7-25-2017 12:00 AM

# Exploring Geographic Variations in Community and Consumer Food Environments for Children

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A thesis submitted in partial fulfillment of the requirements for the Master of Science degree in Geography

# Abstract

Research indicates that diet influences the risk of childhood obesity, as well as other related health issues such as cardiovascular disease and type 2 diabetes. Given that families are spending more money on food away from home now than ever before, it is crucial to understand the food environment (FE) as it pertains to children. This thesis examines geographic variations in children's FEs among varying levels of neighbourhood urbanicity and socioeconomic status, and Canada-US differences in three North American study areas: London, ON, Middlesex County, ON, and Rochester, NY, through the use of children's menu audits and GIS-based analysis. In the London-Middlesex region, both level of urbanicity and level of socioeconomic distress are associated with junk food outlet density around elementary schools, while urbanicity is associated with branded marketing and inclusion of unhealthy desserts on children's menus. When comparing London and Rochester, results indicate Canada-US differences exist and that neighbourhood restaurant quality increases with income level in Rochester, while in London, neighbourhood restaurant quality decreases with income level and increases with unemployment and percentage of lone parent families. These results indicate socioeconomically disadvantaged residents with fewer resources have fewer quality options available in Rochester while disadvantaged residents in London have better access to healthier options. The findings presented in this thesis not only contribute to the body of literature on children's FEs, but support the development and implementation of restaurant and neighbourhood interventions focused on the promotion of healthy restaurant choices for children.



## Keywords

Community food environment; consumer food environment; food environment; children's menus; children's health; health geography; food geography; GIS

# Co-Authorship Statement

The integrated articles within this thesis will be submitted for publication in peer-reviewed academic journals. Chapters 4 (Study 1) and 5 (Study 2) were written by Catherine DuBreck, with Dr. Jason Gilliland, Dr. Godwin Arku, and Dr. Richard Sadler as co-authors. Catherine DuBreck is the primary author and performed the analysis, mapping, and writing in each article. Catherine DuBreck performed data collection in London, ON, with the help of research assistants from the Human Environments Analysis Laboratory, and in Rochester, NY, and received help from the Middlesex-London Health Unit for data collection in Middlesex County, ON. Dr. Jason Gilliland, Dr. Godwin Arku, and Dr. Richard Sadler were involved in creating analysis procedures and editing.

**Chapter 4**: DuBreck, C.M., Sadler, R.C., Arku, G., & Gilliland, J.A. (2017). Examining Community and Consumer Food Environments for Children: An Urban-Suburban-Rural Comparison in Southwestern Ontario.

**Chapter 5**: DuBreck, C.M., Sadler, R.C., Arku, G., & Gilliland, J.A. (2017). A Comparative Analysis of the Consumer Food Environment in New York and Ontario: Assessing Children's Menus by Neighbourhood Socioeconomic Characteristics.

# Acknowledgments

**Dr. Jason Gilliland and Dr. Godwin Arku**: Thank you for taking a chance on a Western New Yorker fresh out of undergrad with big urban planning dreams. It was truly a pleasure and an honour to work with you both and I am so grateful for the opportunities I have received. Without your patience and guidance, this thesis would not have been possible.

This thesis would also not have been possible without the graduate research funding provided by the Human Environments Analysis Laboratory through grants from the Children's Health Research Institute, Children's Health Foundation, and the Healthy Kids Community Challenge of Middlesex County and the City of London, and by the University of Western Ontario through the Western Graduate Research Scholarships and teaching assistantships from the Geography Department.

**Dad**: I could not have done this without your continuous love, support, encouragement, friendship, and advice. "The Grand Canyon doesn't care if you're stressed."

**Mom**: My editor-in-chief, thank you for always being available to chat regardless of what time zone difference we find ourselves with.

**To the rest of my family**: Thank you for supporting me in everything I do. Love you all.

**To my HEAL friends**: I would not have survived all of those long days and even longer nights without you. I'm so thankful to have gone through this with you all, together ☺

To Angela Piaskoski, Ellen Lakusiak, Dr. Richard Sadler, each work study student, and everyone else who contributed time and effort to help this thesis move forward: Words cannot express how thankful I am for your help.

And finally, as my TV heroine Leslie Knope once said, "I am big enough to admit that I am often inspired by myself." I walked over 100 miles (160km) in the heart of summer 2016 to collect the children's menus in London, ON. With that, I have to thank my legs for always supporting me, my arms for being by my side, & my fingers – I can always count on them ☺

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# Chapter 1

# 1 Introduction

## 1.1 Research Context

Children in North America have become increasingly overweight and/or obese over the last four decades, and unhealthy in their food choices. In Canada, childhood obesity levels have tripled since 1979, resulting in one in four children currently being overweight or obese (Public Health Agency of Canada, 2012). Additionally, one in five consume more calories from food than needed (Health Canada, 2012a). In the United States, where children are receiving an astonishing 40% of daily caloric intake from high calorie foods such as sugar-sweetened beverages and pizza (Reedy & Krebs-Smith, 2010), one in three children are overweight or obese. Research shows diet plays an influential role in childhood obesity (USDA, 2012), and that healthy dietary behaviours (e.g., eating fruits and vegetables and drinking water) beginning in childhood are positively linked with physical and mental development, academic success, and a lowered risk of health issues and diseases as an adult (Health Canada, 2012b). By the same token, unhealthy eating (e.g., eating fried and processed foods and drinking sugar-sweetened beverages) puts children at a greater risk for health issues that can persist into adulthood, such as heart disease, stroke, cancer, and even early death by up to seven years (Danaei, Vander Hoorn, Lopez, Murray, & Ezzati, 2005; Peeters et al., 2003; Singh, Mulder, Twisk, Van Mechelen, & Chinapaw, 2008; Smith, 2007).

Unhealthy diets consisting of fried and processed foods are diets that are high in fat, sodium, and calories, and low in fibre and other essential nutrients. Sugar-sweetened beverages, including sodas, are the top contributor of sugar in diets today, and 25% of Canadian children consume those types of beverages daily (Heart & Stroke, 2017). Unfortunately, these foods are easily accessible and low in cost, resulting in a two-fold increase in the amount of processed foods purchased over the last 70 years, from 30% to 60% of Canadian family food purchases (Heart & Stroke, 2017). Consuming those foods and beverages is problematic in and of itself, but is especially problematic when

consumed in large portions, often resulting in larger amounts of energy consumption, primarily in older children (Rolls, Engell, & Birch, 2000). This, when coupled with a decrease in physical activity, has been shown to be statistically significant in increased body mass index (BMI) as well as the risk of related health issues. Larger portions for children and dining out are of concern when considering the average American household spent just over USD $3,000 on restaurant meals and takeout in 2015, compared to the average Canadian household which spent CAD $2,500 in 2017, a trend that has been steadily increasing over the last several years (Statistics Canada, 2017; U.S. Bureau of Labor Statistics, 2017). Knowing the average household is likely to dine out, the presence of a children's menu in a restaurant may help to address the influence of portion size.

Dietary behaviours, however, are not solely influenced by the individual child, and have been shown to be impacted by the local food environment (FE) (Gilliland, 2010; Powell & Bao, 2009; Sallis & Glanz, 2006), or the food outlets and options that exist within a given neighbourhood. Research in the United States indicates that children living in more socioeconomically disadvantaged neighbourhoods have a local FE known as a "food desert". This type of environment is characterized by lower access to grocery stores (Block & Kouba, 2006; Moore & Diez Roux, 2006; Powell, Slater, Mirtcheva, Bao, & Chaloupka, 2007; Zenk et al., 2005) where healthier food items (lower in fat, calories, sugar, etc.) are more available and affordable (Block & Kouba, 2006; Bodor, Rose, Farley, Swalm, & Scott, 2007; Glanz, Sallis, Saelens, & Frank, 2007). Children whose neighbourhood FE consists of high costs for produce, thus a lower level of affordability, tend to exhibit a larger increase in BMI compared to children whose neighbourhood FE consists of lower costs (Sturm & Datar, 2005). Research in Canada, however, finds more evidence of "food swamps" (Health Canada, 2013), a FE where people in those disadvantaged neighbourhoods do not have poor access to healthy food outlets, but rather greater access to fast food outlets and convenience stores – outlets where unhealthy foods tend to be more available (Fleischhacker, Evenson, Rodriguez, & Ammerman, 2011).

Given the influence dietary behaviours have on childhood development and health, on-going research has shifted to understanding the influential factors of children's FEs, with the goal being to use findings in the creation and implementation of successful and effective children's FE interventions. The current field of research involving children's FEs has been focused on how the FE impacts children's food consumption patterns and/or obesity levels (Engler-Stringer, Le, Gerrard, & Muhajarine, 2014). While the outcomes of these studies are crucial for tackling the issue of childhood obesity, they focus on the FE at the individual level and require human participants to conduct the research. We know that dietary habits are complex and are influenced not only by individual choices, but also by socioeconomic characteristics and factors of the physical environment (Gilliland et al., 2012; Glanz, Sallis, Saelens, & Frank, 2005; Story, Kaphingst, Robinson-O'Brien, & Glanz, 2008). Despite this, very few studies have focused on assessing the FE to understand what food choices exist with respect to children in a given neighbourhood and how those options may vary geographically.

Thus, this thesis focuses on the assessment of children's FEs from a geographic perspective, specifically to explore and understand the socioeconomic, urban-suburban-rural (in a Canadian context) and Canada-US (in an urban context) variations in quality and content of food outlets and food choices targeted for children in an area. Researchers and scientists from several different fields including urban planning, public health, food and nutritional sciences, and geography want a better understanding of the relationship between children's health and the environment. By investigating the space and place relationship as it pertains to children's FEs, academics, researchers, scientists, policymakers, and other stakeholders will have a greater ability to encourage changes toward healthier FEs. Children's diets are often influenced by the food outlets available to them, and the food outlets available to children are often a result of neighbourhood socioeconomic characteristics and/or location within the area.

The goal of this thesis is to add to existing FE literature while simultaneously providing a better understanding of the geographic variations in children's FEs. Using a mixed-methods approach by combining spatial and statistical analysis with the use of an

observational restaurant children's menu survey tool, this thesis explores the intra-urban FE content and quality as well as how the FE varies by neighbourhood socioeconomic status and designation as urban, suburban, or rural in Canada (London-Middlesex, Ontario) and the United States (Rochester, New York).

## 1.2 Theoretical Framework

An ecological framework is commonly used in scholarly research to understand the complex and multi-level influential factors of the FE and dietary behaviours (Story et al., 2008). Initially created by Urie Bronfenbrenner in the 1970's, this model places an emphasis on the consideration of environmental factors, in addition to individual-level factors, in order to understand human behaviour and health (Bronfenbrenner, 1979). While Bronfenbrenner's original model has been molded to assess a number of different health behaviours, two applications of the model are relevant to this thesis. The first is by Mary Story and colleagues, who describe how an ecological framework can be used to conceptualize the various levels of the FE that influence dietary behaviours (Story et al., 2008). The second is by Karen Glanz and colleagues, who expand on the environmental variable of the ecological model and recognize the different categories of the FE that ultimately influence eating patterns and dietary behaviours (Glanz et al., 2005). Together, these frameworks guide this thesis to an understanding of the many complex factors that contribute to children's FEs and food choice.

