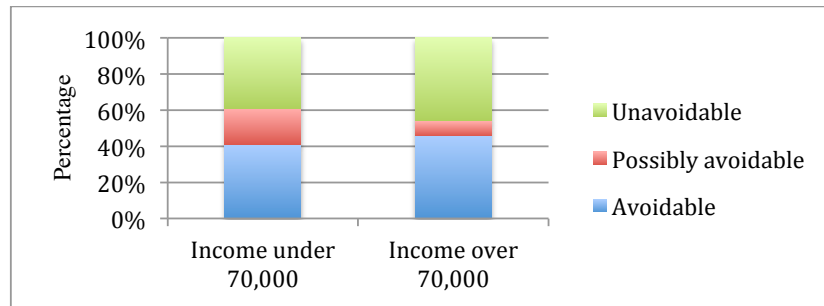


Figure 19: Food waste composition by household income in case study

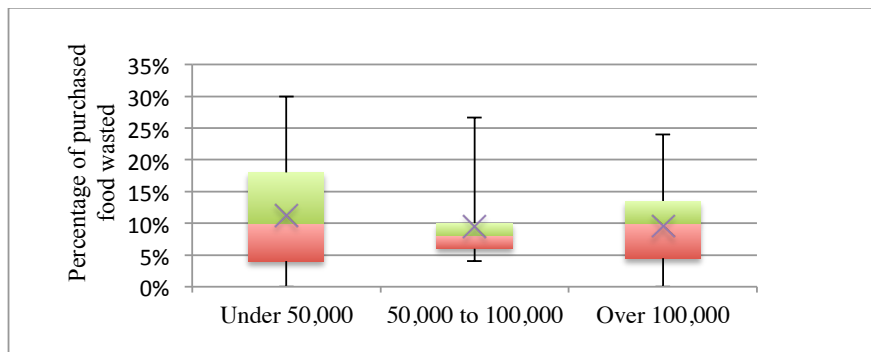


Figure 20: Distribution of reported food waste percentage of households by household income for online survey⁵

⁵ The same bins were not used for the case study and online survey participants due to the uneven distribution of incomes across case study participants. Case study

In summary, the socio-economic factors investigated had very little effect on wastage levels in both the case study and the online surveys, with the exception of income. (Higher incomes were linked to higher wastage). In the case study, larger households produced more wastage, but all households presented similar wastage per capita. In case studies the age of respondents and the presence of children in households may have had some effect on wastage in the case study. However, because only two case study households had children, the case study sample was not large enough to confirm or deny the effect of children or age on wastage. Similar wastage was observed in the online survey across age groups and households with and without children. Table 4 summarizes the findings regarding the relationship between socio-economic factors and food wastage levels for both the case study and the online surveys.

Table 4: Summary table of findings regarding the relationship between the socio-economic factors investigated, and food wastage levels

Average household age	<ul style="list-style-type: none"> • Similar waste levels • More variation (higher and lower wastage) in households with a younger average household age
Average age of respondent	<ul style="list-style-type: none"> • Similar waste levels • More variation (higher and lower wastage) in households with a younger average household age
Household size and composition	<ul style="list-style-type: none"> • Similar wastage per person for all household sizes • Similar wastage in households with/without children. • Surveys found slightly higher reported percentage of wastage in households with no children. • Higher proportion of avoidable food wastage in larger families (and families with children)
Income	<ul style="list-style-type: none"> • Higher waste in households with higher income in case study • Similar levels of reported food wastage levels in surveys • Similar wastage composition across all income levels

4.3. Behaviours

Several overarching themes emerge from the post-collection week interviews with case study participants. These themes include time constraints, struggles dealing with leftovers, the role of refrigerators, the use of best-before type labels, and retail environments that lead to buying too much food. This section examines these themes and links them to the online survey whenever possible.

4.3.1. Time constraints and meal planning

The issue of time constraints and 'not having enough time' for food-related activities was brought up by almost all of the case study participants (9 out of 13 participants, see Appendix 10). In their interviews, they mention food-related day-to-

participants were separated into two bins: incomes above and below 70,000/years. The number 70,000 was chosen as the divider between the two bins because it divided participants into two even groups, and because there was a large gap (of 30,000) between participants with lower incomes (40,000 and below) and participants with higher incomes (70,000 and above).

day activities geared towards saving time by planning ahead for when they are busy. Others mention time constraints as barriers to using the foods they meant to eat before they deteriorate.

Some of the case study participants are meticulous food planners, anticipating time-constrained situations and planning ahead for them in their schedules. They plan ahead for occasions when they will be short on time:

I'm a big fan of cooking for a couple of weeks, so we would make a lasagne. My partner and I won't eat a gigantic 9x11 pan of lasagne, so we do little half pans, and then I put those in the freezer for a week when we're actually really busy.

But these are plans to cook food for when participants do not have time to prepare themselves meals. The bigger issue with time constraints are foods that were going to be cooked going bad before they are prepared, because of other activities cutting into food preparation time. When time is tight, various respondents reported that planning falls apart and food is wasted:

If we have a week that's really busy, our grocery and planning goes off. I don't think now we waste as much, but the coordinated efforts disappear.

[W]e buy a lot of food, and then end up going out for a lot of meals, and it goes bad. Maybe it's partially the social time that we're at, where we still think we need to have enough food for the whole week and then in reality we end up not having time to make anything.

I'll get so inspired and I'll buy all this fresh food, and I'll buy organic stuff, and whatever. And I come to school and then I fall in the trap of "I don't have the time" and I've purchased all this stuff.

Sometimes things, if you run out of time, there's all of these processes that I have in place to try to alleviate it, but sometimes when you just don't have time, you forget. [...] Time constraints are usually the worst when everything else comes and goes out the window.

Eating behaviour changes a lot after having kids. Very much. [...] I don't have the time to spend in the kitchen like I used to. Like, I used to spend 2-3 hours per meal.

When time constraints are an issue, foods do not get prepared, careful meal plans are changed, and foods are forgotten or left for later.

Surprisingly, case study participants who had more meticulous meal planning habits generated more wastage than those who did not (see Figure 21). Case study participants fell into roughly three general categories: (1) meticulous planners, (2) partial planners, and (3) non-planners. (See Table 5 for examples). (Five meticulous planners, three partial planners, and five non-planners, see Appendix 10 for more detailed information). The meticulous planners make spreadsheets and grocery charts; partial planners have rough grocery lists or ideas of meals they want to make; the non-planners just buy food when they run out, and buy similar foods almost every time they

shop. One possible explanation of why meticulous planners produced more waste in their collection weeks was that having a rigid schedule did not allow them to adapt to unforeseen situations that affected their meals. Non-planners are perhaps more used to making decisions based on what is available in the moment and needs to be eaten immediately. Of course, the ability to adapt meal plans on short notice must come with some pre-existing levels of comfort with cooking and adapting recipes in the moment. It is possible that the skewed result shown in Figure 21 is due to the high level of food literacy and environmental concerns of the sample of participants who took part in this case study.

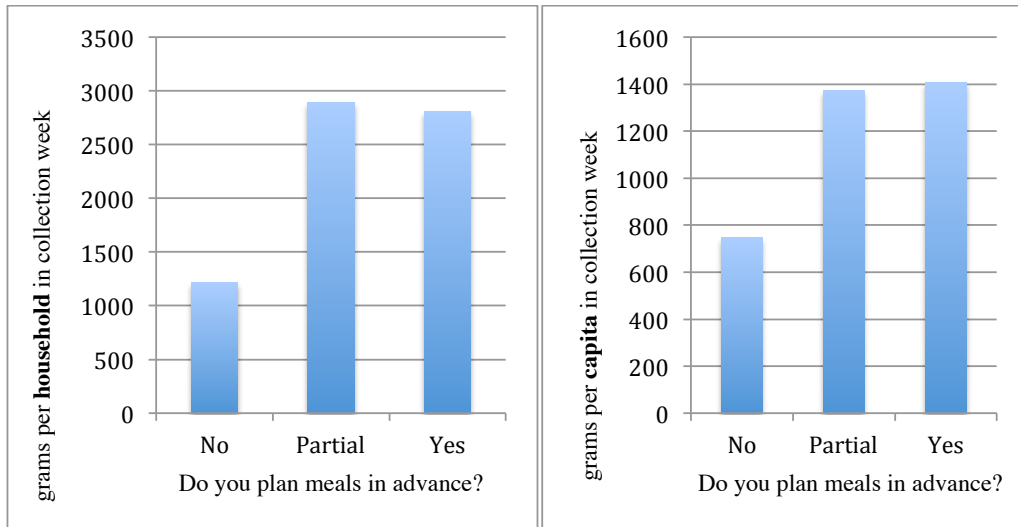


Figure 21: Wastage per household and wastage per person per household by meal planning behaviours in case study

Table 5: Examples of representatives of each type of meal planning category

Meticulous planners (5/ participants)	<ul style="list-style-type: none"> • <i>My partner and I go through the fliers every Thursday and I circle the sales and then I look at what's on sale, what we're buying for groceries, and then I will find recipes that incorporate the stuff that's on sale. [...] We'd pick four main dishes, and we know there's going to be some leftovers in the fridge, and the three other days we pick from that. I'm very organized.</i> • <i>I try to make a table with breakfast, lunch and dinner. If some day we are lazy we will go out. But we have a promise not to go out more than once a week.</i> • <i>When I sit down to do it (meal plans) it is 5 days, detailed.</i> • <i>So typically we sit down together on Sunday and look at ... Um, I am more better than he is at looking at what groceries are left in the house, and then we try to use what's left, and then we actually make a little grid with breakfast, lunch, supper</i>
Partial planners (3/15 participants)	<ul style="list-style-type: none"> • <i>I have a set of recipes that I just eat all the time.</i> • <i>I make a list, usually. It'll be a few things that I know I need, and then vegetables and just whatever looks good. And I'm not overly "plan-y" when it comes to food. I like to just go to the grocery store and see something and get an idea and maybe look up on my phone. Like "oh, beets look really delicious today, so what can I make with beets" and then go and get the other ingredients for that.</i>
Non-planners (5/13)	<ul style="list-style-type: none"> • <i>I don't plan. It's very rare for me to plan meals. Most things that I call</i>

participants) | *meals is like, "ok I have to buy fresh fruit, so strawberries ... " like the berries, and bananas, and I'll get maybe one or two pears.*

- *The main things, it's just "oh, that's running out; we should get more."*
- *I already have a bunch of spices; I just kind of mix things up and hope it works. And if it doesn't, whatever. [...] If I don't run out, I usually don't buy it.*

In summary:

- Many participants brought up time constraints and being too busy as factors that strongly influence their food related patterns and food wastage.
- Even participants who carefully plan meals (to save time and plan ahead) mention that their strategies to avoid food waste sometimes fall apart when time is short.
- Careful meal planning was mentioned as a means of trying to avoid creating food wastage, but was linked to higher levels of wastage in the collection week.
- Buying too much, as though one was going to cook meals for every day, but then being too busy to cook leads to food wastage.