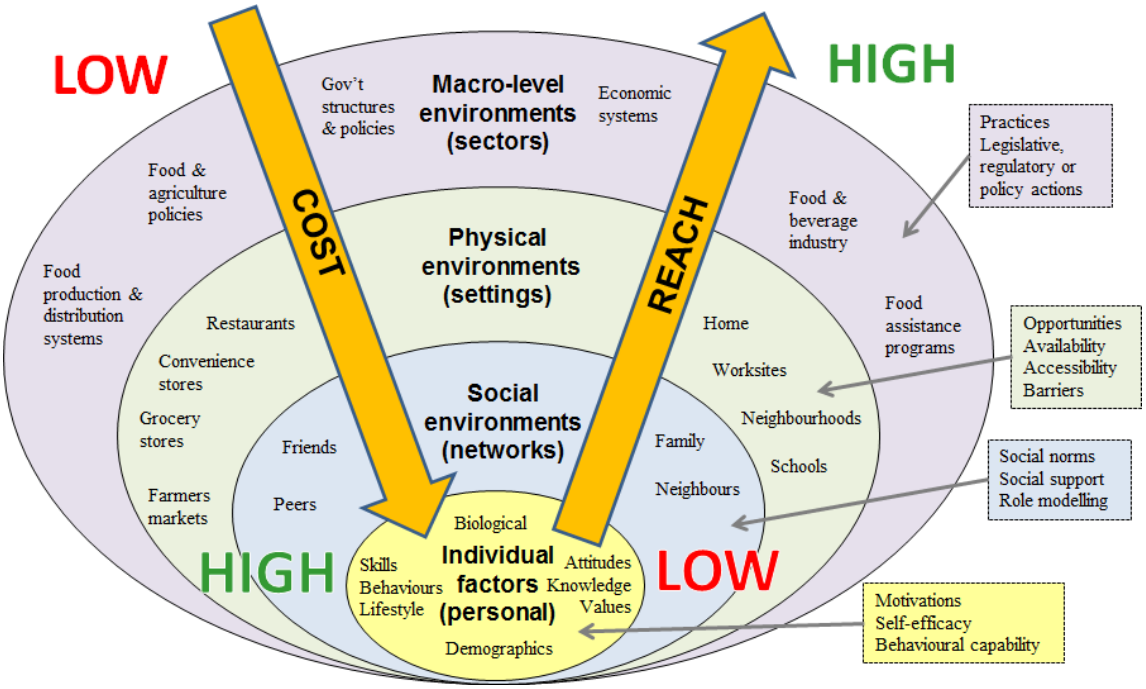


**Figure 1.1** Ecological model of health and food environments – adapted by Gilliland from Story et al., 2008.

Four levels of influence are identified in the ecological framework: individual factors, social environment, physical environment, and macro-level environment (Figure 1.1). Individual factors as they pertain to FEs and dietary behaviours include attitudes and knowledge, biological factors (e.g. sex, age, height, etc.), and demographics (Story et al., 2008). Consider a child ordering a meal from the children's menu in a restaurant; factors pertaining to the individual can impact the food choice the child makes. For example, a previous knowledge of healthy eating may influence the child to order a healthy option. However, the cost (both money and time) of assessing/researching this sphere of influence is high and the reach of the assessment's impact is quite low, depicted by the arrows in Figure 1.1 – requiring the consideration of the additional spheres of influence. The next level of influence is the social environment, which describes how dietary behaviours can be influenced by friends, family, neighbours, peers, and classmates through role modeling or social norms (Story et al., 2008). If a child is at a restaurant with friends that are ordering sugar-sweetened beverages and fried foods, the child may

be influenced by this social norm and order similar food, rather than uphold the individual value of healthy eating.

The third level of influence in the ecological model is encapsulated through the built environment (surroundings in the physical environment built by humans such as buildings or parks) and physical settings; the primary level of focus for this thesis, in order to explore the opportunities (availability and accessibility) that exist for children in the local FE. Physical settings, in terms of FE research, encompass the settings within which one acquires food. According to Glanz *et al.* (2005), the physical setting of the FE can be conceptualized into four different nutrition or food environments: (1) community (e.g., the type, location, and accessibility of food outlets), (2) consumer (e.g., the price, promotion, placement, and availability of healthy options and nutrition information), (3) organizational (e.g., access to food in other settings such as schools), and (4) informational (e.g., marketing, media, advertising) (Figure 1.2). This thesis focuses on the community and consumer FEs within various neighbourhood settings. It places an emphasis on restaurants, but incorporates grocery and convenience stores as well. By investigating the availability and accessibility of healthy food options for children in these two FE settings, the cost is much lower than at the individual level, while the reach of the results is much greater.

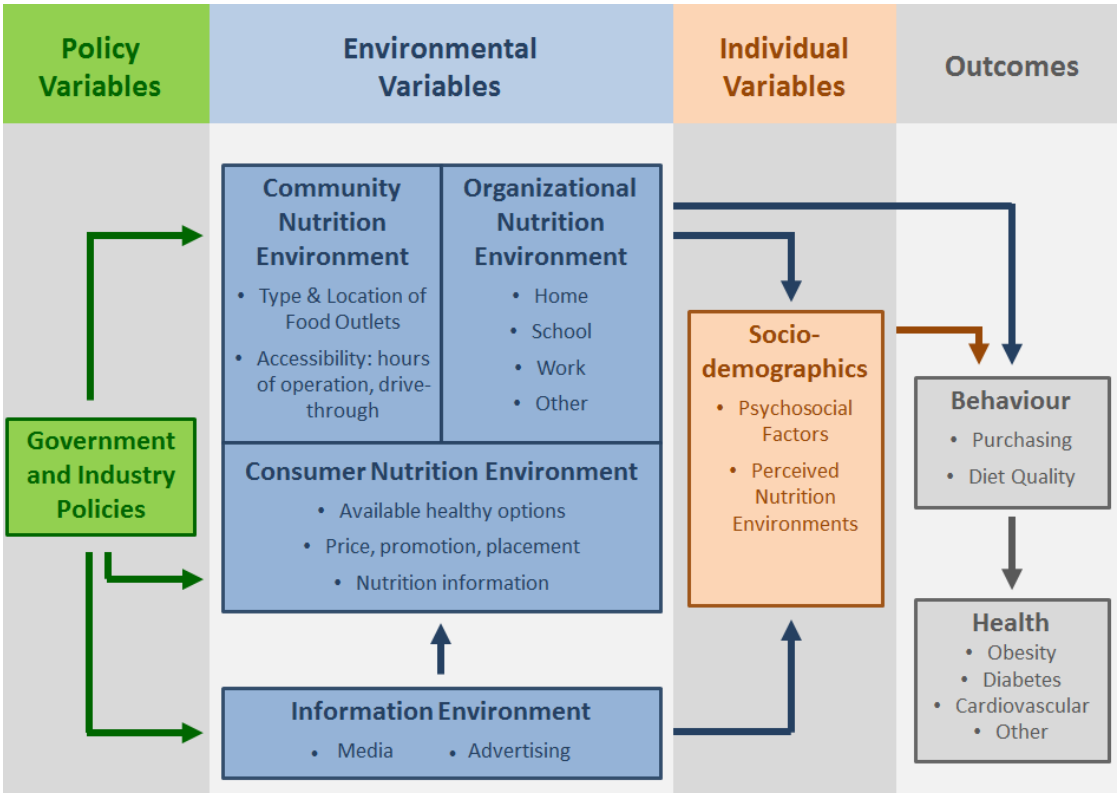


**Figure 1.2** Model of community food environments – adapted from Glanz et al., 2005.

The final sphere of influence relates to macro-level environments. It is at this level researchers observe the relationship between FEs and legislative regulations or policy actions including food production and distribution systems, food and agricultural policies, food and beverage industries, and food assistance programs (Story et al., 2008). This level has the least amount of associated cost and the greatest reach for results.

Ecological models are appropriate for use in FE research because of the various influential factors that can be studied. In this thesis, by assessing what is available for children at the physical environment level through community and consumer FE analysis, researchers and policy-makers will be better able to create and implement interventions targeting all other levels of influence.

## 1.3 Research Purpose

The underlying objective of this thesis as a whole is to contribute to the collective understanding of the relationships between neighbourhood and FE, add to the growing body of literature associating the FE with children's health, and offer results that can impact policy and improve practice. This research will identify what food outlets/items are available to children and analyze the relationship between urbanicity (a term used throughout this thesis to describe neighbourhood form as urban, suburban, or rural) or as Canadian or American, socioeconomic status of the neighbourhood, and healthy food options available to children. Guided by an ecological framework and the model of community nutrition environments, the primary research question that this thesis addresses is: **how do the community and consumer food environments for children vary geographically?** By understanding the spatial relationship between neighbourhood and FE, decision-makers will be better informed and able to introduce interventions targeted toward children's healthy eating.

In addition to the primary research question, this thesis aims to address the following research objectives:

1. Determine how junk food outlet density in a school zone varies by neighbourhood level of socioeconomic distress and level of urbanicity in the City of London and Middlesex County, Ontario, Canada.

2. Determine how the likelihood of neighbourhood restaurants offering children's menus varies by neighbourhood level of socioeconomic distress and level of urbanicity in the City of London and Middlesex County, Ontario, Canada.

3. Determine how the quality of restaurant children's menus varies by level of socioeconomic distress in a neighbourhood and urbanicity in the City of London and Middlesex County, Ontario, Canada.

4. Determine whether the restaurant consumer food environment for children differs between the cities of London, Ontario in Canada and Rochester, New York in the United States.

5. Determine the relationship between neighbourhood restaurant quality for children and socioeconomic characteristics within the city of London, Ontario and within the city of Rochester, New York.

To address these objectives, this research delves deeper into the community and consumer FEs for children in London and Middlesex County, Ontario, and the consumer FE for children in Rochester, New York. Dietary behaviours are complex in nature and influenced by several factors at the individual, social, physical environment, and policy levels. Though this thesis primarily focuses on the physical environment sphere of influence, it is expected that exploring this level of the FE will provide data which will inform decisions about intervention implementation and healthy eating program development. By assessing the FEs in three different areas, this thesis will provide insight into how the FE varies at the urban, suburban, and rural levels, and will allow decision-makers to create best practices for food choice interventions in both Canadian and American cities. The research and results addressed within this thesis will also be valuable to those who reside within London-Middlesex ON, and Rochester, NY as they will gain a greater understanding of what is available not only within their neighbourhood, but within the context of the greater area and how that compares to each of the areas included within the studies.

## 1.4 Thesis Format

This thesis follows an integrated article format and includes two separate but related studies. Each of the two studies aims to understand the role neighbourhood form and socioeconomic status have on the community and consumer FEs for children using a combination of spatial (GIS) and statistical analysis with the Children's Menu Assessment tool. Each study also has the same overarching objective of examining the geographic variations in community and consumer FEs for children. However, one study

looks at both the community and consumer FEs in London-Middlesex, ON, while the other focuses on geographic variation in the restaurant consumer FE within and between the two cities of London, ON, and Rochester, NY. Through these studies, this thesis aims to give a greater understanding of the community and consumer FEs for children, and how they vary spatially based on neighbourhood form (urban-suburban-rural, and Canadian-American) and socioeconomic status. The thesis outline is as follows:

**Chapter 2** reviews the existing literature on community and consumer food environments as it relates to children to identify gaps and methodological limitations, and justify the need for further research.

**Chapter 3** discusses the three study areas, and the methodology for data collection and analysis.

**Chapter 4** examines the community and consumer food environments for children in the City of London and Middlesex County, Ontario through urban-suburban-rural comparisons.

**Chapter 5** investigates the international variation in restaurant consumer food environments for children through children's menu audits within and between two North American cities: one Canadian (London, ON) and one American (Rochester, NY).

**Chapter 6** summarizes and relates the findings from the integrated articles. Additionally, the chapter discusses policy implications, research limitations, and offers suggestions for future research.

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# Chapter 2

## 2 Literature Review

Childhood obesity is on the rise in North America, especially in Canada and the United States, and poor dietary behaviours are a leading cause. Food choices, however, are not just the result of individual actions made in a vacuum. They are heavily influenced by the surrounding food environment (FE), a by-product of an area's level of urbanization and socioeconomic status among other factors. The purpose of this chapter is to examine the literature on community and consumer FEs, with a particular emphasis on children. This chapter reviews the current body of scholarly studies, highlighting major methodologies used while also drawing attention to existing gaps within the literature, thus justifying the need for further research. By reviewing previous research, we will collectively gain a greater understanding of how the relationship between community and consumer FEs and urbanicity and socioeconomic characteristics have been measured in the past and how they need to be measured moving forward, especially with respect to children.

The chapter is divided into five main sections. Section 2.1 reviews the relevant literature on community FEs, specifically those studies on proximity and density, and addresses some of the gaps within this body of literature. Section 2.2 examines the literature on restaurant consumer FEs, with a particular emphasis on children's menu research and the gaps that exist within those studies. Section 2.3 delves deeper into the research on disparities in the FE, reviewing studies on differences in urbanicity and socioeconomic characteristics. Section 2.4 reviews the FE research in the London-Middlesex region of Ontario. There is no section on FE research in Rochester, NY because community and consumer FEs, especially for children, have not, to my knowledge, been previously researched in this area. Finally, Section 2.5 reviews the gaps in the literature that this thesis fills and provides a brief conclusion.