4.3.2. Refrigerators

The majority (eight out of 13, see Appendix 10) of case study participants mentioned that refrigerators played a role in food generating food wastage. This result is particularly interesting, as participants themselves brought up refrigerators in the interviews, usually when discussing leftovers being lost in refrigerators, or when discussing the foods that had gone bad because they were forgotten. Refrigerators were also mentioned by two participants when they were asked why food wastage is high in Canada; participants compared refrigerator sizes in Canada and Europe, as is discussed later in this section, noting their possible effect on shopping patterns.

Participants note that when their refrigerators are full, foods get lost behind others containers and are not found until they have deteriorated:

[I]f anything's a problem area, it would be dairy, and things hiding a little bit in the back. And then all of a sudden you pull it forward and it's like "oh." That happens with leftovers sometimes too. If it's a smaller container, it gets pushed to the back.

[T]hings like tomatoes or cucumbers, I buy them and I forget about them. Because I put them at the bottom of my drawer and because I live with another person so I would not realize which one is which. And so I don't eat it and then I realize those were the tomatoes I bought two weeks ago. Too bad, I can't eat them anymore.

But if it [a refrigerator] is large enough, then things get hidden, and you forget that they're there, and lo and behold, they're there but they're no longer edible.

As Evans writes, refrigerators not only play a role in preservation of food but are also "an active participant in the processes of devaluing and decay that work to ameliorate anxieties about acts of binning" (D. Evans, 2011). Refrigeration allows households to put off dealing with foods that are going bad. Foods can be wilfully

ignored because of taste, or because they have already begun to deteriorate but not to a point where they are obviously inedible.

I know there's stuff in the fridge right now that's almost definitely bad, and it's just you know, I should eat it, but I'm not going to deal with it at this point. So it'll stay there until ... the next garbage day?

I'd say our number one waste is in our leftovers that don't get eaten. The containers of leftovers go in the fridge and then they don't get eaten.

I lived with my mom for two months [...] she has a giant freezer and two fridges and a pantry upstairs and two pantries downstairs and I was continuously finding these stockpiled foods, and I hated it. And they would waste a lot of fresh stuff.

Using a refrigerator to cut wastage requires food literacy. Specifically, it requires the forethought to plan ahead and not over-purchase. The ability to refrigerate large volumes of foods at home may contribute to excess shopping by accommodating large consumption habits. Study participants note the effect of refrigerators on shopping patterns:

I know in Europe they go every day and they have these tiny fridges. We have these giant fridges, which save a ridiculous amount of food. Our eyes are bigger than our stomachs. When you go, you buy too much, and you intend to eat it, you don't, and it just goes bad.

If you have a large room with a couch and one chair in it, it looks empty. It looks like you need to fill it to make it. But if you have a smaller apartment and you have that same couch and chair in it, it looks like you've decorated appropriately. I think when people have a large fridge, and it is half full, they feel like there's nothing in it. They have to keep filling it. [...] And you want variety, and you think you want all that stuff, but when you have a smaller fridge, you buy what you need. And you go more often [to the grocery store.] We just have the luxury of being able to go once a week and fill our fridges. But if you don't have that space and you can't, you will just go more often and buy what you need.

One couple notes that their shopping pattern changed when they were living in Europe. They had to adapt their shopping patterns to having a smaller fridge, and bought less food:

When we moved overseas and didn't have a big freezer, in fact we didn't even have a big fridge, we had to adjust our shopping. In fact, we had to go like the locals, which means that you go twice a week, because you just don't have the room to put stuff. I wouldn't say drastically adapt, but we had to make allowances. Because we have a nice big deep freeze and it's just too easy.

Refrigeration has shaped modern diets by enabling perishable foods to be stored in homes, and by creating a new demand for 'fresh' foods (Fellows, 2000). In doing so, refrigerators have given us the capacity to store large amounts of fresh foods in our

houses. The access to refrigeration eliminates the need to use perishables immediately, and allows for the freedom to eat and buy food on a 'preference-first' basis. Managing a large inventory of fresh foods, frozen foods and pantry items makes it more difficult to remember which foods need to be eaten when.

Online survey respondents were asked about their shopping patterns, and to indicate how full their refrigerator was. There was a relationship between fridge 'fullness' and shopping patterns (Figure 22). The households that reported having mostly empty refrigerators were ones that either shopped small top-up trips several times a week or ones that did no top-up shopping at all (probably those that shop in one main shopping trip have refrigerators that oscillate between being fairly full and fairly empty, depending on how recently their last shopping trip occurred). Households that reported having very full refrigerators reported shopping in both big shopping trips and small top-up trips. Of course, shopping patterns are probably a result of environmental influences (such as distance, convenience, and access to a vehicle) but it is interesting that from seeing how full a refrigerator in a household is, one can guess with some accuracy how often shopping activities occur.

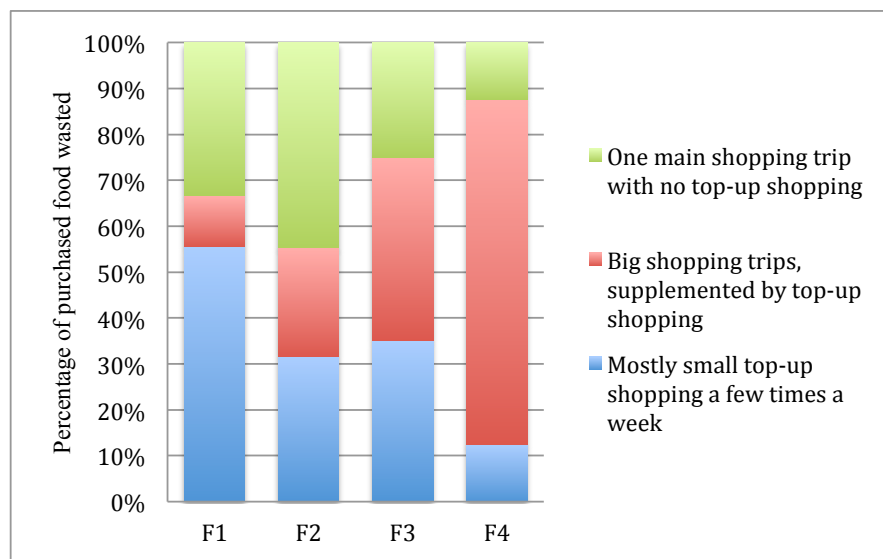


Figure 22: Shopping patterns by reported fridge "fullness." F1 corresponds to a mostly empty fridge, and F4 corresponds to a full fridge. See Appendix 4 for images F1, F2, F3 and F4.

In summary:

- Food wastage might be enabled by refrigeration technologies, rather than alleviated.
- Refrigerators allow participants to over-buy foods and forget about them in fridge because they keep longer. In this way, households do not have to prioritize eating the foods at home first, because they keep for so long in refrigeration.
- A couple of participants note that they might buy more food, partly due to increased storage capacity, noting that in parts of the world with smaller refrigerators, you cannot do large grocery trips every few weeks, but are forced to shop for only a couple of days in advance due to limited refrigeration and food storage capacity (smaller refrigerators).

4.3.3. 'Best-before' labels

Both case study and online survey participants did not really use the dates on food labels to determine whether the food could still be consumed or had to be thrown out. The online survey showed that fewer than one in five respondents strictly adhere to best-before labels when deciding whether or not to eat a food product (see Figure 23), and only two out of the 13 case study participants uses best-before labels (see Appendix 10). These results are noteworthy, as some studies have shown this to be an important factor in food wastage (Brook Lyndhurst, 2008; Morisaki, 2011; WRAP, 2007) the literature review highlighted that food wastage research efforts have focused on 'best-before'-type labels. (For example, WRAP research in the UK showed that three quarters of participants used best-before type dates to determine whether or not a food was safe to consume (Brook Lyndhurst, 2008)).

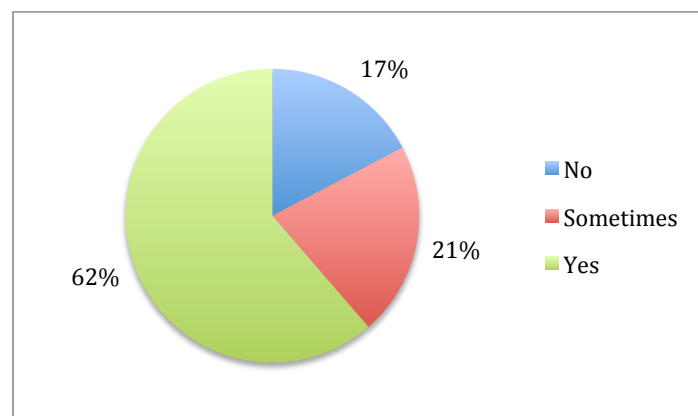


Figure 23: Survey respondents answers to whether they eat foods past their 'best-before' labels

Case study participants note that they do not follow 'best-before' type labels when deciding whether or not a food should be discarded:

I don't really trust the expiry date, because things are usually still good.

I don't look at expiry dates, if it has one, for example. If it seems ok, I'll usually eat it.

I think I've been known to toss something when it's extreme, but not if it's a day or even probably a few days after. I would not. I expect it to show itself to be bad, either it's going to taste bad, or more likely it's growing something.

[T]hings like yogurt, the best before date isn't necessarily when something goes bad. It's just when they recommend you eating it. So I'll eat expired yogurt as long as it looks fine.

Those who do follow dates, only do so loosely:

I follow them most of the time. Normally we don't make it to that point. I know they are more guidelines and I usually assume there are a few days after, or in some cases probably a few weeks of wiggle room.

Yet, despite feeling that they themselves have a good understanding of the flexibility surrounding best-before dates, participants noted that they thought that *others* followed dates more strictly than they did themselves:

I think people assume they are hard-set dates and that as soon as it's midnight that night they're going to turn green or something and be poison.

I think people take them too seriously, too literally sometimes. I feel like they are there for guidelines. And there obviously is a spectrum; sometimes it goes bad before and sometimes after. So just go with what feels right, what it smells like.

My fiancé thinks as soon as the expiry date, then we must throw it out. I'll eat things a bit longer than most people would.

On the other end of the spectrum, participants who use best-before dates acknowledge that they do so out of habit, or because of exceptional situations. For example, one participant acknowledges that eating foods past the expiry date is a matter of comfort and boundaries for her, rather than a belief that the foods themselves spoil after their best before dates.

In terms of whether that means to throw it out right after the date? I know for myself, some of that has been pushing my own comfort boundaries in the last couple of years [...] in my past I would have throw them out when the date was gone. And I would have checked the date for basically anything that had a date.