## 2.1 Community Food Environment

As identified in Chapter 1, the community food environment (FE) consists of the type and location of food outlets (e.g., restaurants, stores, etc.), as well as their accessibility (i.e. hours of operation, presence of a drive-through in restaurants, etc.) (Glanz et al., 2005). Previous studies that have assessed this type of FE tend to use GIS-based spatial measures to identify the location of the food outlets in the study area, and assess accessibility through proximity, density, or diversity analysis (Black, Moon, & Baird, 2014; Charreire et al., 2010; McKinnon, Reedy, Morrissette, Lytle, & Yaroch, 2009). Most studies regarding the community FE analyze general populations; however, there is a growing body of literature focusing on children. These studies usually employ proximity or density analyses within a certain distance around schools or homes to assess the community FE for children. Thus, this section focuses primarily on proximity and density analyses of the community FE for children.

### 2.1.1 Proximity

Assessing the community FE by proximity requires calculating the distance along a road network to each food outlet. Distance can be measured in metres or kilometres, or in travel times usually from a child's home or school.

In Fleischhacker and colleagues' review on fast food access, one-third of included studies considered access with respect to child populations and found schools to be in very close proximity to fast food restaurants (Fleischhacker et al., 2011). This review also found schools to also be in close proximity to convenience stores, another outlet typically characterized as unhealthy (Fleischhacker et al., 2011).

Studies in the United States produced mixed results when examining proximity to nearest food outlet as it pertains to children. Burdette and Whitaker (2004) found distance to the nearest fast food restaurant was not associated with childhood obesity, while Crawford *et al.* (2008) found that as distance to the nearest fast food outlet decreased, childhood BMI actually decreased. Another study found proximity to the nearest food store was positively associated with fruit and juice consumption, while proximity to the nearest fast

food restaurant was negatively associated (Jago, Baranowski, Baranowski, Cullen, & Thompson, 2007). Lamichhane *et al.* (2012) found children living further away from the three nearest supermarkets had decreased intakes of fruit, vegetables, and low-fat dairy. Similarly, this study found children living further away from the three nearest fast food outlets had decreased intakes of meat and sweets, and increased intakes of low fat dairy. Laska *et al.* (2010) found as distance to the nearest restaurant or grocery store increased, consumption of sugar-sweetened beverages decreased.

Proximity has also been investigated in a Canadian context. In Saskatchewan, Engler-Stringer, Shah, Bell, & Muhajarine (2014) calculated proximity from schools to food outlets and found unhealthy food outlets were located shorter distances from schools in low income neighbourhoods in Saskatoon. In Ontario, Larsen *et al.* (2015) found children whose home address had a shorter distance to a supermarket had decreased rates of obesity in Toronto. Similarly in Ontario, He and colleagues found as distance to the nearest convenience store increased, diet quality increased while as distance to the nearest fast food outlet or convenience store decreased, unhealthy food purchasing increased in London (He et al., 2012a; He et al., 2012b).

Many of the proximity studies regarding the community FE for children compare distance to the nearest food outlet with some sort of individual measure such as obesity, BMI, consumption levels, or purchasing rates. This thesis expands on these studies by measuring distance from elementary schools in a Canadian setting to the nearest food outlet and assesses the variations in urbanicity and socioeconomic characteristics that exist.

### 2.1.2 Density

Assessing the community FE by density requires calculating the availability of different food outlet types within a specific area. Defined areas employed in these studies include census units (block group, tract, dissemination area, etc.) or buffers around the census unit centroid, home addresses, postal or zip code, school locations, and more.

In the United States, it is common to investigate the community FE for children through density analysis. Zenk and Powell (2008) found one-third of public secondary schools across the nation had at least one unhealthy food outlet (fast food restaurant or convenience store) within 805m of the school. Sturm (2008) found public high schools have more convenience stores, restaurants, snack stores, or off-license outlets such as liquor stores within 400m and 800m buffer distances when compared to middle schools. Both of these studies found disparities in income and race/ethnicity, but were limited by the use of only circular buffers rather than network buffers. When created, circular buffers are just a circle with a particular diameter around a point; for example, an 800m circular buffer around a school location is merely a circle around the school with a diameter of 800m. This type of buffer is more likely to ignore barriers to walking (e.g. rivers and/or railroads that are difficult to cross), and thus erroneously includes additional areas (Oliver, Schuurman, & Hall, 2007). Network buffers follow the road network, thus more accurately depicting the area that influences walking.

Kipke *et al.* (2007) calculated 300m and 500m buffers around public schools in Los Angeles, California and found nearly half of all food outlets were within 500m of a school, while the majority of these food outlets were unhealthy (fast food, bakeries, donut and cookie shops, ice cream shops, or convenience stores). Though the study used varying buffer distances, the use of 300m seems very narrow in scope and may not accurately reflect the distance that children actually walk around school to obtain food.

Research is growing in a Canadian context as well. At the national level, Seliske *et al.* (2013) found children whose schools had a larger number of food outlets within a 1 kilometre buffer (both circle and network) were more likely to eat lunch at these outlets. Pabayo *et al.* (2012) found children were statistically less likely to consume soda when a grocery store was located within 1km of their home. In Ontario, researchers found a statistically significant relationship between density of fast food outlets and purchasing patterns in that children purchased more fast food when their home or school had a higher density of fast food outlets within a 1km buffer, and also found children had poorer diet quality when their school had three or more fast food outlets within a 1km buffer (He et

al., 2012a; He et al., 2012b). Le, Engler-Stringer, and Muhajarine (2016) found within 800m circular and network buffers from a child's home, 76% of almost 1500 children included in the study did not have a grocery store, and 58% had access to at least one convenience store.

Many of the density studies conducted in the past regarding children examine how density of food outlets compares to childhood obesity-related factors. Additionally, many of these studies use very small buffer distances, use only circular buffers, or do not assess variations in buffer sizes. This thesis expands on these studies by measuring density of junk food outlets (defined as grocery stores, convenience stores, fast food restaurants, and full service restaurants) within 800m and 1600m network buffers around elementary schools in a Canadian setting to assess the variations in urbanicity and socioeconomic characteristics that exist.

### 2.1.3 Community Food Environment Gaps Addressed

Literature on community FEs is rapidly growing; however, the majority of research in this field does not consider child populations. Though the studies reviewed above do focus on children, there is still much to be learned about community FEs for children, especially in a Canadian context. Much of this research analyzes the relationship between the community FE and children's individual-level factors such as BMI, weight, or fruit and vegetable consumption. By focusing on the individual level, the cost of research is greater while the reach is much too narrow (refer back to Figure 1.1).

This thesis assesses geographic variations, rather than individual impacts, in community FEs in a Canadian setting, by examining what disparities exist in the FE around elementary schools. By using schools, this thesis is better able to assess the community FE for children, since children spend a majority of their time at school and within the surrounding school neighbourhood. Similarly, the focus of this thesis' community FE study is on elementary schools, exploring the type and location of food outlets within 800m and 1600m of each elementary school, rather than middle or high schools as previous research has done. Exploring what is available *within* the elementary schools is,

however, outside the scope of the community FE and is therefore not examined in this thesis. Elementary schools are an appropriate study area as the age of the student body is typically the same age as that which restaurant children's menus are targeting.

There are also inconsistencies with how proximity or density is measured, and how food outlets are considered. Several studies measure buffer distances from schools as circular buffers. This method is not the most accurate, as circular buffers may include barriers to walking such as railroad tracks or rivers that are not easily crossable (Oliver et al., 2007). By utilizing road network buffers, especially at varying distances, this thesis is better able to more accurately measure the community FE.

Most of the community FE studies regarding children designate grocery stores and supermarkets as "healthy" where produce is readily available, whereas convenience stores and fast-food outlets are considered "unhealthy". This definition, however, neglects to consider the fact that grocery stores, though typically characterized as healthy, still sell sugar-sweetened beverages, unhealthy snacks (e.g., potato chips, chocolate, and other candy), highly-processed foods and meals to-go, and/or have tables and seating where one can sit and dine, ultimately making them on par with a fast food restaurant. Similarly, by only assessing fast food and convenience stores as unhealthy, studies exclude the fact that full service restaurants generally offer the same items as their fast food counterparts and in some cases offer items that are unhealthier than that found in a fast food restaurant. Thus, this thesis includes grocery stores, convenience stores, fast food restaurants, and full service restaurants all as unhealthy or junk food outlets.

## 2.2 Consumer Food Environment

While the community food environment (FE) is characterized as the different types and locations of food outlets and the accessibility of each, the consumer FE is the FE that exists *within* those outlets. It incorporates the availability of healthy options, the presence of nutrition information, and the different prices, promotions, and placements of healthy and unhealthy choices within the given food outlet. We know food outlets include places such as grocery stores, supermarkets, convenience stores, bodegas,

farmer's markets, specialty food stores such as ice cream shops or cafés, food banks, snack bars, and so forth. These can be assessed through a variety of instruments including checklists, interviews/questionnaires, market baskets, and inventories (Gustafson, Hankins, & Jilcott, 2012; Lytle & Sokol, 2017; McKinnon et al., 2009). However, this thesis focuses on the restaurant consumer FE using menu audits.

### 2.2.1 Restaurant Menu Research (NEMS-R)

Since its development in 2007, the validated Nutrition Environment Measures Survey (NEMS) has been one of the most widely used methods of assessing the consumer FE. Because of the various aspects of the consumer FE (grocery stores, corner stores, convenience stores, restaurants, etc.), each aspect has its own corresponding NEMS tool. The NEMS-R assesses availability of healthy options on restaurant menus (Saelens, Glanz, Sallis, & Frank, 2007), the NEMS-S assesses the availability and pricing differences in healthy and unhealthy grocery store items (Glanz et al., 2007), the NEMS-CS assesses the healthfulness of items commonly found in corner stores (Cavanaugh, Mallya, Brensinger, Tierney, & Glanz, 2013), the NEMS-V assesses the availability of healthy options in vending machines (Voss, Klein, Glanz, & Clawson, 2012), and the recently developed NEMS-GG assesses food outlets that sell grab and go foods on university campuses (Lo, Minaker, Chan, Hrgetic, & Mah, 2016). For the remainder of this thesis, the focus of analysis will be on the restaurant consumer FE.

The NEMS-R was created as a response to the increase in Americans dining out and consuming more calories away from home, so researchers could better assess and understand the factors within a restaurant that influence food choice, such as healthy main dish choices, availability of fruits and vegetables, availability of whole grains and baked chips, beverages, children's menus, promotional material, pricing, and accessibility (Saelens et al., 2007). Since its creation, the tool has been applied in several different case studies in the United States. Pereira *et al*. (2014) used the tool in Minnesota to assess the consumer FE of rural New Ulm with obesity rates and fruit and vegetable consumption. Neckerman *et al.* (2014) employed the NEMS-R in New York City to compare the consumer FEs of restaurants and bodegas, as well as examine the

relationship between total score and neighbourhood poverty level. Partington *et al.* (2015) used the NEMS-R in Seattle, San Diego, and West Virginia in order to create a reduced-item version of the audit tool.

Though it was developed in the United States, the NEMS-R has also been used in various geographic settings outside the continental US. Lee-Kwan *et al.* (2015) applied the NEMS-R to assess availability of healthy food in restaurants in American Samoa. While the tool was modified to reflect more common foods typically found on the island territory, the findings were consistent with previous studies – that restaurants offered very minimal healthy options. Duran *et al.* (2013) employed a modified version of the NEMS-R in Brazil to assess the relationship between healthy food accessibility and neighbourhood socioeconomic status.

The NEMS-R has also been applied in a Canadian context. Hobin *et al.* (2014) used the NEMS-R in Ontario to descriptively assess the availability, location, and format of nutrition information in fast food chains. Minaker *et al.* (2013) applied the NEMS-R in the Regional Municipality of Waterloo and assessed whether or not perceptions, such as perceived access, availability, or quality, assist in associations between objective FEs, such as the restaurant consumer FE, and diet-related outcomes, like BMI and waist circumference. Wang, Engler-Stringer, and Muhajarine (2016) used the NEMS-R in Saskatoon, Saskatchewan to investigate the relationship between restaurant consumer FE and level of neighbourhood socioeconomic distress.