Another participant notes that they follow best-before labels because of how they grew up and a lack of confidence in their food knowledge, rather than because of a belief that foods go bad if they go over their best before dates:

With milk I am swayed by due dates, and it's something I grew up with, where as soon as it was past the due date, my mom would throw it out, so I'm really cautious about them. I feel fairly confident with milk because you can tell pretty quickly, so sometimes I'll let that go over. Yogurt I always let go over, or I'm not too hesitant. If there's no mould on it, I will eat yogurt.

A participant that doesn't follow expiry dates notes that their roommate follows the dates due to a bad personal experience. When I asked if she thinks that others use dates to determine if a food is still good or not, the participant answers:

[F]or example, my roommate, she told me that she became very ill from bad milk once, so she is on the date for milk, typically. Whereas I'll smell it and decide "meh, I think it can go an extra few days" and I'll wait until it turns.

A participant who eats foods past their expiry date notes that they do follow dates for foods they will feed their children. For example, I ask him how he determined that the cottage cheese from his sample should be discarded. He answers:

The date. I'd go by the date on that. Just because they [their children] are the only two that eat it and they are more sensitive. Their stomachs are a little more sensitive.

Finally, one participant notes that she uses the expiry dates in order to purchase the freshest foods possible:

I will go back behind, because they [the store] often will put the old stuff in the front, and I'm the one who checks backs and checks the milk tags, and pulls back. I'm the one who messes up their [the store] little order because I picked the one ... because that's what they want. But I figure that's their [the store] problem, not my problem. I want the freshest stuff I can buy with my money.

In summary:

- Most participants (all but two) do not use best before dates as guidelines to determine if a food is bad or not.
- Most participants (all but two) said they though *others do* use best before dates as guidelines to know if a food is bad or not.
- Participants with children were more likely to follow best before dates because of food safety.
- One participant noted using dates when shopping at the grocery store to pick fresher foods (instead of the older ones on the shelf).
- If dates are used, they are used loosely and not as time stamps or expiration.
- Participants understood that best before dates were flexible, and if they used them, it was more out of discomfort or habit, but not because a belief that foods are immediately inedible after the date.

4.3.4. Leftovers

Leftover foods that are prepared and not eaten were highlighted by roughly half of case study participants as a problem area or key contributor to their food wastage (see Appendix 10). Leftovers go uneaten because they are forgotten about, or simply because there is something else available to eat that is nicer and leftovers are put aside for another day that never comes.

Leftovers are regarded by some as a convenient way of planning ahead for times when there will be limited time to cook:

When we get lazy, or we know ahead of time that she has something coming up, then we make leftovers on purpose.

Well, I think fresh is slightly better, but leftovers are perfectly fine. It saves time.

However, if there is no plan to consume leftovers and other foods are eaten instead, leftovers are more often forgotten and go uneaten. As was highlighted in our previous section on refrigerators, leftovers get pushed to the back of the fridge and hidden behind other foods:

We always forget about leftovers and they end up being tossed.

I'd say our number one waste is in our leftovers that don't get eaten. The containers of leftovers go in the fridge and then they don't get eaten [...] they sit in the fridge. Sometimes they just get forgotten about. Or maybe it's not a favourite, or there are lots and lots of leftovers – like, I make too much. Like,

there are lots of leftovers, and we just eat something else instead of eating the leftovers.

Part of the reason that leftovers are left uneaten is because there are tastier foods that can be eaten instead. In some cases participants recognize that their choice to not eat leftover foods is a matter of preference and habit:

I don't know if it's because I've been spoiled as a child, but I never ate leftovers. For me, eating leftovers is a really weird concept, so I never tried to cook too much. But whenever I do, thinking I'll have for every day when I'm busy, I never eat it. I never take it with me, so I have always rice that gets mouldy in my containers or anything that I prepared.

I really don't like eating the same thing back to back. It's really weird, but unless it's my favourite dish, I'm instantly like "I had that yesterday, I don't want to have it again." Even now, in our planning, we'll space out the leftovers by a day if we can, just for whatever reason. It's psychological.

Case study data revealed little difference between household that prepare leftovers on purpose and those that avoid leftovers for both the amount and composition of food wastage (see Figure 24). However, data from the online survey found that participants report leftovers and prepared foods as being the second highest type of food that is wasted in their households, after fruits and vegetables (see Figure 8).

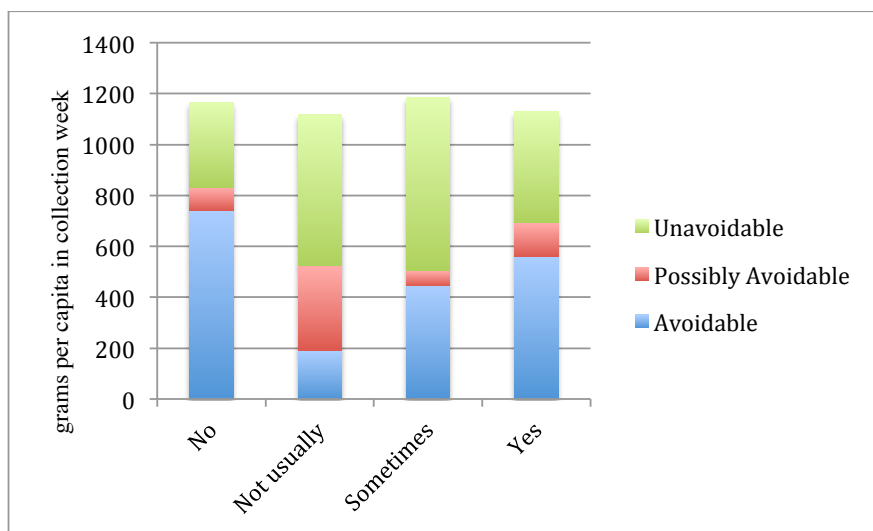


Figure 24: Wastage and composition of food wastage per household member by the frequency of leftovers being prepared in case study participants – the x axis answers the question "Do you prepare leftovers often?"

In summary:

- Leftovers are a problem area for many households.
- Some consider leftovers as a convenient way to plan ahead for when time constraints will restrict food preparation time.
- Personal preference and habits make some less inclined to eat leftovers, and instead opt for choosing other meals.
- Leftovers are often forgotten and go bad before they are eaten.

4.3.5. Shopping behaviours: Store location and promotions

Frequent shopping contributes to households purchasing too much food, which *may* be a reason for high food wastage. (The relationship between shopping frequency and fridge "fullness" was discussed in the section on refrigerators). A few other factors that contribute to buying too much were mentioned by case study participants in their interviews: a) the location of grocery stores, and b) store promotions (like store sales, bulk packaging).

a) Location and shopping frequency

Four case study participants who did not have access to cars noted that if they were closer to a grocery store, they tended to shop more often, in smaller trips.

I used to live pretty close, about a ten-minute walk from a grocery store. Five-minute bike, and I biked a lot too. There was a nice path and everything. It was convenient to get to the grocery store, and I would buy groceries every single day. I'd buy groceries as needed, which might mean two, three trips a week depending on if I forgot something. It was never a hassle to go and get something else, so I never had to overstock with groceries, like I do now. I go to the grocery store once every two weeks. I would try to go on the sale day, and then I'd miss the sale day. And then I'd go the next week on the sale day, and then I'd be all out and have to buy a lot of things.

My bus takes me to Food Basics and then I walk back from Food Basics. It's like a two-minute walk. [So basically whatever you can carry?] Yeah, in my backpack. I don't enjoy carrying a lot of groceries.

Everything is a lot bigger, and they are a lot cheaper if you buy them in bulk, so it's a lot harder to carry. But if you are to buy something, like the 1 litre of milk, that milk costs me two dollars for the deposit of the bottle, and three fifty for the price of the milk. Whereas I can buy, for that price, a big 4 litres as opposed to 1 litre. So for me when I think I'd rather pay five bucks for something as opposed to two bucks because I don't want to carry it because I don't have a car.

Additionally, three participants who did not always have access to a car noted buying more when they did have access to one because of the added ability to carry large quantities of foods.

My mom actually comes to visit about once a month, so about once a month I get to go grocery shopping with a car, and this is when I stock up on things that can be saved, specifically things that will last forever.

As was noted in the section on refrigerators, shopping patterns affect fridge "fullness." Among case study participants, shopping very often and very sporadically was linked to higher levels of avoidable food wastage, whereas those who shopped about once a week (with or without top-up shopping in between) generated more unavoidable food wastage (Figure 25). In general, case study participants who shopped less frequently generated more food wastage. Contrary to findings from the case study,

online survey participants reported very similar wastage levels across different shopping patterns (Figure 26).

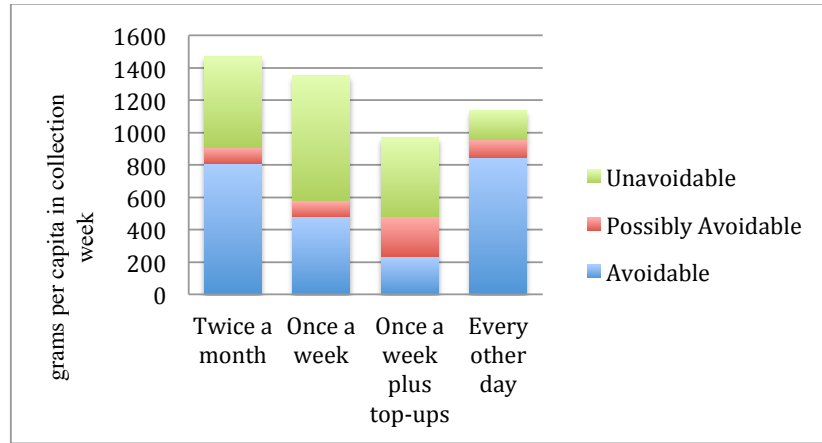


Figure 25: Wastage and composition of food wastage per household member by shopping pattern in case study participants

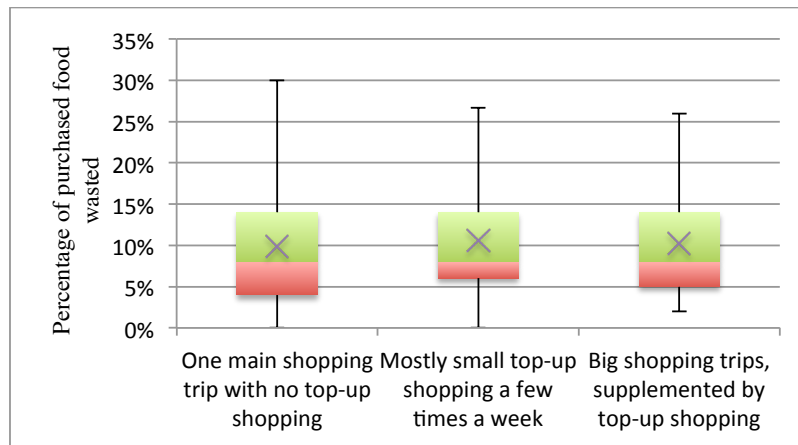


Figure 26: Distribution of reported food wastage by shopping pattern in online survey

b) Bulk shopping and large portion sizing

Store sales can sway grocery store patrons to purchase more food than they might buy otherwise.