While these studies add to our collective understanding of the restaurant consumer FE, more research is needed regarding the restaurant consumer FE and children. The NEMS-R has a very clear subsection regarding children's menus, yet almost none of the studies using the NEMS-R discuss the results pertaining to that section. Saelens and colleagues investigated nutrition-labelling regulation impacts in restaurants in the Portland and Seattle areas by using the NEMS-R and while they did note the impact on children's menus, it was brief in comparison to the impacts on the general menu (Saelens et al., 2012).

Holsten and Compher (2012) apply the NEMS-R to a children's FE study, but rather than assess for children's menu content, they instead examine the relationship between NEMS-R overall menu score with children's BMI. Similarly, Le *et al.* (2016) use the NEMS-R to measure availability, quality, and price of healthy food items, and examine whether the proximity to or density of restaurants, among other stores, was associated with children's weight in a Canadian context. These studies are very narrow in scope as they focus on the smallest-reaching level of the ecological model of health – examining the restaurant consumer FE with respect to the *individual*, rather than examining it at the neighbourhood or *environmental* level. Of all the NEMS-R studies mentioned in Section 2.2.1, only three employ the tool in a way that examines geographic variations in restaurant consumer FEs with respect to neighbourhood characteristics.

Other tools are being developed to assess menus, such as the Fast-Food Observation Form which, like the NEMS-R, does include a children's menu section but the children's menu is again not the primary focus of the tool (Rimkus et al., 2015).

### 2.2.2 Children's Menu Research

High sugar, high fat diets are on the rise, and varying levels of government have funded efforts aimed at reducing childhood obesity through promoting healthier eating. These efforts tend to prioritize increasing access to grocery stores while oftentimes placing a lower priority on, or even neglecting altogether, the inclusion of working with the restaurant industry to ensure children's menus offer healthy items as well (White House Task Force, 2010). This lack of focus directed toward children's menus is worthy of research given that over 40% of all food spending in the US is on food away from home (e.g., in restaurants), and 34.3% of US children consume calorie-dense foods every day (Vikraman, Fryar, & Ogden, 2015). Additionally, though falling under more of the information environment aspect of the model of community nutrition environments (refer back to Figure 1.2), advertising – included branded marketing on menus – has placed a large emphasis on targeting children. In Canada, children see over 25 million advertisements for food and beverages online per year, and in the average two hours of television the average child watches per day, he or she is exposed to up to five food and

beverages commercials (Heart & Stroke, 2017). Children see these commercials and items with familiar characters on the outside, may be drawn to these items that they now have had previous exposure to, and may now be more inclined to purchase the items (or have a family member purchase them).

Studies that do assess children's menus in particular may involve purchasing all items on the menu, weighing them, and subsequently analyzing that information (Serrano & Jedda, 2009). Similarly, several studies assessing children's menus focus solely on the nutrition information available. Sliwa *et al.* (2016) analyzed total calorie, percent calories from fat and saturated fat, and total sodium content available online for children's meal combinations from leading restaurant chains to assess the availability of healthier children's meals. Moran *et al.* (2017) examined the changes in mean calories, saturated fat, and sodium in children's menu items based on nutrient data for 45 US chain restaurants. Deierlein, Peat, and Claudio (2015) compared the change in nutrient content of US chain children's menu items between 2010 and 2014.

Anzman-Frasca *et al*. (2014) studied whether or not children's perception of restaurants and menus aligned with actual children's menu choices through a coding comparison of child completed surveys and menus. This study did not use any type of menu assessment tool or protocol and while it did focus on children's menus, it had a study population of ages 8-18 which is typically not the target population for children's menus. Commonly, the older one gets, the less likely one is to order from the children's menu as children's menus are generally labelled ages 12 and under. Additionally, research and intervention studies have been done in order to help create healthier children's menus for restaurants, but do not involve assessing or auditing the existing menus with a reliable tool beforehand (Economos et al., 2009).

Though all of these children's menu studies can be taken into consideration when creating or implementing neighbourhood restaurant interventions, none of these studies investigate the relationship between menu quality/content and neighbourhood environment. By focusing solely on chain restaurants, the influencing factors of urbanicity and socioeconomic characteristics are lost and the local "mom-and-pop"

restaurants which may be frequented are excluded. In an effort to fill this gap in children's restaurant FE research, Krukowski and colleagues created the Children's Menu Assessment (CMA) tool (Appendices A-B) which has subsequently allowed children's menu research to grow (Krukowski, Eddings, & Smith West, 2011).

#### 2.2.2.1 Children's Menu Assessment

The CMA, an expansion of the children's menu subsection of the NEMS-R, is a survey assessment tool used to evaluate at the restaurant consumer food environment for children. The tool's questions are grouped into eight categories: (1) healthfulness of entrées, (2) proportion of whole to white grains, (3) desserts (e.g., whether the price of a meal includes an unhealthy dessert), (4) beverages (e.g., availability of 100% juice or low-fat milk), (5) sides (e.g., availability of non-fried vegetables or fruits with no added sugar), (6) nutritional information, (7) toy promotions, and (8) branded marketing (Krukowski et al., 2011; Saelens et al., 2012). Of the 29 questions on the CMA, 21 are scored, providing more information on item availability, particularly with "healthy" items. The tool places the burden of proof on the restaurant, rather than the researcher, regarding whether or not an item is healthy. Menu scores can range from -5 to 21, where higher scores correspond to a greater number of healthy options.

To date, the CMA has typically been used in American studies, primarily revealing a low number of healthy options available on area children's menus (Hill et al., 2015; Krukowski et al., 2011). An application of the CMA in Santa Clara County, California assisted with the evaluation of restaurant compliance to a new toy ordinance prohibiting toys and other child-friendly incentives from being distributed alongside restaurant items that did not meet the study's given nutrition guidelines; by employing the CMA before and after the implementation of the ordinance, the research team was able to see how many restaurants did or did not comply, and whether or not those children's menus changed to offer healthier options as time progressed (Otten et al., 2012). The CMA was used in a similar fashion in San Francisco, California, after the implementation of another toy ordinance (Diedrich & Otten, 2015).

The CMA has also been used as part of restaurant interventions. Crixell and team used the CMA in San Marcos, Texas to assess how healthy or unhealthy menus were before collaborating with restaurant management for improvement (Crixell, Friedman, Fisher, & Biediger-Friedman, 2014). Similarly, Ayala *et al.* (2016) applied the CMA in pre-post fashion in San Diego, California to assess changes in area children's menus before, during, and after a restaurant intervention took place. The CMA has also been used to assess whether healthier entrées on restaurant children's menus in the 200 top-grossing US restaurant chains were more expensive than less healthy entrées (Krukowski & West, 2013).

Edwards (2010) applied an adapted NEMS tool to assess the availability of healthy entrées on children's menus in Washington State. This was a descriptive study that found most restaurants in the study area offered unhealthy children's menus. Though not explicitly stated as such, this study is similar to the studies that employ the CMA.

#### 2.2.2.2 Children's Menu Assessment Gaps

While the introduction of the CMA as an instrument with which to measure the restaurant FE has aided in advancing our understanding of the consumer FE as it directly pertains to children, its use has been primarily descriptive in nature and falls short of taking the analysis further into how the children's FE varies based on neighbourhood level of urbanicity or socioeconomic characteristics. The closest application of the CMA in this sense is in the 2015 study of the Dan River Region of Virginia and North Carolina in which the researchers found children's menu scores to be the lowest (poorest quality menus) in primarily African-American block groups (Hill et al., 2015). These menu scores were also significantly different from menu scores found in primarily Caucasian and mixed race block groups (Hill et al., 2015). Not only did this study analyze some aspect of socioeconomic variation, but it also examined the variation among urban and rural areas. Hill and colleagues did not find CMA total scores to differ significantly between urban and rural areas, but did find menus in urban areas to have more healthy entrées available while menus in rural areas had more whole grain options (Hill et al., 2015).

Internationally, the CMA has been used in Ireland to assess quality of food and availability of healthy options (McGuffin et al., 2013). This, however, has been the only application of the CMA in a country other than the United States and is, like the majority of other CMA studies, merely describing the menu content in the study area rather than conducting any real analysis. While the examination of the quality and content of children's menus in any study area is worthwhile for both researchers and decision-makers, to merely describe the different menu choices within the study area is not enough. This thesis therefore uses previous applications of the CMA as the basis to take restaurant consumer FE research for children one step further. The studies within this thesis address the content and quality of children's menus within the study areas, but delve deeper into the geographic variations of those menu choices to explore whether restaurant children's menus are influenced by environmental variables such as level of neighbourhood urbanicity and socioeconomic status.

Previous applications of the CMA have been in the southern and western regions of the United States. This thesis will be one of, if not *the* first to not only employ the CMA in a Canadian context, but assess the menu variation across urban, suburban, and rural areas within the study site. Despite the similarities between the United States and Canada, the FE in Canada is quite different from that in the United States (Minaker et al., 2016), so it is crucial to recognize this with respect to children and restaurants. It will also be the first time the CMA has been used in the northeast region of the United States, specifically in Rochester, New York. Additionally, this thesis will be one of the first to not only analyze and compare the geographic variations in children's menus within two study sites, but analyze and compare the menu variation across an international border.

Children's menu audits in one urban area do not reflect the state of children's menus nationally or internationally. With the global rise in childhood obesity rates and related health issues, coupled with the rise in meals consumed away from home, it is becoming increasingly important to analyze not just restaurants in general, but restaurants as they are targeted to children. By building off previous applications of the CMA and by expanding the study area not only to another country beyond the United States, but to

varying levels of urbanicity beyond the typical urban centre, and to various socioeconomic characteristics beyond race/ethnicity, this thesis fills multiple gaps in the body of literature specific to children's restaurant consumer FEs, as well as research on FEs in general.

## 2.3 Disparities in the Food Environment

Many disparities exist within the food environment (FE). This section reviews those disparities most relevant to this thesis, including socioeconomic characteristics as well as level of neighbourhood urbanicity (urban-suburban-rural differences) and comparison of Canada-US differences.

### 2.3.1 Urbanicity

In their review on measures of the consumer FE, Gustafson *et al.* (2012) included 56 total studies: 39 in urban areas, 13 in rural areas, while only four were conducted in both urban and rural settings. Of those four, three were in Scotland, and one was in the United States. This shines a light to a serious gap in the literature: that many studies are assessing the consumer FE within an urban area or within a rural area, but very few are comparing it between urban and rural areas, and even fewer are considering the differences between urban, rural, and suburban areas. Most of the studies included in this review were conducted in the United States. However, the FE in the United States is vastly different than in other countries. This in itself is a gap as well, one that this thesis addresses by examining Canadian and American FEs and comparing the two.

In their systematic review of fast food access studies, Fleischhacker *et al.* (2011) examined 40 articles. Of these articles, 24 were in urban areas, one was in a rural area, and 11 studies compared urban-rural settings. The remaining studies did not indicate study area. The review found that if urban-rural areas were compared, the urban areas tended to be more exposed to fast food (Fleischhacker et al., 2011). While the comparison of urban and rural settings in FE studies is promising, none of these studies compared urban-suburban-rural. This is a clear gap, as neighbourhoods are not strictly urban or rural; thus it is important to consider the variations in suburban environments as

well. This review found only one study that compared a study area in the United States to one in another country, Canada, but this study was extremely narrow in scope and examined environments within children's hospitals. Fleischhacker and colleagues recommended additional research to investigate geographical differences (Fleischhacker et al., 2011), a gap in the literature that this thesis directly addresses.

A 1999 study of grocery and convenience stores in the Twin Cities region of Minnesota found chain stores were more likely to locate in suburban areas rather than inner-city urban areas, the prices were cheaper in the suburban setting, and a greater array of items was offered in the suburban areas (Chung & Myers, 1999). While this study accounted for differences in urban and suburban settings, it neglected the rural component. Powell *et al.* (2007) found similar results in a national study in the United States, noting chain grocery stores were more likely to locate in urban than rural areas, and even more-so in suburban areas. While these studies work towards contributing knowledge regarding how suburban FEs compare to the urban and rural counterparts, they are limited by their US setting and the fact that they assess the grocery store environment. To address the restaurant FE, a recent study by Martinez-Donate *et al.* (2016) compared restaurant differences among these three (urban-suburban-rural) neighbourhood forms and found urban neighbourhoods had a higher restaurant density and urban and suburban neighbourhoods had healthier restaurants compared to rural areas.