[W]hen you go to grocery stores, they're so big that you have all these choices and you're like "oh, I'm going to try this, oh I'm going to try that." And the way it's presented is with all these deals you can buy three or four packages for this price, and you just get excited and buy more. And they even give you the date until when you can get this deal. And you're like "well, I won't have the time to come back, so I'm going to buy more."

When foods are on sale, case study participants mentioned stocking up on frozen foods (mainly frozen vegetables, frozen pizzas, and meat). These foods are purchased and then often kept frozen for later use. Prepared foods, like frozen pizzas, are often quick to prepare, and thus may be eaten instead of more perishable alternatives.

Sometimes portion sizes of fresh foods sold in stores are larger than what a household can go through before the food deteriorates. Participants noted that this was especially the case for herbs and dairy products, among other things:

The one thing that stands out is herbs. Sometimes I'll get mad when he [the husband] buys a huge bag of onions. Because of course we're not going to eat those all, and then they sprout, and then that's it.

I find with herbs, their portion sizes are too much. Like, you'll buy a big thing of dill, or parsley, or cilantro.

Participants note that the larger portion sizes are sold at a better price per unit than smaller ones. This motivates them to purchase more than they might need:

A lot of the produce we buy is a lot bigger size. The juices that are two litres, I find they are cheaper. Everything is a lot bigger, and they are a lot cheaper if you buy them in bulk.

I think of, cottage cheese and sour cream in particular, where realistically, the smaller one would be more appropriate because it's just going to be me eating it, but they are usually so close in price to the big one, so I'll just go with the big one. I often go with the bigger of whatever it is if it's cheaper, even if all I actually need is a smaller container.

In summary:

- Grocery store locations can shape shopping behaviours. In particular, access to a convenient grocery shopping location might make households shop more often, in smaller trips. This shopping pattern is linked to having more empty refrigerators.
- Shopping in a car can lead to buying more food at each shopping trip because of the added capacity to move food.
- Store sales and large portion sizes lead to the purchase of more food, as shoppers stock up on foods to take advantage of retail promotions.

4.3.6. Culture: Modern families and food literacy

At the end of their interviews, study participants were asked why they thought households in Canada waste so much food, based on their experience in the study, and from day-to-day observations. Participants theorized that changes to family structure lead to the loss of food literacy, and thus to food wastage. The loss of food literacy is reflected in poor food management skills. In particular, they highlight the loss of a housewife figure: a family member who is primarily responsible for a household's food management activities. Additionally, they speculate that the loss of food literacy may be a side effect of children not eating at home and not learning to cook, perhaps because of parents being too busy, or because of culture:

If people are raised to be more experienced with food from a younger age too, like in different cultures kids from the youngest age will start cutting things and using knives, whereas I think that a lot of people here are like "a five year old

with a knife, that's not ok" whereas my mom's like "well, you have to learn at some point."

Most countries, I expect, don't waste nearly as much as we do. Part of it is kids aren't raised to be as food-aware, I don't think there's as much family communication with cooking, with partaking in the meal. It's not a family thing here. People don't sit down to dinner every single night.

I also think that there is a gap in education. Kids and families aren't learning about, what we're told that we should be doing. [...] We aren't taught about what to do with food waste, or about portion sizes as much as we could be. So I think education and mindset are a huge issue in North America, to combat this issue.

I think little kids should have more of a part. [...] They should be part of the process of cooking the food; they should be part of the process of grocery shopping. They should learn at a young age what it means to grocery shop, and what it means to meal plan. But I think that a lot of families don't ... have a family; it's disorganized, it's hard. You get home from work, you have a full time job, especially these days. Both parents have a full time jobs and you get home from work, you're tired, things get disorganized.

Participants suggested that, as women joined the formal workforce, time constraints cut into the time that used to be dedicated to household management:

A lot is expected from you, as women, we are trying to fit in the big picture and be educated, and a lot is expected from us today. I have friends who do have the time to cook, and they cook, but I think I've noticed a big portion of us still eat whatever's there.

I recognize that role was the role of women, to spend their entire days and lives caring for and providing food for their families. And I don't think it's a negative thing that women have plenty of opportunities to work and have a career and a job outside of the house. There's positives and negatives that have come from that.

Although it is true that women have been steadily entering the work force since the 1900's, working-class women are not a new phenomenon, and food prepared from packages (e.g. frozen pizza) to save time have been around for a few generations (Bowers, 2000). The loss of food knowledge resulting from an increased focus on convenience is likely as important for household food wastage production as the loss of the figure of a household member who is singlehandedly responsible for the majority of food management activities. The changing role of women and changing families are mentioned as factors to food waste, but are beyond the scope of this work and will not be discussed in detail in this thesis.

Other factors were investigated in the online surveys, but were found to have no influence on food wastage levels. Whether participants immigrated to Canada or not had very little effect on food wastage. Study participants who had experienced household food insecurity had slightly less food wastage than those who had not. (See Figure 27 and Figure 28 in Appendix 9).

In summary:

- Participants speculate that the changing role of women and children not being involved in food preparation activities result in higher levels of food wastage.
- It is possible that the loss of food literacy resulting from the aforementioned changes are linked to the loss of food literacy, and thus more food wastage.

5. Discussion of findings

First, this chapter presents the differences and similarities between the drivers of food wastage found in this study and in the literature. Secondly, it presents a synthesized narrative of why food wastage occurs, based on the data in the previous chapter. The causes of household food wastage are examined, noting that some are driven by environmental factors (food environments), and others are driven by individual behaviour. Table 6 presents the findings of the online survey and case study and compares them to the findings of the literature review.

5.1. Comparison Between Study Findings And Literature Review Findings

5.1.1. Similarities

Many of the findings of this study agreed with findings from the literature. Purchasing too much food was a predominant theme in both this study's findings and the literature (Cox & Downing, 2007; Koivupuro et al., 2012; Morisaki, 2011; Stefan, 2011; WRAP, 2007). For instance, large package sizes encourage households to purchase too much food (Buzby et al., 2011; Glanz, 2008; Williams et al., 2012). Case study data agreed that package sizing that was too large for households' needs caused food to be wasted, particularly in the case of dairy products and fresh herbs that are only sold in large bunches. Case study participants also noted buying larger quantities of products if they were on sale, mostly frozen products and convenience foods that might be eaten instead of fresh foods.

The literature also suggested that high standards of food quality and food safety lead to higher food wastage (Brook Lyndhurst, 2008; Mikkelsen, 2012). Online surveys respondents reported that the second most frequent reason a food was discarded was that it was old, suggesting that high quality standards are a large contributor to food wastage (see Figure 9). Likewise, a few study participants mentioned that they struggled eating leftovers because they did not like how they tasted (when reheated or in general), or simply that they did not want to eat them because it was too repetitive to eat the same thing twice in a row. These views both speak to high quality standards. Finally, case study interviews suggested that food safety is a more salient concern in households with children, as was suggested by the literature review (Cox & Downing, 2007).

Higher income was linked to higher food wastage in some (Clive et al., 2005; Thanh et al., 2010) but not all (Koivupuro et al., 2012; Pekcan et al., 2006; Pham, 2011; Stefan, 2011) studies reviewed. In this study, higher incomes were weakly linked to higher wastage. In the case study, higher income households generated higher wastage per household, but not per person. This finding suggests that the financial ability to more easily purchase food as a result of higher incomes may contribute to households buying too much food.

The literature linked not eating older foods first to higher food wastage (Glanz, 2008; Pham, 2011). Case study interviews agreed with the results found in the literature review and suggested common reasons that households struggle to eat older foods (particularly leftovers) before they degrade. As mentioned in the section on refrigerators (Section 4.4.2), foods are often forgotten if they are pushed to the back of the fridge, or

if families opt to eat other foods instead, driven by preference, convenience, or time constraints.

5.1.2. Differences

A few socio-economic factors suggested by the literature review were investigated, but were less influential than expected in both the case study and online surveys (with the exception of reported income, as mentioned above). Age, household size and the presence of children had very little effect on food wastage levels in this case study, whereas the literature review suggested that age (Clive et al., 2005; Cox & Downing, 2007; Morisaki, 2011; Ventour, 2008; WRAP, 2007), and household size and composition (Clive et al., 2005; Koivupuro et al., 2012; Pham, 2011; Thanh et al., 2010; Ventour, 2008; Williams et al., 2012; WRAP, 2007) affected food wastage. The only evidence linking the presence of children in households to higher wastage was anecdotal, from case study interviews. Given the small sample of case study, this data was not enough to confirm a link between children and food wastage. It is possible that the differences between the literature and study findings are due to the samples used.

Time constraints were a central theme in case study interviews, but were not highlighted by the literature review. Many food choices relating to which (and how much) foods to prepare, shopping patterns, and deviation from meal plans were based on time-related considerations. It is possible that time scarcity was a big issue for case study participants because of sample bias: in particular, many participants had some previous interest in food issues and generally preferred homemade foods (which might take more time to prepare) to boxed foods.

The literature review suggested that more frequent shopping was linked to lower wastage (Glanz, 2008; Stefan, 2011; Williams et al., 2012), and weekly shopping with top-up trips were linked to higher household food wastage (Cox & Downing, 2007). (Top up shopping trips are generally understood to be smaller than so-called main shopping trips). However, this study did not find a relationship between 'top-up' shopping and higher food wastage. The groups that generated the least amount of wastage were those that had one main shopping trip a week (with or without small 'top-up' trips), in contrast to the findings of Cox & Downing. Additionally, groups with the most wastage were found to be those that shopped very frequently (no main shopping trip but many small shopping trips several times per week), and very infrequently (twice a month or less).

As noted in the section on leftovers (Section 4.4.4), this study's findings are not consistent with literature review findings on the effect of on-pack 'best-before' type labels and thus, on their contribution to food wastage. Many studies reviewed found that customer confusion over on-pack 'best-before' type dates was linked to higher food wastage (Brook Lyndhurst, 2008; WRAP, 2007). However, this study's participants, for the most part, did not follow on-pack dates strictly when deciding if a food was still edible. This may be due to the sample of study participants, who generally had some previous interest in food, likely had higher food knowledge, and thus knew that foods are often edible past their 'best-before' dates.

The thematic analysis of case study interviews highlighted the role of leftovers, time constraints, convenience and refrigerators as central food wastage themes. The categories from the literature review did not correspond very well to the themes from

the thematic analyses. Instead, these themes suggest that an examination of them as a whole, and their interactions, can form a more accurate picture of how and why food wastage occurs.

Table 6: Comparison table of factors linked to household food wastage in the literature review and in data from the online survey and case study.