On a similar note, Black *et al.* (2014) conducted a review on published FE reviews and found four out of 10 included review papers were on studies only in the United States; while almost 70% of studies included in the remaining six were from the United States as well. Additionally, 11% of that same group of studies were from Canada; however, none of the included studies compared FEs between the two countries, or between any countries for that matter.

In their 2008 article on creating healthy FEs, Story and colleagues recommended further research is necessary in order to ensure healthy food is available and affordable to people "in all types of geographic locations (e.g., urban, suburban, rural)" (Story et al., 2008, p 266). It is important to consider all settings, not just urban and rural, as there may be

significant relationships between the FE and the suburban setting. It is also important to consider the fact that FEs in one country are not the same in another country. Minaker *et al.* (2016) highlight this in their recent scoping review of FE literature in Canada by affirming that the FEs found in Canadian settings cannot be equated to FEs found in the United States. Similarly, the Minaker review also highlights a lack of consideration on rural FEs in Canada as the majority of Canadian studies are conducted in large urban centres. They explicitly recommend future Canadian FE studies to consider the rural component of FEs.

This thesis recognizes this geographic gap in the literature, that spatial disparities do exist when investigating the FE, and addresses not only the urban-suburban-rural differences in FEs for children, but the international differences that may exist as well by examining the FEs for children in one Canadian city and one American city and comparing the two.

### 2.3.2 Socioeconomic Characteristics

Fleischhacker *et al.* (2011) also noted the socioeconomic differences in fast food access, specifically in the United States, reporting that most of the studies regarding socioeconomic characteristics resulted in more fast food restaurants locating in low income areas rather than higher income areas. The review indicated high minority neighbourhoods were more often found to have greater access to and composition of these unhealthy food outlets when compared to Caucasian/white neighbourhoods (Fleischhacker et al., 2011). Interestingly, this review points out that income dominates the literature as the socioeconomic measure in American studies, but many non-US studies tend to use a socioeconomic deprivation score or index compiled of several socioeconomic variables rather than just one (Fleischhacker et al., 2011). This thesis explores both approaches by examining the FE for children with respect to neighbourhood socioeconomic distress (a combination of low educational attainment, unemployment, lone parent families, and low income measure – described more in depth in Chapters 3 and 4), as well as through individual variables of the social environment (including median household income, unemployment, percentage of visible minorities, percentage of lone parent families, and population density – described in Chapter 5).

Research in the United States suggests low income, high minority, high distress areas have worse access to healthy foods, indicating a food desert. These studies tend to be more concerned with grocery store access, as grocery stores/supermarkets are typically considered as healthy food outlets. In Erie County, New York, Raja, Ma, and Yadav (2008) found a lack of supermarkets in minority neighbourhoods when compared to predominantly Caucasian/white neighbourhoods. Morland *et al.* (2002) found more supermarkets in higher income or Caucasian/white neighbourhoods than in lower income or minority neighbourhoods. In their review of the consumer FE, Gustafson *et al.* (2012) found six studies that examined socioeconomic influence out of 56 total, reporting healthy food was less available in low income or high minority neighbourhoods than in high income or low minority neighbourhoods. All six of these studies were conducted in the United States, consistent with the American FE literature. The review also found food quality to be worse and food pricing to be higher in low income or high minority neighbourhoods in the US (Gustafson et al., 2012). In Detroit, supermarkets were consistently located further away from residents' homes in low income areas when compared to higher income areas (Zenk et al., 2005).

Though FE research is a relatively new field in Canada, existing research tends to suggest low income, high distress areas have better access to unhealthy foods, indicating a food swamp rather than a food desert – the FE commonly found in the United States. In their scoping review of FEs in Canada, Minaker *et al.* (2016) noted that the majority of Canadian food desert papers actually found more socioeconomically disadvantaged areas had the same or better access to healthy foods when compared to less disadvantaged areas. On the other hand, almost all of the papers included which investigated Canadian food swamps found more socioeconomically disadvantaged areas had greater access to unhealthy foods when compared to less disadvantaged areas.

Black *et al.* (2014) found similar results in their review of previous FE reviews. Low income or high minority neighbourhoods in the United States were found to have worse access to healthy foods when compared to high income or low minority neighbourhoods (Black et al., 2014). Alternatively, in other countries including Canada, low income or

high minority neighbourhoods were found to have better access to unhealthy foods when compared to high income or low minority neighbourhoods (Black et al., 2014).

Most of the studies that examine variations in the FE by socioeconomic characteristics focus on the grocery store setting. Studies that examine the FE in the restaurant setting tend to examine restaurant density or proximity by socioeconomic status and do not examine the socioeconomic disparities that may exist for menu content and quality. Similarly, the primary focus of these studies is not on children. This thesis recognizes this gap in the literature, that socioeconomic disparities do exist when investigating the FE for children, and addresses not only how the social environment influences FEs, but the international differences that may exist as well.

## 2.4 Food Environment Research in London-Middlesex, ON

Food environment (FE) research is not new to the London-Middlesex region. Previous London-Middlesex FE studies have investigated topics including supermarket accessibility (Larsen and Gilliland, 2008), how the introduction of a farmer's market impacts price and availability of healthy food (Larsen and Gilliland, 2009), and measuring accessibility to food retailers (Sadler, Gilliland, and Arku, 2011). Although each of these studies assesses some aspect of either the community or consumer FE, the primary focus is on grocery stores rather than restaurants.

London-Middlesex has also been the study area of research on FEs as they pertain to children. Much of this research has been quantitative in nature and has included analyzing the influence FEs have on adolescent food purchasing (He et al., 2012a; Sadler, Clark, Wilk, O'Connor, & Gilliland, 2016), analyzing how restaurants and convenience stores impact adolescent food consumption (He et al., 2012b), assessing children's fruit and vegetable consumption in socioeconomically disadvantaged neighbourhoods (Glen et al., 2013), comparing children's GPS tracks with non-objective geospatial measures of junk food exposure (Sadler and Gilliland, 2015), and characterizing the FE for children by examining differences in BMI and diet preference (Rangel, 2013). This previous research has shown exposure to (e.g. walking or biking past an outlet, or riding in the car

with a parent and driving past the outlet) and density of junk food outlets in a neighbourhood leads to an increase in junk food purchasing and a decrease in diet quality for children and youth.

London children's FE research has also been qualitative in nature. Battram *et al.* (2015) conducted focus groups with area elementary school children to assess perceptions of sugar-sweetened beverages, while Turton *et al.* (2016) conducted focus groups with area high school children to assess perceptions towards and consumption of caffeine and caffeinated beverages. Loebach and Gilliland (2010) conducted child-led walking tours to assess children's perceptions and use of their school neighbourhood built environment, including the food outlets existing within the neighbourhood.

Every single one of these studies examined the relationship between a certain aspect of the FE and how it impacts children directly whether that is by examining GPS tracks, conducting focus groups or child-led walking tours, or conducting surveys on fruit and vegetable consumption as well as food purchasing patterns, thus requiring ethics approval to interact with the participants. This thesis takes the previous studies into consideration, and aims to add to London-Middlesex FE research by assessing the community and consumer FE not at the individual level, but at the environmental level.

## 2.5 Gaps Filled and Conclusion

The purpose of this chapter was to provide an overview on previous food environment (FE) studies, especially pertaining to community and consumer FEs for children. The sections within this chapter highlighted several gaps within the literature, many of which are addressed by this thesis research. First and foremost, this thesis addresses the fact that very few community and consumer FE studies target child populations. Most of the studies that do consider children assess the FE with respect to children's diet or BMI. This thesis examines FEs for children at the physical environment level rather than the individual. Additionally this thesis examines the community *and* consumer FEs rather than one or the other; an approach very little research takes despite the fact that neighbourhood FEs cannot be accurately approached without consideration of both. To

do this, the thesis combines GIS-based methods with restaurant menu audits to create a more appropriate assessment of the neighbourhood FE.

As Engler-Stringer and colleagues write in their 2014 systematic review of the community and consumer FE for children, "there are few studies that use in-store measures of the consumer [food] environment in the food environment literature as a whole and" they "were only able to find three studies that were focused on children as the population of interest" (Engler-Stringer et al., 2014, p 13). This thesis aims to fill this gap by employing restaurant menu audits as a method of assessing the consumer FE for children. Regarding this methodology, this thesis is the first to undertake children's menu audits in Canada, specifically in the London-Middlesex region, and the first in the Northeast region of the United States, specifically in Rochester, NY. The thesis builds on previous FE research in London-Middlesex, and examines the FE in Rochester, an area where this type of research has not previously occurred. Additionally, the thesis is the first to statistically compare the menu audits across an international border to investigate Canada-US differences in children's consumer FEs.

Next, the thesis addresses the gap regarding urbanicity and geographic setting. This thesis explores the spatial disparities that exist between urban, suburban, and rural settings, rather than focusing in on one specific setting. We know FE research suggests urban areas are more saturated with unhealthy outlets, but more research is needed to understand the comparison between urban and other neighbourhood forms like suburban and rural areas. The thesis also recognizes the lack of rural studies in Canada, as well as the lack of FE studies that compare findings between the US and Canada.

By examining FEs in two different countries, the thesis also addresses the gap regarding socioeconomic disparities. Research shows that FEs in the US are indicative of "food deserts", where highly distressed (low income, high minority) areas have poor access to healthy foods; while in Canada, FEs are representative of "food swamps", where highly distressed areas have greater access to unhealthy foods. However, distress is not the same between these two countries as minority status carries an entirely different connotation in the United States than in Canada. The United States is much more racially

segregated than in Canada, and it is important to examine the relationship between FEs and socioeconomic characteristics in both countries because the findings in the United States cannot be generalized north of the border to Canada.

Knowing this, it is crucial to explore the FEs in both of these settings, rather than just one or the other in order to gain a greater understanding of North American FEs as they pertain to children.

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# Chapter 3

# 3 Research Setting, Data Collection, and Analysis

This chapter provides an overview and explanation of the thesis research setting, data collection process, and methodology for analysis. The chapter is divided into five main sections. Section 3.1 describes the three study areas of this thesis: London, Ontario, Middlesex County, Ontario, and Rochester, New York. Section 3.2 details the exhaustive data collection process required to collect the children's menus in each study area. Section 3.3 addresses the sources of all additional data used. Section 3.4 describes the analysis procedures. Finally, Section 3.5 summarizes the chapter and provides a brief conclusion.

## 3.1 Research Setting

This thesis focuses on three study areas in North America, two Canadian and one American. Chapter 4 focuses on Middlesex County, a rural county in Southwestern Ontario, Canada, with a population of 71,704, and the City of London (surrounded by Middlesex County), with a population of 383,822 (Statistics Canada, 2016). Based on previous food environment (FE) research in the London-Middlesex region (e.g. He et al., 2012; Sadler et al., 2016; for a full reference, see Section 2.4), this area was deemed an appropriate study area in order to expand on existing studies and assess an aspect of the children's FE that has not been previously examined. London is characterized as an over-bounded city, meaning it incorporates its suburbs and agricultural land. In this study, "urban" is defined as the area within the limits of the City of London as of 1959, "suburban" is defined as the developed area annexed by the City between 1960 and 1992, and "rural" is defined as the remaining (predominantly agricultural) areas in London and Middlesex County in its entirety (Larsen & Gilliland, 2008).

These definitions of urban and suburban are commonly used by the City of London, based on the urban morphology or form of such neighbourhoods. Urban areas have more mixed land use, including commercial zoning where food outlets can operate, with larger population densities. The built density is different as well, as urban streets tend to be

more grid-like, while suburban areas are more residentially zoned with a lower population density and the loop and lollipop street structure commonly found in housing developments. Using these definitions of urban and suburban, it was appropriate to designate everything outside of suburban London – and the entirety of Middlesex County – as rural, especially since the area is more agricultural and less dense in terms of population.