Factor	Literature review	Online survey	Case study
Socio-economic factors			
Age	The literature review found mixed results about the effect of average household age, and age of the main shopper, on household food wastage.	Lower average household age was linked to a larger variation in reported food wastage levels (the majority of data covered a larger range in younger households than older). Older survey respondents reported a slightly lower (negligibly) percentage of food wastage.	Age was found to have no effect on food wastage.
Household composition: Size	Most studies reviewed found that larger household generated more wastage, but less wastage per household member.	Households reported similar percentages of food wastage across all household sizes.	Larger households generated more wastage. Contrary to literature review findings, wastage per person was similar across all household sizes. Larger households in the case study were those that had children; these households had more avoidable waste than smaller households.
Household composition: Presence of children	The review found mixed results about the effect of children on households.	Households with children reported a slightly higher percentage of wastage than households with no children.	Only two case study households had children, and they were the larger households. See above. No difference was found in the amount of food wasted.
Income	The review found either higher wastage in higher income households, or no effect of income on wastage.	Survey respondents reported no differences in wastage between income levels.	Lower income households generated less wastage than higher income households. Wastage per person was similar across different income levels.

Factor	Literature review	Online survey	Case study
Behaviours			
Shopping	Factors linked to increased food wastage were buying too much food, either because of bulk packaging or store promotions.	Behaviours at grocery stores were not investigated in the online survey.	Participants tended to stock up on foods that were on sale. Foods like dairy products and herbs were wasted often because portions available in stores were too large for household needs.
Storing food	Factors linked to higher wastage were not eating older foods first, and 'top-up' and 'spontaneous' shopping.	Households reported similar percentages of wastage across different shopping patterns.	Households that shopped less frequently produced more wastage. Shopping about once a week (with or without top-up shopping) was linked to less avoidable food wastage, and more unavoidable wastage. Shopping only a couple of times a month, or several times per week was linked to more avoidable wastage.
Food preparation	Factors that were linked to higher food wastage were on-pack 'best-before' type dates, high perceptions of food quality, and high standards of food safety.	Less than one in five survey respondents reported following 'best-before' labels.	Most participants (all but two) did not use on-package labels to determine if a food should be discarded, or only followed dates loosely.
Eating food and lifestyles	Factors linked to higher wastage were making too much food, being dissatisfied with how foods taste, and using a large variety of ingredients which are difficult to combine.	Respondents rarely report throwing foods away because of taste, and most often report that foods went bad. Other factors were not investigated in the online survey.	Dissatisfaction with food and making too much food was linked to difficulties eating leftovers before they went bad.

5.2. Discussion: How And Why Does Food Wastage Occur

The following "story" of how food wastage occurs was reconstructed from the study data, integrating the themes that emerged from the thematic analysis in Chapter 4 with case study interview responses:

As household members are short on time, there may be one dedicated day of the week in which to get all of the shopping out of the way⁶. If not, shopping happens when households run out of a staple food, usually milk, bread or vegetables⁴. In car-centric environments, shopping trips are often larger than expected; the ability to bring foods back in a car leads to bigger purchasing; households can take advantage of store sales and stock up⁷. Sometimes shoppers see foods that they had forgotten about, or that suggest meal ideas⁸. That food then goes into the shopping cart. Once home, groceries are stored in the fridge. Often, if the fridge was not entirely empty before shopping or if it was not reorganized, the new purchases contribute to the process of pushing older ingredients and leftovers back and out of sight⁹. Sometimes a large meal is prepared, inspired by all the fresh purchases, but if time is short, and plans to cook are abandoned, the quickest meal possible is prepared (perhaps a frozen or packaged food, or something that requires little preparation), leaving fresh perishables for another day with more time¹¹. Maybe leftovers are eaten instead, or they are considered, but they may not look appealing, or there is not enough leftover food to make a meal from them¹⁰. When time is available, new foods are cooked; leftovers are made on purpose to use up on another occasion when time is short¹¹. Or the amount of food that would be eaten is overestimated for any number of reasons (for example, a household member made last-minute plans to eat elsewhere) and the meal generates unexpected leftovers¹⁰. The leftovers are put away in the fridge or freezer. Sometimes leftovers are used for work or school lunches the next day¹⁰. Eventually they are consumed, or buried in the back of the fridge and forgotten, together with the ingredients that were not cooked before they went bad.

At first glance, this seems to be a story of time management, lack of know-how, and disinterest. But it is important to note that just like other challenges in today's food system, much of the responsibility lies beyond individuals. Many behaviours and attitudes influencing food wastage in this study are attributable to either influences from food environments or behaviours influenced by low food literacy, cultural norms and attitudes. These factors push households to buy too much food, cook too much food, and as a result not eat foods before they go bad. This next section notes the environmental and human factors that contribute to food wastage.

5.2.1. Food environments and food wastage

This study's results suggest that the relationship between food environments and household food wastage should be further investigated. This section explores some of the *possible* ways in which food environments may play a central role in shaping many of the behaviours that affect food wastage, such as shopping patterns, buying too much, and not eating older foods first.

This study suggests that shopping patterns *may* affect food wastage. Although the data was not conclusive, it suggested that infrequent shopping trips are not only linked to fuller fridges, but also to larger grocery hauls. Interviews also suggest that

⁶ From interview responses to prompts on what triggers shopping trips.

⁷ Section 4.4.5. on store promotions, part a).

⁸ Section 4.4.5. on store promotions, part b).

⁹ Section 4.4.2. on refrigerators.

¹⁰ Section 4.4.4. on leftovers and interviews segment.

¹¹ Section 4.4.1. on time constrains.

both time constraints and access to grocery stores play a role in spacing out the frequency of shopping trips. Having a grocery store close by or on the way home might make it easier to shop more frequently. If there is a store within walking distance (for example, that one can bus to on the way home from school, and then walk home from, as one of the case study participants mentioned) then grocery-shopping trips might be smaller and more frequent. On the other hand, only being able to access grocery stores by car could push households to buy larger amounts of groceries because of the convenience of being able to carry home larger grocery hauls, and thus shop less frequently or overbuy, or both. A 2005 study on the Waterloo Region's food system reported that 71 percent of urban residents do not live within a reasonable walking distance (defined as 450 m) of a supermarket, and 47 percent do not live within reasonable walking distance of either a convenience store or supermarket (Xuereb & Desjardins, 2005). Thus, in Waterloo Region, car-centric environments are likely to favour shopping behaviours that are linked to higher household food wastage.

Retail environments also influence shopping behaviours. Shoppers are presented with ample displays of colourful, fresh foods and produce. Products are sold in large packs, either without options to buy singles, or at better prices per unit than smaller sizes. Signs warn that sales will end soon, so customers stock up on foods before promotions end. These prompts can sway customers to over-purchase, and to deviate from their grocery lists and meal plans (if they have them). Furthermore, the large food storage capacity of households with large refrigerators and the increased purchasing capacity of Canadian consumers make taking advantage of store promotions easy. It is then likely that retail environments, combined with larger storage capacity at home, might succeed in pushing customers to over-purchase and thus waste more.

Another matter that can be linked to food environments is the struggle of households to consume foods and leftovers before they deteriorate. Sometimes leftovers are not eaten because of unplanned circumstances. For example, one participant mentioned that eating out with friends or coworkers is a social activity; it might be preferable to eating one's leftovers alone. Moreover, the additional food storage capacity in homes creates an environment that facilitates food wastage by making it easy to forget or ignore leftovers. Thus, as well as playing their intended role in food preservation, refrigerators might even aid the process of creating wastage.

Other studies have found that attitudes towards time and time constraints are important determinants in the amount of time allotted to food related activities, such as grocery shopping and food preparation (Chetthamrongchai & Davies, 2000; Davies, 1997; Jabs & Devine, 2006). These studies find that shopping and cooking activities are often shaped by time availability, but do not link time availability to food wastage. Case study interviews indicated that a lack of time factored into foods not being prepared, and meal plans falling apart. Given the influence of time constraints on food preparation and consumption activities, it is interesting to note that literature on time attitudes and time scarcity has not been framed as a central piece of food wastage research. Thus, future research on household food wastage might benefit from investigating the relationship between time scarcity and household food wastage.

Thus, broader food environments, including retail settings and time constraints, may drive households to purchase more food by favouring shopping patterns that lead to more food wastage, by prompting customers to over-purchase food in stores, and

through modern kitchens that allow for the storage of large amounts of food at a time. These broader environments shape the behaviours that are singled out by other food wastage studies as factors that cause higher food wastage.

5.2.2. Food literacy and leftovers

Time-constrained schedules and low food literacy make it difficult for households to navigate environments that push them to waste food. For example, more experienced shoppers are better equipped to navigate retail environments, resist their influences and buy only what is needed. Additionally, food knowledge allows for enough flexibility to adapt menus to include extra purchases, or to adjust to unforeseen time constraints.

Food literacy, specifically the ability to cook the right amount of food and keep track of foods that need to be eaten, is linked to food wastage. In this study, instances in which households cooked too much and struggled to finish foods were mostly related to leftovers. Being able to reincorporate leftovers into new meals can help avoid throwing out food. However, this skill requires a certain level of comfort with food preparation activities. Additionally, less experienced cooks might be prone to cooking large batches of food that are hard to consume before they go bad. More experienced households are better equipped to face time constraints, environmental triggers when shopping, and unplanned circumstances. Whether it is because of the changing role of women, or a food education gap in families, low food literacy and time constraints contribute to higher food wastage.

The matter of personal habit and taste was also found to contribute to difficulty consuming foods (particularly leftovers) before they deteriorate. Foods that do not taste as good reheated, or that simply do not taste appetizing in the first place, are left in the fridge, and minimal effort is made to consume them. When other options are cheap, quick, convenient, and tastier, there is little incentive to eat leftovers.

5.3 Conclusions

This study confirms some of the findings from the literature: buying too much food, cooking too much, certain shopping patterns, and low food literacy contribute to food wastage. However, this study has revealed new information about the food environments (when shopping and at home) that may cause households to waste food. In particular, the role of time constraints, retail environments, and lack of accessible and convenient retail locations as household food wastage triggers should be further investigated.

6. Conclusions and future research

This study set out to explore the factors that lead to household food wastage in Canada. A literature review on household wastage in other countries suggested examining socio-economic factors and behaviours surrounding food-related activities to answer the question: What factors drive Canadian households to waste food? Using a combination of food wastage collection, interviews, and an online survey, this study found the following:

1. The households examined share many of the food wastage-related behaviours that affect households in other developed countries. Higher food wastage can be linked to a combination of factors that lead to households buying too much food, and struggling to consume foods before they deteriorate. With a few exceptions (such as the use of best-before type labels), behaviours suggested by the literature review (including certain shopping patterns, personal taste, not eating leftover foods first) were linked to higher household food wastage in Waterloo Region.
2. This study highlighted the importance of food literacy and broader food environments as influences that shape household food-related behaviours. Food environments inside and outside food retail spaces drive households to over-purchase. Additionally, time constraints and low food literacy make it difficult for households to navigate environments that push them to waste food. Although certain aspects of food literacy have been central in household food wastage research, literature on time scarcity and retail environment influences has yet to be strongly linked to the issue of food wastage.
3. This study's findings suggest the need to widen the scope of household food wastage research to include other food chain actors. Household food wastage reduction efforts, like Love Food, Hate Waste in the UK, have brought attention to the issue through education and awareness campaigns. However, programs that focus mainly on households fall short of addressing the larger picture, and might risk minimizing the complexity of food wastage and the multiple scales that influence it. What is clear from this study is that an individual focus on food literacy efforts alone cannot address household food wastage. Additional attention needs to be paid to the broader food environments that shape consumer behaviours.