Chapter 5 focuses again on the City of London (population of 383,822) and compares it to the City of Rochester, New York, USA, with a population of 209,983 (Bureau of the Census, 2015). Though much less research has been undertaken regarding children's FEs in Rochester, this city was deemed an appropriate study area as it is comparable to London. Both London and Rochester are geographically located within the Great Lakes region, with a major river winding through the city, and are located similar driving distances from the Canada-US border. The two cities also have similar economies, as former manufacturing cities turned medical/research centres: London with the University of Western Ontario, and Rochester with the University of Rochester.

At the same time, London (in Canada) and Rochester (in the US) have developed under different political and socioeconomic conditions. Politically, there exists in Canada (and in London) a much more extensive system of social programs, including universal health care. Because of this, public health tends to be more of a priority in Canada, and socially, the more disadvantaged residents are more able to receive the help and care they need. Alternatively, health care in the United States tends to be more of a privilege and disadvantaged residents who are unable to afford private health care are unable to receive adequate care.

There are also differences in the way food environments are incorporated into urban planning. Food environment planning in the United States has been on the rise through the American Planning Association (APA) with the implementation of the APA Policy on Community and Regional Food Planning (American Planning Association, 2007). Despite the encouraging effort by some cities in the US to incorporate this aspect into

their own plan, the official/comprehensive plan of the City of Rochester currently has no mention of food at all.

On the other hand, the Canadian Institute of Planners and the Ontario Professional Planner Institute have both encouraged more discussion around including the food environment as a key component of planning (Canadian Institute of Planners, 2013). Similarly, the government of Canada has been more involved in food environments – looking in to how to examine various aspects of the food environment through collaboration between stakeholders and Health Canada (Health Canada, 2013). Unlike the City of Rochester, the official plan of the City of London has 120 mentions of the word "food" and addresses how the city will meet goals related to the food environment in the future including ensuring all Londoners have access to food sources providing affordable, safe, healthy, local foods (City of London, 2016). Canadian cities have also had generally better efforts toward central control of land use planning despite the fact that modern zoning as a means of protecting public health was born in the US as a result of the enactment of a zoning ordinance in Euclid, OH in 1926.

The above reasons, and the fact that I am very familiar with both cities, thus making the data collection process much easier, address why these particular study areas were chosen. By using three study areas, this thesis can assess the variation in the children's FE between urban, suburban, and rural areas in a Canadian context, as well as assess the Canada-US urban differences. These three areas specifically serve as unique case studies where restaurant menu audits have not previously been assessed. Though the results will be unique and provide concrete evidence for future actions within the study areas, such as restaurant interventions, they can be extrapolated to other cities and areas to justify the use of children's menu audits and FE research.

## 3.2 Children's Menu Collection Process

As mentioned in Chapter 2, this thesis employs the use of an observational restaurant children's menu survey tool. The Children's Menu Assessment (CMA) is a menu checklist audit tool (see Appendices A-B) based on the NEMS-R children's menu

subsection, which provides a more comprehensive and extensive method to evaluate the consumer FE for children in restaurants (Krukowski, Eddings, & Smith West, 2011; Saelens, Glanz, Sallis, & Frank, 2007). Where the NEMS-R simply asks whether or not a children's menu has any healthy entrées, sides, etc., the CMA delves deeper to inquire further on the quantity and type as well as the availability of whole grains, fruits and vegetables, and other non-fried items (Krukowski et al., 2011; Saelens et al., 2007).

The tool was created by a team of researchers at the University of Arkansas for Medical Sciences in Little Rock, Arkansas, USA. The team, led by Dr. Rebecca Krukowski, recognized the lack of efficient methods to assess children's consumer FEs specifically, and created the tool. It was piloted in Little Rock, Arkansas in 2009-2010, employed in other regions of the United States (e.g., Hill et al., 2015; Otten et al., 2012; for a full reference, see Section 2.2.2.1), and urged future research to consider urban vs. rural differences, regional (and national) differences, and differences in healthy children's menu options based on neighbourhood characteristics (Krukowski et al., 2011): three areas into which this thesis delves deeper.

### 3.2.1 Preliminary Google Search

Restaurant location data for London and Middlesex County were provided by the Middlesex-London Health Unit (MLHU). Rochester data was provided by the City of Rochester Planning Department. Because the MLHU database included the locations of every kitchen in the respective area, only restaurants designated as "restaurant," "bar," "fast food," "pizza," or "food take-out," were selected, as locations such as church kitchens and school concession stands were outside the scope of this study. For Rochester, the data was already narrowed down, as only restaurants with city business permits were included in the study.

After determining the location of all restaurants to be included, an excel spreadsheet was created for each study site to record the following information: restaurant name, unique identification number, address, whether or not a children's menu was online, phone number, whether or not the restaurant confirmed having a children's menu on the phone,

hours of operation, and comments. Data collection occurred from June-August 2016, beginning with an extensive Google search conducted for each individual establishment to see if a children's menu was posted online. Because some restaurants have an entire separate children's section while others only have one item, often advertised as a "kid's combo" or "kid's meal", both were included. Menus were looked at from the official restaurant website, the official restaurant Facebook page, the Google search result link to the right-hand side underneath the restaurant address and phone number, and websites such as Locu, Menupix, and Allmenu, which have user posted menu images and reviews. If the establishment's children's menu was found online, the menu was saved and the spreadsheet row was highlighted and completed accordingly. This comprehensive process was repeated for London, Middlesex County, and Rochester.

### 3.2.2 Telephone Confirmation Call

After completing this exhaustive Google search for all restaurants, phone calls were made to the restaurants that did not have children's menus online to confirm if a menu existed in house, and information was recorded in the spreadsheet. Comments from restaurant employees were also recorded, as many restaurants did not have separate children's menus but employees assured that the restaurant did offer "kid-friendly" items such as "grilled cheese", "hot dogs", "French fries", and other unhealthy items. Restaurants with phone numbers that did not work were noted and visited in-person to confirm. This thorough process was again repeated for London, Middlesex County, and Rochester.

### 3.2.3 Children's Menu Assessment

A new spreadsheet was then created to store data from only restaurants that confirmed having a children's menu. Locations with children's menus were mapped to calculate the shortest distance between each. Restaurants were visited in-person and menus were collected, both in physical paper form and by taking a picture of the menu. If the menu had to be captured by picture, permission was obtained by restaurant staff before doing so. Of the original 926 restaurants in the City of London, 144 restaurants in Middlesex County, and 242 restaurants in the City of Rochester, 323 were identified as having separate children's menus in London, 48 were identified in Middlesex County, and 50 in

Rochester. After excluding duplicates (i.e., a restaurant has several locations within a city but has the same menu at each location, thus the menu is only counted once), there were 145 unique children's menus in the City of London, 39 unique menus in Middlesex County, and 40 unique menus in the City of Rochester.

After all of the menus were collected for a given study site, each menu was assessed using the Children's Menu Assessment or CMA (Appendix A). Throughout this thesis, the terms "healthy" and "unhealthy" are used to refer to children's menu items. These terms are based off the definitions and instructions included with the CMA, which puts the burden of proof on the restaurant to identify healthy items. For example, the CMA considers whole grain items to be healthy but if the menu does not clearly indicate the type of grain, the researcher is to count the grain source as white or unhealthy.

To increase efficiency, an online version of the tool was created. Questions 1-10 were put into a Qualtrics online survey format and Tables 1-3 put into an accompanying Excel spreadsheet. This online version was created to enter all of the menu assessment and scoring data directly into a database, rather than complete individual paper copies of the tool for each menu and then transfer the information into spreadsheets. It eliminated the extra time that would have been spent doing data entry because the data were able to be entered directly. After the menu was assessed, it was then scored using the CMA scoring protocol (Appendix B). The scoring conveys information on healthy option availability for each restaurant, with higher scores (ranging from -5 to 21) corresponding to a greater number of healthy options (Krukowski et al., 2011). Previous CMA studies do not divide menu scores into various quality categories; however, based on the natural breaks in the menu scores that will be discussed in the subsequent chapters, poor quality menus were categorized as those menus with CMA scores of 0 or lower, average quality menus as those with CMA scores from 1 to 4, and high quality menus as those with CMA scores of 5 or higher. The assessment phase involved a dual rater system to ensure accuracy of scores.

## 3.3 Additional Data

Socioeconomic data used for analysis were obtained from Statistics Canada for London and Middlesex County, Ontario and from the United States Census Bureau for Rochester, New York. As mentioned, food outlet locations were provided by the Middlesex-London Health Unit and the City of Rochester Planning Department. All other data used in GIS mapping, including shapefiles and base layers for parks, roads, schools, water, neighbourhood boundaries, and more, were provided by the City of London Planning Department, the Middlesex County Planning Department, and the City of Rochester Planning Department.

## 3.4 Analysis

Chapters 4 and 5 represent different but related studies. The geographic information system (GIS) and statistical analysis methodology within each paper is quite similar, as will be discussed below. However, Chapters 4 and 5 also employ GIS mapping and statistical analysis methods unique to the individual studies and further detailed descriptions of these specific methods can be found in the individual chapters.

### 3.4.1 Statistical Analysis

Both studies employ the use of regression analysis as well as correlation analysis. Spearman's correlation is used for the variables representing a rank. In Chapter 4, it is used to assess the correlations between urbanicity and the community and consumer FE variables. Urbanicity in this study was a ranked value where "1" was assigned to rural areas, "2" was assigned to suburban areas, and "3" was assigned to urban areas. In Chapter 5, Spearman's correlation is used when comparing the correlations between the social environment variables to a neighbourhood's designation as American or Canadian, where "0" was assigned to all Rochester neighbourhoods and "1" was assigned to all London neighbourhoods. Pearson's correlation is used for data that is not ranked. In Chapter 4, it is used to assess the correlations between socioeconomic distress and the variables of the community and consumer FEs. In Chapter 5, Pearson's correlation is

used to identify any significant correlations between the measure of the FE and the social environment variables.

Both studies also use demographic data available at the dissemination area (DA) level in London and Middlesex County, and at the block group (BG) level in Rochester. The smallest unit at which Census data is available is at the DA level in Canada and the BG level in the United States. The two studies also use the following equation to calculate the z-score of various socioeconomic variables:

$$z = (x - \mu) / \sigma$$

Where x = the value of the variable for the individual DA or BG, $\mu$ = the mean of the variable over all DAs or BGs, and $\sigma$ = the standard deviation of the variable over all DAs or BGs.

Chapter 4 uses this equation to calculate the z-scores for low educational attainment (i.e., the proportion of the population that have not graduated from high school), 2) unemployment rate (i.e., the proportion of the population reported to be able to work but unemployed), 3) lone parent families (i.e., the proportion of single parent families to all families), and 4) low income measure (i.e., the proportion of individuals that fall below 50% of the median adjusted household income), and then sums those z-scores together to get a socioeconomic distress index for each DA in London and Middlesex County where higher values correspond with greater socioeconomic distress (Larsen & Gilliland, 2008; Gilliland & Ross, 2005; Sadler, Gilliland & Arku, 2011; Sadler, Clark, & Gilliland 2013). Chapter 5 uses this equation to calculate the z-score for median household income for each DA in London and each BG in Rochester in order to normalize the values to analyze income across an international border. This method was used rather than converting values to either all US dollars or all Canadian dollars because currency exchange rates fluctuate daily and would not accurately reflect the overall values.

### 3.4.2 GIS Mapping

The GIS this thesis uses is ArcGIS 10.3, created by ESRI (Redlands, California). Chapters 4 and 5 use this GIS to create road network buffers as a means of assessing the surrounding environment. Network buffers were chosen over circular buffers because they more accurately depict the area that influences walking, whereas circular buffers are more likely to ignore barriers to walking (e.g. rivers and/or railroads that are difficult to cross), and thus erroneously include additional areas (Oliver et al., 2007). In Chapter 4, network buffers are created at 800m and 1600m around the 136 public, Catholic, and private elementary schools in the London-Middlesex region. The chapter uses these buffers to map out the community FE around these schools – an important aspect as children spend the majority of their daily lives in or around their schools. These distances are commonly used in children's FE studies, as discussed in the chapter. In Chapter 5, network buffers are created at 800m around the centroid of each census block in both London and Rochester. This chapter uses the buffers to capture the variety of restaurants in a neighbourhood. Without the creation of the network buffers, restaurants that may be located just outside the block could be missed – resulting in an edge effect and inaccurate results. The distance of 800m was chosen as it is commonly used in the literature, further described in the chapter.