A growing body of literature has begun to address household food wastage. Although some attention has been put towards the effect of food packaging on household food wastage (Brook Lyndhurst, 2008; Williams et al., 2012), for the most part, this body of literature has focused on the role of individuals. Despite the limited study sample, this research suggests that future research should examine alternative ways of framing the study of household food wastage to understand the role of food environments in food wastage. Additionally, the role of technological aids (widespread use of large home refrigeration and car-aided grocery shopping) in day-to-day food activities has not been central in household food wastage research, despite the large effect that these technologies may have on wastage-related behaviours; this too should be addressed in future household food wastage research.

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APPENDICES

Appendix 1: Literature review table on behaviours and household food wastage

Some studies from 1993–present that study consumer food wastage and either attempt to measure it or relate it to behaviours conducive to waste, and that include some source of primary data.

Study	Factor	Effect
Canada (Abdulla et al., 2013)	<ul style="list-style-type: none"> • “Healthy dietary trends” including increased consumption of fresh fruits and vegetables 	<ul style="list-style-type: none"> • more waste, <i>suggested</i>
Denmark (Mikkelsen, 2012)	<ul style="list-style-type: none"> • High sensitivity to food hygiene • “Food knowledge” • Feelings of guilt associated to food wastage 	<ul style="list-style-type: none"> • more waste, <i>suggested</i> • less waste • less waste, <i>suggested</i>
Finland (Koivupuro et al., 2012)	<ul style="list-style-type: none"> • Buy foods on sale/at discount prices often • Consider package portion sizes to be too big • Consider price of foods to be important • More purchases of fresh foods for health reasons • Eating habits • Food preparation habits 	<ul style="list-style-type: none"> • less waste • more waste • less waste • more waste, <i>suggested</i> • no effect • no effect
Sweden (Williams et al., 2012)	<ul style="list-style-type: none"> • Frequency of shopping (main/top-up unspecified): more frequent • “Environmental education” (awareness) • Awareness of the cost of food wastage 	<ul style="list-style-type: none"> • less waste • less waste of prepared foods • less waste
UK (Pham, 2011)	<ul style="list-style-type: none"> • Not being aware of foods that are at home (“forgetting food”) • Cooking too much food • Not eating foods that need to be eaten first 	<ul style="list-style-type: none"> • more waste • more waste • more waste
Japan (Morisaki, 2011)	<ul style="list-style-type: none"> • Buying impulse items 	<ul style="list-style-type: none"> • more waste
Romania (Stefan, van Herpen, Tudoran, & Lähteenmäki, 2013)	<ul style="list-style-type: none"> • Intention to not throw away food • Shopping when hungry • Top-up shopping • Buying too much food 	<ul style="list-style-type: none"> • partially supported: more waste • no effect • no effect • more waste

Study	Factor	Effect
	<ul style="list-style-type: none"> • Awareness • Frequency of main shopping trip: more frequent 	<ul style="list-style-type: none"> • no effect • less waste
Austria (Glanz, 2008)	<ul style="list-style-type: none"> • Attitude: feelings of guilt associated to throwing out food • Habits such as buying 'specialty' foods • Infrequent shopping • Buying too much food because of retail promotions • Rough handling bringing food home • Not being aware of foods that are at home 	<ul style="list-style-type: none"> • more intention not to waste food • more waste • more waste • more waste • more waste • more waste
UK (WRAP, 2007)	<ul style="list-style-type: none"> • One weekly main shopping trip followed by frequent top-up shopping • Higher "home economics" skills • Higher sensitivity to food packaging labels • Sitting down for a meal at least once a day • Eating more fresh produce 	<ul style="list-style-type: none"> • more waste • less waste • more waste • low correlation: less waste • more waste of inedible foods, less waste of uneaten food
UK (Brook Lyndhurst, 2008)	<ul style="list-style-type: none"> • Buying too much because of large packages • Poor understanding of food packaging labels 	<ul style="list-style-type: none"> • sizes & more waste • more waste

Appendix 2: Literature review table on socio-economic factors and household food wastage

Some studies from 1993–present, that study consumer food wastage and either attempt to measure it or relate it to socio-economic factors conducive to waste, and include some source of primary data

Study	Factor	Effect
Finland (Koivupuro et al., 2012)	<ul style="list-style-type: none"> Household size: larger Household type: single occupant Household type: single occupant, woman Primary shopper a woman (vs both spouses, or a man) Age: oldest household member Area, form or type of residence Education level Type of work of adults 	<ul style="list-style-type: none"> more waste per household more waste most waste (more than single man), not statistically significant more waste no effect no effect no effect no effect
Sweden (Williams et al., 2012)	<ul style="list-style-type: none"> Household size: larger 	<ul style="list-style-type: none"> less waste per capita
Romania (Stefan, 2011)	<ul style="list-style-type: none"> Age Income Household size Presence of children, no effect 	<ul style="list-style-type: none"> no effect no effect no effect no effect
UK (Pham, 2011)	<ul style="list-style-type: none"> Income Household size Presence of children 	<ul style="list-style-type: none"> no effect more waste per household no effect
Japan (Morisaki, 2011)	<ul style="list-style-type: none"> Employment status, unemployed housewives and non-working Age: 70 and older Age: 30–39 Level of education Presence of children Education (university or higher or high school or lower) 	<ul style="list-style-type: none"> less waste less waste less waste no effect less waste, <i>suggested</i> no effect
Vietnam (Thanh et al., 2010)	<ul style="list-style-type: none"> Higher income Larger household size Higher population density and urbanization level 	<ul style="list-style-type: none"> more waste more waste more waste
UK (Ventour, 2008)	<ul style="list-style-type: none"> Larger household Larger household Presence of children under 16 Single occupancy household 	<ul style="list-style-type: none"> more waste per household, less waste per capita more avoidable waste more waste per household, less waste per capita more waste per capita

Study	Factor	Effect
	<ul style="list-style-type: none"> • Single occupancy household, age 25-35 • Age: main shopper • Age • Housing tenancy: privately rented • Employment status: main household earner is self employed • Employment status: main household earner is retired • Occupation: main household earner dependent on state • Occupation: main household earner works in professional or higher-managerial capacity 	<ul style="list-style-type: none"> • max waste per capita among single occupancy • households of older shoppers waste less • no effect on average waste per capita • more waste • more waste • less waste • low correlation: waste more dependent on state • low correlation: less more
UK (WRAP, 2007)	<ul style="list-style-type: none"> • Age: older • Housing tenancy: rented • Larger food storage space 	<ul style="list-style-type: none"> • less waste • more waste • low correlation: more waste
Turkey (Pekcan et al., 2006)	<ul style="list-style-type: none"> • Income 	<ul style="list-style-type: none"> • no effect
Australia (Clive et al., 2005)	<ul style="list-style-type: none"> • Age: older • Higher income • Presence of young children 	<ul style="list-style-type: none"> • less waste • more waste per household • more waste per household

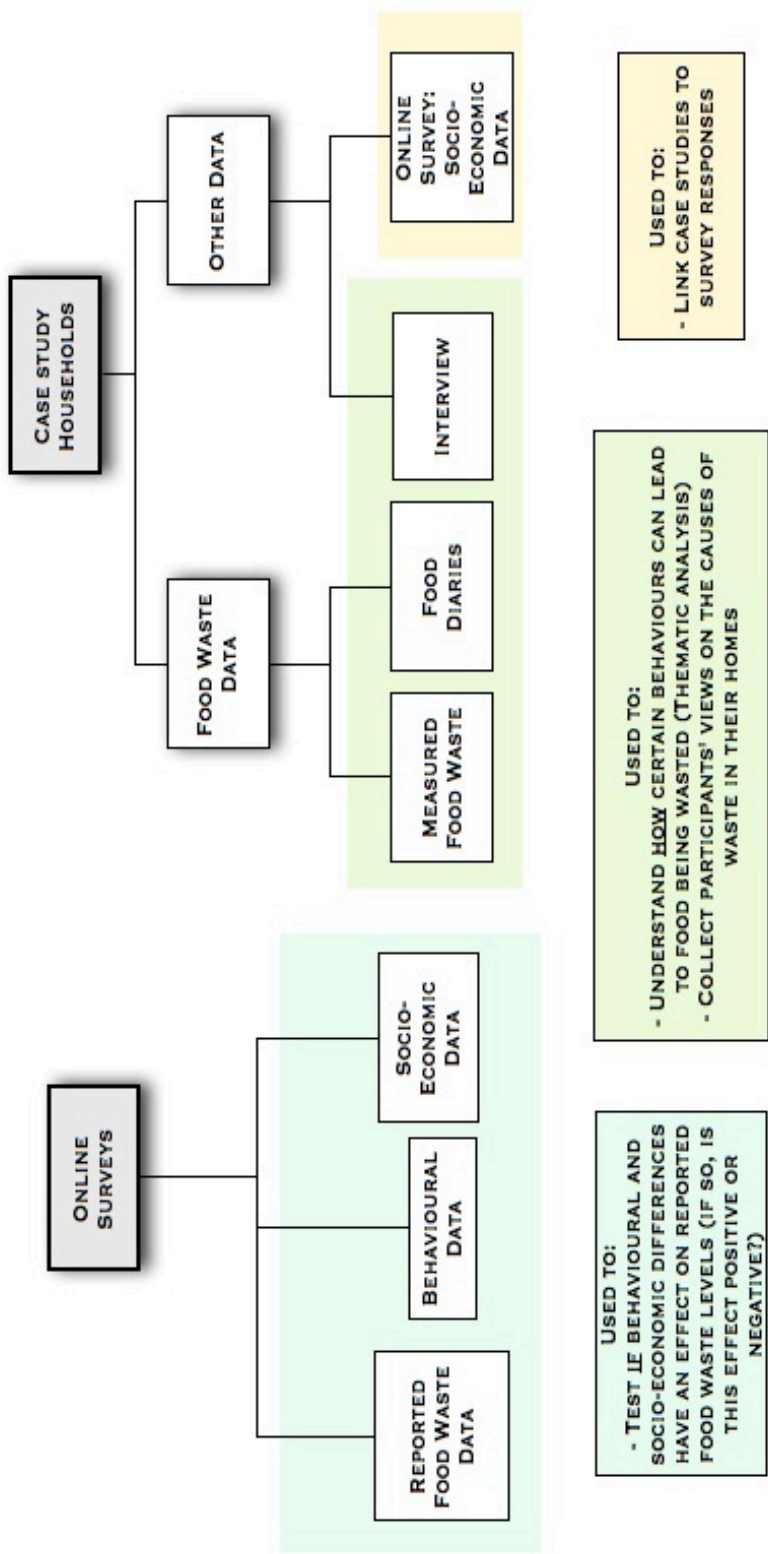
Appendix 3: Literature review table on household food waste study methods

Some studies from 1993-present that measure consumer food waste and use primary data or inferential methods.