Chapters 4 and 5 also make ample use of the spatial join tool. In Chapter 4, spatial join is used to calculate the number of fast food restaurants, full service restaurants, convenience stores, and grocery stores (designated as junk food outlets or JFOs) for each 800m and 1600m network buffer around each elementary school. These calculations are then used to assess the JFO density around the school, as well as additional measures that will be addressed in the chapter. Spatial join is also used in Chapter 4 to assign each elementary school and restaurant with a children's menu the socioeconomic distress variables and index of the dissemination area within which the school or restaurant lies in order to assess the socioeconomic influence. In Chapter 5, spatial join is used to determine the number of restaurants and the sum of the children's menu scores within each network buffer. These values are then used to calculate an index used to quantify restaurant

accessibility/opportunity measures from each residential neighbourhood in Rochester and London, which will be discussed further in Chapter 5.

Finally, Chapters 4 and 5 both use the GIS to create visually appealing maps to display the results of the analyses.

## 3.5 Summary

The purpose of this chapter was to provide a description of the study areas, data collection process, and analysis methodology. This thesis examines the community and consumer FEs for children in the City of London and Middlesex County, Ontario, as well as the City of Rochester, New York. The community FE is explored in the London-Middlesex region, and the consumer FE is explored in all three study areas. The thesis uses the Children's Menu Assessment (CMA) tool, an observational survey checklist tool that assesses content and quality of restaurant children's menus. Children's menus were collected through a comprehensive Google search as well as in-person visits, and assessed/scored using an electronic version of the CMA. Similar methods were employed in each of the two studies, including regression and correlation analysis, as well as creating network buffers and using the spatial join function of ArcGIS. However, Chapters 4 and 5 also employ methods unique to the individual studies and further detailed descriptions of these specific methods can be found in the individual chapters that follow.

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# Chapter 4

# 4 Examining Community and Consumer Food Environments for Children: An Urban-Suburban-Rural Comparison in Southwestern Ontario

## 4.1 Introduction

Childhood obesity is a growing public health issue of global importance. In Canada, one in four children and youth are overweight or obese, which can result in a number of health issues including type 2 diabetes, poor emotional health, and hypertension, among others (Reilly et al., 2003; Singh et al., 2008). Childhood obesity is likely to continue into adulthood, causing an increased risk in heart disease, stroke, and cancer, as well as a shortened lifespan (Danaei et al., 2005; Peeters et al., 2003; Singh et al., 2008; Smith, 2007). Research suggests diet plays a crucial role in childhood obesity (USDA, 2012), and that prevalence rates of overweight or obesity among children in a neighbourhood may relate not just to individual choices, but to area socioeconomic characteristics as well as factors of the built environment (Glanz, Sallis, Saelens, & Frank, 2005; Story, Kaphingst, Robinson-O'Brien, & Glanz, 2008; Gilliland et al., 2012). In other words, the dietary behaviours people exhibit are heavily influenced by the environmental choices available to them. This chapter will examine this notion by assessing the relationship between children's food environments, neighbourhood socioeconomic distress, and urbanicity.

### 4.1.1 Community and Consumer Food Environments

The food/nutrition environment, according to Glanz *et al.* (2005), is comprised of four features: (1) community (e.g., the type, location, and accessibility of food outlets), (2) consumer (e.g., the price, promotion, placement, and availability of healthy options and nutrition information), (3) organizational (e.g., access to food in other settings such as workplaces and schools), and (4) informational (e.g., marketing, media, advertising). In this chapter, nutrition environment is used synonymously with food environment (FE). When Glanz and colleagues created the model of community nutrition environments,

both community and consumer FEs were deemed as most important for future study (Glanz et al., 2005). While knowledge of these environments has increased since then, gaps remain in the existing literature. Engler-Stringer *et al.* (2014) found most existing scholarly studies focus primarily on adult populations, rather than children.

Within the small body of literature on community and consumer FEs for children, few studies assess both. As Le *et al.* (2016, p. eS44) observed, "Not many studies have described the walkable community nutrition environment (proximity to and density of food outlets and fast-food restaurants) and the consumer nutrition environment (pricing, quality of food items within the stores or restaurants) together" especially with respect to children. In their systematic review of the community and consumer FE for children, Engler-Stringer *et al.* (2014) identified 26 studies, all of which assessed either the community or the consumer FE, but none assessed both in the same study area.

### 4.1.2 Food Environments, Urbanicity, and Socioeconomic Status

Research in the United States continues to highlight food deserts as the prominent type of food environment, where people in highly socioeconomically deprived neighbourhoods have worse access to healthy foods compared to people in wealthier, less deprived neighbourhoods (Black, Moon, & Baird, 2014; Larsen & Gilliland, 2008; Larson, Story, & Nelson, 2009; Walker, Keane, & Burke, 2010). In Canada, research suggests people in highly deprived neighbourhoods have better access to unhealthy food outlets such as fast food restaurants or convenience/variety stores than people in less deprived neighbourhoods – indicating a food swamp rather than a food desert (Black et al., 2014; Health Canada, 2013). In Gustafson and colleagues' 2011 systematic review of the consumer FE, 10 out of 30 studies using an audit tool tested for socioeconomic deprivation, but these studies all took place within the United States (Gustafson, Hankins, & Jilcott, 2012). In assessing the consumer FE in restaurants specifically, Larson *et al.* (2009) found that restaurants in wealthier areas offer healthier menu options than low income areas.

With respect to urbanicity, many FE studies have been conducted in urban and/or rural environments. In a 2011 systematic review of the consumer FE, only four of 56 included studies focused on both urban and rural areas; none were labelled as suburban (Gustafson et al., 2012). Similarly, Fleischhacker *et al.* (2011) found 24 out of 40 reviewed studies on fast food access were conducted in urban areas. Only one took place exclusively in a rural area, while 11 compared urban and rural areas. Despite the differences in population density, land use, and built density between urban, suburban, and rural environments, research that combines all three of these areas is lacking. An exception is a recent study by Martinez-Donate *et al.* (2016) which compared restaurant differences among these three neighbourhood forms and found urban neighbourhoods had a higher restaurant density and urban and suburban neighbourhoods had healthier restaurants compared to rural areas.

### 4.1.3 Children's Menus

Since its initial creation and use in 2009-2010, the Children's Menu Assessment tool (CMA) has enabled increased research on children's menus (Krukowski, Eddings, & Smith West, 2011). This tool is an expansion of the Nutrition Environment Measures Survey for Restaurants (NEMS-R) children's menu subsection, and a more comprehensive and extensive means of measuring the FE for children in restaurants (Krukowski et al., 2011; Saelens, Glanz, Sallis, & Frank, 2007). While the NEMS-R has been widely used, its role in FE research is assessing restaurant menus, not assessing children's menus specifically. The CMA addresses this and not only asks whether a healthy option is available, but inquires further on the quantity as well as the availability of whole grains, fruits and vegetables, and other non-fried items.

The CMA has been used in several studies in the United States, to reveal a lack of healthy meal options on children's menus, assist in evaluating restaurant compliance to new toy laws, and assess changes before and after restaurant interventions (Hill et al., 2015, Krukowski et al., 2011, Otten et al., 2012, Diedrich & Otten, 2015, Crixell, Friedman, Fisher, & Biediger-Friedman, 2014, Ayala et al., 2016). The CMA has also been used in Ireland, revealing how limited the children's menus were in both quality of food and

availability of healthy options (McGuffin et al., 2013). To my knowledge, the tool has not been used in Canada.

### 4.1.4 Purpose

The purpose of this study is to examine both the community and consumer food environments for elementary school-aged children (ages 3-13 years) in the City of London and Middlesex County, Ontario, Canada to determine the extent to which exposure to junk food outlets (JFOs) varies based on urbanicity and level of socioeconomic distress. The study has the following research objectives:

1. Determine how JFO density in a school zone varies by neighbourhood level of socioeconomic distress and level of urbanicity.

2. Determine how the likelihood of neighbourhood restaurants offering children's menus varies by neighbourhood level of socioeconomic distress and level of urbanicity.

3. Determine how the quality of restaurant children's menus varies by level of socioeconomic distress in a neighbourhood and urbanicity.

Several existing studies examine the relationship between neighbourhood demographics and food access/availability, but few studies have examined the relationship between children's FE and urbanicity to determine variation in both neighbourhood food outlet composition and items available between urban, rural, and suburban neighbourhoods. These studies tend to examine the impact that the FE has on children's BMI or diet, requiring ethics approval to interact with children, rather than examine the availability and accessibility of food options (Engler-Stringer et al., 2014).

This study addresses several gaps in the literature. It assesses aspects of both the community and consumer FEs, which is important in order to accurately assess neighbourhood FEs (Caspi, Sorensen, Subramanian, & Kawachi, 2012). It combines restaurant audit measures alongside GIS-based methods of food retail accessibility to contextualize spatial differences in food availability. It also expands on previous research focusing on food environments around schools. For example, while He and

colleagues created school neighbourhoods using 1km straight line buffers around schools to describe the impact of JFO density on junk food purchasing (He et al. 2012a) and diet quality (He et al., 2012b) among elementary school children in London, Ontario, this paper will improve on those GIS-based methods by employing 800m and 1600m network buffers around all London and Middlesex County, ON elementary schools. Though the use of network buffers is not novel on its own, this will be one of the first papers to combine measures of both the community *and* consumer FEs. For instance, while Gilliland *et al.* (2012) studied the relationship between childhood obesity and fast food restaurants within a short walk of children's schools; this paper incorporates audits of the children's menus within those restaurants, to identify whether the menus are offering healthy options.

This paper also addresses the urbanicity gap identified by Fleischhacker *et al.* (2011): studies with urban/rural comparisons tend to focus mostly on the urban environments, whereas this study examines the FE for children in rural Middlesex County compared to the urban and suburban environments in the neighbouring City of London. Similarly, in the CMA pilot study, Krukowski *et al.* (2011) call for future CMA studies that focus on additional factors such as urbanicity or region.

Interestingly, Engler-Stringer and colleagues' (2014) systematic review of the community and consumer FE for children identified 26 studies, but only three focused on the consumer FE for children and none analyzed children's menus specifically or used the CMA (Engler-Stringer et al., 2014). Of those three that focused on the consumer FE, two examined cost from a cost of living index, and one examined fruit, vegetable, and 100% juice availability and shelf space (Engler-Stringer et al., 2014). Consumer FE studies tend to focus on what is available within grocery stores, or assess restaurant menus using variations of the NEMS. By using the CMA to explore the variation in children's menus specifically, not just in urban regions, but in suburban and rural regions as well, and by analyzing children's menus with respect to level of neighbourhood socioeconomic distress, this study attempts to fill gaps in the children's FE literature.

## 4.2 Methods

This chapter focuses on Middlesex County, a rural county in Southwestern Ontario, Canada, with a population of 71,704, and the City of London (surrounded by Middlesex County), with a population of 383,822 (Statistics Canada, 2016). London is characterized as an over-bounded city, meaning it incorporates its suburbs and agricultural land. For the purpose of this chapter, "urban" is defined as the area within the limits of the City of London as of 1959, "suburban" is defined as the developed area annexed by the City between 1960 and 1992, and "rural" is defined as the remaining (predominantly agricultural) areas in London and Middlesex County in its entirety (Larsen & Gilliland, 2008). These definitions of urban and suburban, based on the urban morphology of the neighbourhoods, are commonly used by the City of London. Urban areas have more mixed land use with larger population densities, and have more grid-like street networks. Suburban areas are more residentially zoned with a lower population density, and have more loop and lollipop street networks, typical of housing developments. Using these definitions, it was fitting to designate the remaining area in London and Middlesex County entirely as rural, since the area is more agricultural and less dense in terms of population.

Food outlet location data provided by the Middlesex-London Health Unit were used for both London and Middlesex County. Outlet types included in this study were grocery stores, convenience/variety stores, restaurants, and food take-out locations. All other location data and GIS shapefiles, were provided by the planning departments of the City of London and Middlesex County. The full civic addresses of school and food outlet locations were geocoded in a GIS (ArcGIS 10.3, ESRI) and verified through websites, Google Maps and Streetview, phone calls, and site visits.

### 4.2.1 Neighbourhood-level Socioeconomic Distress

To address the research objectives, neighbourhood-level socioeconomic 'distress' or 'deprivation' was assessed by creating an area-based index of socioeconomic distress (Gilliland, Holmes, Irwin, & Tucker, 2006; He, Tucker, Gilliland, et al., 2012; Larsen &

Gilliland, 2008; Ley & Smith, 2000; Pampalon, Hamel, Gamache, & Raymond, 2011; Carstairs & Morris, 1991). The socioeconomic distress index in this study consists of four variables from the 2011 Canadian Census and the 2011 National Household Survey (a new, voluntary survey created to replace a long portion of the Census form in Canada): 1) low educational attainment (i.e., the proportion of the population that have not graduated from high school), 2) unemployment rate (i.e., the proportion of the population reported to be able to work but unemployed), 3) lone parent families (i.e., the proportion of single parent families to all families), and 4) low income measure (i.e., the proportion of individuals that fall below 50% of the median adjusted household income) (Sadler, Gilliland, & Arku, 2011; Sadler, Clark, & Gilliland, 2013). The index was calculated at dissemination area (DA) level, the smallest geographic unit for which complete Canada census data is available (Statistics Canada, 2016). A DA is a geographic census unit containing about 400 to 700 people. For every DA in both Middlesex County and London, the z-score of each variable was calculated using the following equation:

$$z = (x - \mu) / \sigma$$

Where x = the value of the variable for the individual DA, $\mu$ = the mean of the variable over all DAs, and $\sigma$ = the standard deviation of the variable over all DAs.

Following previous studies, the z-scores for all four variables were then summed to create the distress index for each DA (Larsen & Gilliland, 2008; Gilliland & Ross, 2005; Sadler, Gilliland & Arku, 2011; Sadler, Clark, & Gilliland 2013). Index scores ranged from -4.76 to 10.89, where higher scores indicate higher levels of socioeconomic distress.

### 4.2.2 Community Food Environment Data

The community FE was evaluated by measuring how saturated the environment around each elementary school is with junk food outlets (JFOs). The environments around the schools were mapped using both 800 metre and 1600 metre network service areas or network buffers (synonymous with “school zone”) around each of the 136 public, Catholic, and private London-Middlesex elementary schools. Network buffers were built around schools because children spend much of their waking hours both at school and

within the neighbourhood around the school (McConnell et al., 2010; He et al., 2012; He et al., 2012b; Hofferth & Sandberg, 2001), and several studies have used schools as the point of focus (Engler-Stringer et al., 2014; Fleischhacker et al., 2011; Gilliland et al., 2012; Glen et al., 2013; Sadler, Clark, Wilk, O'Connor, & Gilliland, 2016; Sadler & Gilliland, 2015; Simon, Kwan, Angelescu, Shih, & Fielding, 2008; Zenk & Powell, 2008). Elementary schools were also an appropriate focal point as the student body at this level of schooling is typically the same age as that listed on restaurant children's menus (i.e., under 13 years of age).

The Network Analyst extension of ArcGIS 10.3 was used with a 2015 road file for Southwestern Ontario to calculate network distances (DMTI, 2015). Network buffers were used because they more accurately depict the area that influences walking, whereas circular buffers are more likely to ignore barriers to walking (e.g. rivers and/or railroads that are difficult to cross), and thus erroneously include additional areas (Oliver, Schuurman, & Hall, 2007). Two buffer distances were used rather than one because research suggests using varied distances provides a better estimate of exposure (Sadler & Gilliland, 2015). These two distances were chosen specifically as they are frequently used among children's FE studies (Engler-Stringer et al., 2014): 1600m is the school board-mandated walking distance (the distance a student can live from the school before becoming bus-eligible), while 800m is a distance recognized as walkable in 10-15 minutes (Gilliland et al., 2012).

For this study, both fast food restaurants (restaurants where customers order, pay, and receive food at a register or drive-thru) and full service restaurants (restaurants where food is served to customers by wait staff), convenience/variety stores, and grocery stores were included as JFOs. After assessing the children's menus in the study area, as outlined in the following section, full service restaurants were found to offer the same items as their fast food counterparts (i.e., hamburgers, chicken fingers, fried sides, soda, etc.), thus their inclusion as JFOs. Grocery stores are typically characterized as healthy food outlets; however, Creel *et al*. (2008) found grocery stores were on par with convenience stores in providing over double the potential availability of unhealthy foods

in their rural study area. Since the majority of these outlets still sell sugar-sweetened beverages, unhealthy snacks (e.g., potato chips, chocolate, and other candy), highly-processed foods and meals to-go, and/or have tables and seating where one can sit and dine, grocery stores have been included as JFOs (Creel, Sharkey, McIntosh, Anding, & Huber, 2008; Sharkey, Johnson, Dean, & Horel, 2011). These four food outlets were chosen as JFOs rather than focusing solely on traditional fast food restaurants and convenience stores as unhealthy food sources to more accurately measure exposure to junk food (Creel et al., 2008; Sharkey et al., 2011).

For each school, the number of restaurants, convenience stores, and grocery stores were calculated via spatial joins for both the 800m and 1600m respective network buffers. These three outlet counts were then summed together resulting in the total number of JFOs per school per buffer distance. JFO density was calculated by dividing each buffer area (calculated in square kilometres) by the total number of JFOs within that buffer. The population of each 800m and 1600m school zone was calculated using intercept and join functions to account for the percentage of the population from each DA covered by the school zone. Using these population figures, total number of JFOs per school zone population was calculated by dividing the total number of JFOs by the population of each school zone. Finally, proximity measures in kilometres were calculated using Network Analyst, including distance to the nearest grocery store, convenience store, and JFO.

Each elementary school was assigned the individual socioeconomic distress variables and index of the DA within which the school lies to analyze whether the socioeconomic measures influence the measures of JFO saturation within the respective school zones. JFO density with respect to level of socioeconomic distress and urbanicity were then mapped in ArcGIS, with each school proportionally symbolized per the JFO density within the respective 800m buffer (Figure 4.1).

SPSS (IBM SPSS Statistics 24) was used to conduct statistical analyses including descriptive statistics, linear regressions, and correlation matrices on the variables of the community FE, socioeconomic distress, and urbanicity to meet the first objective. Spearman's Rho was used for the correlations between variables of the community FE

and urbanicity because urbanicity is a rank, whereas Pearson's correlation was used for analysis on variables of the community FE and level of socioeconomic distress because distress level is continuous and normally distributed.

### 4.2.3 Consumer Food Environment Data

The second part of this study analyzes the consumer FE through children's menus. Though the community FE analysis examines what outlets are available around elementary schools, the FE *within* the schools was not examined. The consumer FE is essentially what is available within a food outlet, and to examine further within schools would be to examine the organizational FE, a separate aspect of the FE as discussed by Glanz *et al.* (2005) in Figure 1.2. Additionally, elementary schools within this region do not have cafeterias nor vending machines where food can be purchased. Some schools have optional hot lunch programs that students can subscribe to, where a weekly lunch is brought in from a local restaurant such as a pizza or sandwich shop that is subsequently included in the children's menu analysis. There is, however, not a daily school-served lunch – thus, the focus is to explore what is offered within one of the outlet types included in the community FE analysis – restaurants.

Menu collection occurred from June to August 2016, beginning with a Google search conducted for each individual establishment to determine if a children's menu was posted online. Because some restaurants have an entire separate children's section while others only have one item, often labelled as "kid's combo" or "kid's meal", both were included. If the establishment's children's menu was found online, the menu was saved.

After the Google search was completed for all restaurants, phone calls were made to the restaurants that did not have children's menus online to confirm if a menu existed in house. Comments from restaurant employees were recorded, as many restaurants did not have separate children's menus but employees assured that the restaurant did offer "kid-friendly" items such as "grilled cheese", "hot dogs", "French fries", and other generally unhealthy items. Restaurants with phone numbers that did not work were noted and visited in-person to confirm.

After online and in-person menu collection, each menu was assessed using the CMA. The CMA audit questions are grouped into eight categories: (1) healthfulness of entrées, (2) proportion of whole to white grains, (3) desserts (e.g., whether the price of a meal includes an unhealthy dessert), (4) beverages (e.g., availability of 100% juice or low-fat milk), (5) sides (e.g., availability of non-fried vegetables or fruits with no added sugar), (6) nutritional information, (7) toy promotions, and (8) branded marketing (Krukowski et al., 2011; Saelens et al., 2012). The term "healthy" is used throughout this chapter to refer to children's menu items, but the CMA puts the burden of proof on the restaurant, rather than the researcher scoring the menu, to identify whether items are healthy or not using the criteria included with the tool. For example, the CMA instructs that an entrée prepared as grilled, baked, smoked, or broiled would be considered healthy when referring to proteins such as chicken or fish, while a sandwich that is grilled, such as grilled cheese, is not necessarily healthy even though it is described as grilled.

To increase efficiency, the tool was transcribed into an online survey format. After a menu was assessed, it was then scored using the CMA scoring protocol which yields information on healthy option availability for each restaurant with higher scores (ranging from -5 to 21) corresponding to a greater number of healthy options (Krukowski et al., 2011). Two raters assessed and scored each menu, and when discrepancies arose, a third rater was consulted. Previous CMA studies do not divide menu scores into various quality categories; however, based on the natural breaks in the menu scores, poor quality menus were categorized as those menus with CMA scores of 0 or lower, average quality menus as those with CMA scores from 1 to 4, and high quality menus as those with CMA scores of 5 or higher.

Each restaurant with a children's menu was then assigned the socioeconomic distress variables and index score of the DA within which the restaurant lies to assess whether the socioeconomic measures influence the children's menu scores. SPSS was used to conduct statistical analyses including descriptive statistics, linear regressions, and correlation matrices on the variables of the consumer FE, socioeconomic distress, and urbanicity to meet our second and third objectives. Like the community FE, Spearman's

Rho was used for the correlations between variables of the consumer FE and urbanicity because urbanicity is a rank, whereas Pearson's correlation was used for analysis on variables of the consumer FE and socioeconomic distress because distress level is continuous and normally distributed.

## 4.3 Results

### 4.3.1 Community Food Environment Results

**Table 4.1**: Descriptive statistics for the community food environment for children in London-Middlesex, ON.

| | Urban | | | | Suburban | | | | Rural | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **800m Threshold** | **Min.** | **Max.** | **Mean** | **Median** | **Min.** | **Max.** | **Mean** | **Median** | **Min.** | **Max.** | **Mean** | **Median** |
| **Total # Grocery** | 0 | 3 | 0.87 | 1 | 0 | 4 | 0.49 | 0 | 0 | 1 | 0.06 | 0 |
| **Total # Convenience** | 0 | 13 | 6.43 | 6 | 0 | 10 | 2.36 | 1 | 0 | 6 | 0.9 | 0 |
| **Total # Restaurants** | 0 | 37 | 9.77 | 8.5 | 0 | 33 | 3.25 | 1.5 | 0 | 10 | 1.53 | 0 |
| **Total # JFOs** | 0 | 49 | 17.07 | 16.5 | 0 | 38 | 6.92 | 3 | 0 | 16 | 2.5 | 0 |
| **1600m Threshold** | | | | | | | | | | | | |
| **Total # Grocery** | 0 | 6 | 2.7 | 2.5 | 0 | 7 | 2.01 | 2 | 0 | 3 | 0.4 | 0 |
| **Total # Convenience** | 2 | 78 | 25.93 | 20.5 | 0 | 32 | 10.39 | 7.5 | 0 | 12 | 2.47 | 1 |
| **Total # Restaurants** | 5 | 200 | 27 | 46.73 | 1 | 62 | 16.04 | 12.5 | 0 | 35 | 5.35 | 2 |
| **Total # JFOs** | 7 | 267 | 75.4 | 54 | 1 | 90 | 28.4 | 21.5 | 0 | 40 | 8.24 | 2 |

Descriptive statistics for the community food environment of each urbanicity can be found in Table 4.1. As expected, the number of JFOs increased as the school zone threshold increased from 800m to 1600m. Similarly, the number of JFOs increased as urbanicity shifted from rural to urban.

**Table 4.2:** Correlations between Urbanicity, Level of Neighbourhood Distress, and Measures of Junk Food Outlet Exposure.

| | | a | b | c | d | e | f | g | h | i | j | k |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **a** | **Urbanicity** | 1 | | | | | | | | | | |
| **b** | **Socioeconomic Distress