Study	Methods	Sample Size/Source	Results
Sweden (Williams et al., 2012)	Waste was recorded through food diaries and measured with scales by household members	61 families	Food waste per household, on average, of 1.7 kg per week. About a third of waste was from leftovers, the rest from stored perishables such as fruit, vegetables and dairy products
Finland (Koivupuro et al., 2012)	Food waste diary over 2 weeks, and a background questionnaire	380 households	Reported waste ranged from 0 to 23.4 kg per household per year
Romania (Stefan, 2011)	Web based survey	245 respondents	Report wasting one tenth of food brought into households
UK (Pham, 2011)	Each household's food waste bin was weighed weekly, for three weeks in a row	55 households participated in food waste measurement	An extra 0.26 kg per additional household member per week
USA (Hall, Guo, Dore, & Chow, 2009)	Results were found by subtracting the calculated average food energy intake from the food supply of the US population	FAO food balance sheets	Food waste per capita has increased from 900 kcal per day in 1974, to 1,400 kcal per day in 2003
Austria (Glanz, 2008)	Record of expired products found in the household	21 households	Average: 10 items per household
UK (Ventour, 2008)	Waste was collected from households (allowing for a minimum of 4 weeks after interviews about food waste behaviours had elapsed)	2138 households	Average waste was 270 kg per year or 5.3k g per household per week, the equivalent to £520 per year

Turkey (Pekcan et al., 2006)	24-hour recall survey technique: the household member in charge of food was interviewed about food consumption from the previous day. Food consumed was subtracted from the food available, as estimated through Food Balance Sheets and expenditure surveys.	500 households	Average waste was 816.4 g per household, and 318.8 g/day per person, or 481.7 kcal/day per household and 215.7 kcal/day per person
Australia (Clive et al., 2005)	Self reported fortnightly, monthly or annual spending on different types of uneaten food	1644 respondents	“\$2.9 billion of fresh food, \$630 million of uneaten take-away food, \$876 million of leftovers, \$596 million of un finished drinks and \$241 million of frozen food, a total of \$5.3 billion”
USA (Newton & Burger, 1994)	Homes were provided with 42-quart containers in which to deposit food waste, which was weighed and separated over four weeks	35 households	Households wasted 7.57 lb (3.43 kg) of food per week on average

Appendix 4: Methods flowchart



Appendix 5: Online survey

SCREENING QUESTIONS:

- Do you reside in Kitchener or Waterloo? Yes/No/Other
- Do you hold primary responsibility for managing food in your household?
Yes/No/Other

SOCIO-ECONOMIC FACTORS:

- What is your age?
- Please indicate the ages of the **other** members of your household (separated by commas - for example: "5,7, 35"):
- Please indicate you household yearly income:
- Has **your household** ever experienced food insecurity, that is, hunger or undernourishment due to lack of access to adequate food due to economic factors?
Yes No Don't know
- Have **you** experienced food insecurity – lack of access to adequate food due to economic factors? Yes No Don't know
- Please select 'Yes' if any of the following apply to you:
 - I immigrated to Canada as an adult Yes No
 - I immigrated to Canada as a child Yes No
 - I am a first generation Canadian Yes No

If you answered 'Yes' to any of the questions above, please indicate what your ethnic heritage is

BEHAVIOURS:

- How full is your refrigerator right now?
Please select the image that most accurately represents how full your refrigerator is:
Select image



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F1



www.shutterstock.com · 41432293

F2



www.shutterstock.com · 122491663

F3



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F4

- Do you believe that food labels, such as "best before"/"best by"/"freeze by"/"sell by"/"display until", are confusing for shoppers and consumers? Yes/No/Other

- Do you eat foods past their "best before"/"best by"/"freeze by"/"sell by"/"display until", are confusing for shoppers and consumers?

Yes/No/Other

- Do you prefer to cook new meals every day? Yes/No/Other
- Do you feed your family leftovers? Yes/No/Other
- Which of the following choices best describes your normal shopping pattern?
Shopping trips are:
 - Mostly smaller top-up shopping a few times a week
 - Very little, I/we usually eat out
 - Big shopping trips supplemented by top-up shopping
 - One big shopping trip with no top-up shopping

Dropdown menu options to answer the question "Why?"

- It was moldy/rancid/fermented/gone bad
- It was old/past its prime
- There was an excess of this food in my house
- It had a bad/unpleasant/unpalatable taste
- It didn't meet my dietary guidelines
- It was expired

<p>In the past week, to the best of your recollection, how many times did you throw away:</p>	<p>On an average week, how many times do you usually throw away:</p>
<p><u>FRUITS and VEGETABLES</u> What/how much was thrown away, and why was it discarded?</p> <p>Examples:</p> <ul style="list-style-type: none"> • about a dozen grapes out of a pack; • about 1 cup of frozen peas; • 1/4 cup of onion; a peach; • 1 avocado; • half a pound of spinach; • about 5 leaves of wilted lettuce <ol style="list-style-type: none"> 1. What? Why? 2. What? Why? 3. What? Why? 4. What? Why? 5. What? Why? 6. What? Why? 7. What? Why? 8. What? Why? 9. What? Why? 10. What? Why? 	<p><u>FRUITS and VEGETABLES</u> What/how much is usually thrown away, and why is it discarded?</p> <ol style="list-style-type: none"> 1. What? Why? 2. What? Why? 3. What? Why? 4. What? Why? 5. What? Why? 6. What? Why? 7. What? Why? 8. What? Why? 9. What? Why? 10. What? Why?
<p>On average, what percentage of FRUITS AND VEGETABLES purchased by your</p>	

household are wasted?	
<p><u>MEATS, SEAFOOD, POULTRY, and EGGS</u></p> <p>What/how much was thrown away, and why was it discarded?</p> <p>Examples:</p> <ul style="list-style-type: none"> • 2 raw chicken drumsticks • 3 eggs <ol style="list-style-type: none"> 1. What? Why? 2. What? Why? 3. What? Why? 4. What? Why? 5. What? Why? 6. What? Why? 7. What? Why? 8. What? Why? 9. What? Why? 10. What? Why? 	<p><u>MEATS, SEAFOOD, POULTRY, and EGGS</u></p> <p>What/how much is usually thrown away, and why is it discarded?</p> <ol style="list-style-type: none"> 1. What? Why? 2. What? Why? 3. What? Why? 4. What? Why? 5. What? Why? 6. What? Why? 7. What? Why? 8. What? Why? 9. What? Why? 10. What? Why?
On average, what percentage of MEAT, SEAFOOD, POULTRY and EGGS purchased by your household are wasted?	
<p><u>BAKED GOODS, BREADS, TORTILLAS</u></p> <p>What/how much was thrown away, and why was it discarded</p> <p>Examples:</p> <ul style="list-style-type: none"> • half a loaf of whole grain bread (about 6 slices); • 2 corn tortillas; • 1/4 piece of an 8in pita bread; <ol style="list-style-type: none"> 1. What? Why? 2. What? Why? 3. What? Why? 4. What? Why? 5. What? Why? 6. What? Why? 7. What? Why? 8. What? Why? 9. What? Why? 10. What? Why? 	<p><u>BAKED GOODS, BREADS, TORTILLAS</u></p> <p>What/how much is usually thrown away, and why is it discarded?</p> <ol style="list-style-type: none"> 1. What? Why? 2. What? Why? 3. What? Why? 4. What? Why? 5. What? Why? 6. What? Why? 7. What? Why? 8. What? Why? 9. What? Why? 10. What? Why?
On average, what percentage of BAKED GOODS, BREADS, and TORTILLAS purchased by your household are wasted?	
<p><u>LEFTOVERS and PREPARED FOODS</u></p> <p>What/how much was thrown away, and why was it discarded</p>	<p><u>LEFTOVERS and PREPARED FOODS</u></p> <p>What/how much is usually thrown away, and why is it discarded?</p>

<p>Examples:</p> <ul style="list-style-type: none"> • about 1 cup of cooked rice; • 2 slices of pizza; • about 5 cup of assorted plate scraps; • about 1 cup of chinese mixed veggie stir fry; • a couple bites of spinach omellete (about 3 tablespoons) <ol style="list-style-type: none"> 1. What? Why? 2. What? Why? 3. What? Why? 4. What? Why? 5. What? Why? 6. What? Why? 7. What? Why? 8. What? Why? 9. What? Why? 10. What? Why? 	<ol style="list-style-type: none"> 1. What? Why? 2. What? Why? 3. What? Why? 4. What? Why? 5. What? Why? 6. What? Why? 7. What? Why? 8. What? Why? 9. What? Why? 10. What? Why?
<p>On average, what percentage of LEFTOVERS and PREPARED FOODS purchased by your household are wasted?</p>	
<p><u>PACKAGED FOOD PRODUCTS, such as YOGURTS, DAIRY PRODUCTS, BOXED/FROZEN MEALS</u></p> <p>What/how much was thrown away, and why was it discarded</p> <p>Examples:</p> <ul style="list-style-type: none"> • 1 225gr blueberry yogurt; • 1 frozen pizza, 12 oz/340gr; • about 4 tbsp of hot sauce (stuck in the bottom of the bottle); • 1 250gr pack of tofu (about 1 cup); • about 2 cups of stale cherrios; <ol style="list-style-type: none"> 1. What? Why? 2. What? Why? 3. What? Why? 4. What? Why? 5. What? Why? 6. What? Why? 7. What? Why? 8. What? Why? 9. What? Why? 10. What? Why? 	<p><u>EXPIRED PACKAGED FOOD PRODUCTS, such as YOGURTS, DAIRY PRODUCTS, BOXED/FROZEN MEALS</u></p> <p>What/how much is usually thrown away, and why is it discarded?</p> <ol style="list-style-type: none"> 1. What? Why? 2. What? Why? 3. What? Why? 4. What? Why? 5. What? Why? 6. What? Why? 7. What? Why? 8. What? Why? 9. What? Why? 10. What? Why?
<p>On average, what percentage of PACKAGED FOOD PRODUCTS purchased by your household are wasted?</p>	
<p><u>OTHER FOODS</u> _____</p>	<p><u>OTHER FOODS</u> _____</p>

What/how much was thrown away, and why was it discarded	What/how much is usually thrown away, and why is it discarded?
<p>Examples:</p> <ul style="list-style-type: none"> • 1/3 cup of uncooked beans; • about 1/4 cup of flour <ol style="list-style-type: none"> 1. What? Why? 2. What? Why? 3. What? Why? 4. What? Why? 5. What? Why? 6. What? Why? 7. What? Why? 8. What? Why? 9. What? Why? 10. What? Why? 	<ol style="list-style-type: none"> 1. What? Why? 2. What? Why? 3. What? Why? 4. What? Why? 5. What? Why? 6. What? Why? 7. What? Why? 8. What? Why? 9. What? Why? 10. What? Why?

Appendix 6: Case study information pamphlet

FOOD WASTE INFORMATION PAMPHLET

Hello! Thank you for your interest in my study! Please feel free to contact me at any time if you have any comments/questions/concerns regarding this study at ihurruti@uwaterloo.ca (or [phone number-omitted] on weekends!) - Isabel

MATERIALS:

Your waste collection kit includes:

- 7 white opaque containers with lids
- 7 transparent 1ltr containers with lids
- 7 transparent 500 ml containers with lids
- 7 resealable plastic bags
- A food diary record sheet
- This information pamphlet!



INSTRUCTIONS:

During your collection week place any kitchen scraps (except tea bags/leaves and coffee grounds) in the containers in your kit instead of disposing of them as you normally would.

1. Discard each item (e.g one sandwich, leftovers from one meal) in a separate container
 2. Use one container per day to discard kitchen scraps (such as egg shells or vegetable peels) together
 3. Use your food diary sheet to record the container number, date, and what food was discarded (the purpose of recording what type of food was discarded is just so I can tell what it is)
 4. If you are discarding a food that is in a vessel that you don't wish to keep (such as a milk carton, juice bottle, jar, plastic container with a lid, a bag) you do not need to transfer the food into one of the containers in your kit. Simply record that this food on your food diary record sheet, and I can pick up food in it's original vessel.
- You can use the containers in your kit in whatever way is most convenient for you. I suggest using the big white containers for kitchen scraps (one per day) if you do a lot of cooking at home, and using the resealable bags and transparent containers for individual items.
 - Let me know if at any time in the week you need more of any type of container or more bags.

Appendix 8: Interview topic list

SECTION 0: General views

- What are your general thoughts on household food waste?
 - Do you think it is a good or bad or neither?
 - How do you think that food waste is perceived by society?

SECTION 1: Shopping and food storage

Tell me about the steps you go through when you go shopping.

- Do you buy the same staple foods every week?
- Do you prepare a shopping list before going shopping?
 - How do you write your shopping lists?
- What thought process do you go through when you notice sales or food promotion?
 - If applicable: Do you adhere to your shopping list when shopping?
- Do you do the bulk of your household's shopping in small "top up" trips, or in big "main" shopping trips?
- Do you purchase fresh foods when you still have some fresh foods at home, or do you wait until you are out of fresh foods before restocking them?
- Do other household members also purchase foods for your household?

SECTION 2: Food preparation

Let's talk about what happens with food at home.

- What is your thought process when deciding what foods to prepare?
 - How do you decide which foods to prepare/ how do you plan menus?
- Do follow recipes?
- Do you plan your meals around recipes?
- Do you plan meals around what fresh foods you have at home?
 - How do you decide how much food to prepare?
- What about left overs?
 - Do you cook enough food to have left overs?
 - Would you or your family members eat the same meal two days in a row?
 - Do you prefer to prepare new meals over reheating leftovers?
 - Do you share left over foods with your neighbours/friends/family?
- Do you prepare boxed foods/frozen/convenience foods?

SECTION 3: Eating food, and lifestyles

How do you decide whether or not a food item should be eaten or not?

- Do you eat foods past their "best before", "display until", "best by", "freeze by", or "sell by" dates?
 - Would you serve expired foods to others in your household?
 - What do you think about "best before"-type food labels?
- Have you found that packaging/portion sizes at food retail stores are too big for your household's needs?
 - Have you ever bought more food than you can eat because you get a better deal/pay less if you buy a smaller portion?

SECTION 4: Concluding remarks

- Why do you think that household food waste levels are high in Canada?

Appendix 9: Figures for Chapter 4

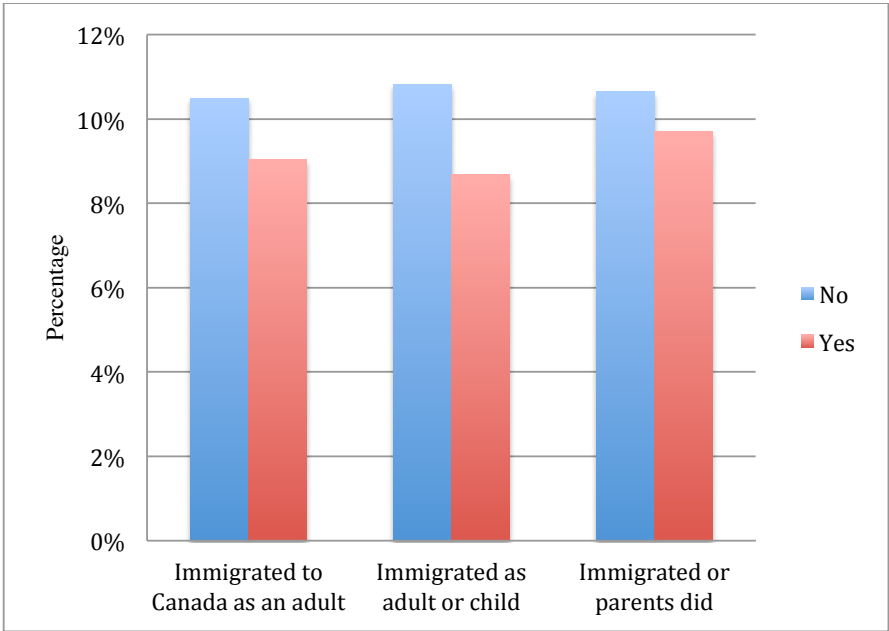


Figure 27: Reported food wastage percentage by immigration in online surveys

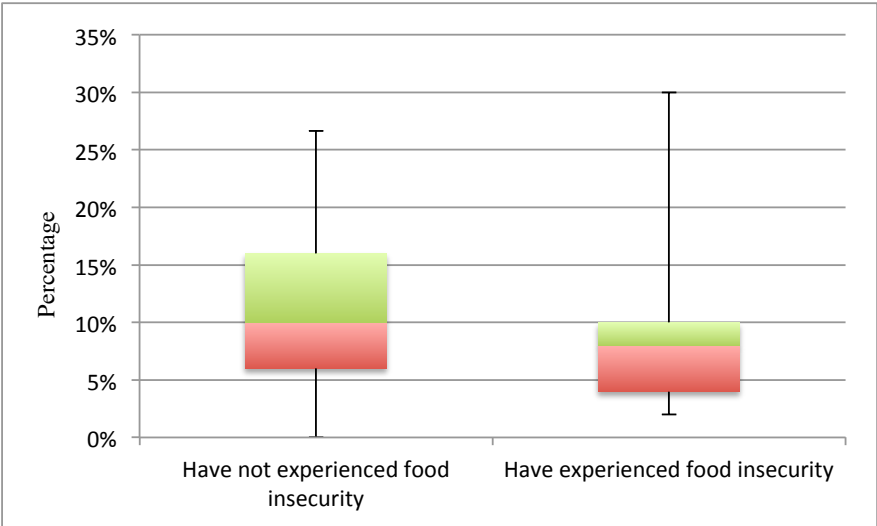


Figure 28: Comparison of distribution of reported percentage of food waste for participants that have and have not experienced food insecurity in online survey

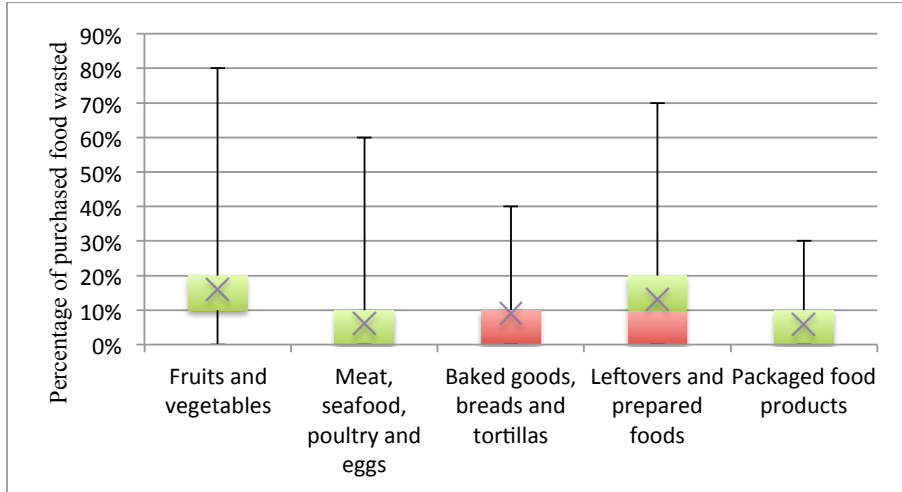


Figure 29: Distribution of reported food wastage percentages for online survey participants, by food type category

Appendix 10: Interview response summary of selected themes

Time constraints (are they an issue)	Type of planner	Refrigerators (are they a contributor to food wastage)	On-pack "best-before" type labels (are they used)	Leftovers (are they a big contributor to food wastage)
Couple 1 Yes	Meticulous planner	Not an issue	Not used	Not an issue
Single 1 Yes	Partial planner	Yes (foods are forgotten)	Not used	Not an issue
Family 1 Yes	Meticulous planner	Not an issue	Sometimes used	Yes, main source of waste
Single 2 Yes	Non-planner	Yes (foods are forgotten)	Not used	Yes
Couple 2 Yes	Meticulous planner	Yes (foods at the back don't get eaten)	Not used	Yes, especially when hidden in the fridge
Couple 3 Yes	Non-planner	Yes (foods are forgotten)	Not used	Yes, main source of waste
Single 3 Yes	Non-planner	Yes (full fridge leads to waste)	Not used	Not an issue
Family 2 Not a major issue	Non-planner	Yes (food pushed to the back)	Labels are used	Yes
Couple 4 Yes	Meticulous planner	Yes (foods are forgotten, get lost)	Not used	Yes, especially when hidden in the fridge
Couple 5 Not an issue	Meticulous planner	Yes (foods are pushed to the back, forgotten)	Not used	Not an issue
Single 4 Not an issue	Partial planner	Yes (full fridge leads to waste)	Not used	Sometimes an issue
Single 5 Not an issue	Non-planner	Not an issue	Not used	Not an issue
Single 6 Yes	Partial planner	Yes (put off eating foods in the fridge)	Not used	Not an issue

Appendix 11: Diagram of food wastage related behaviours

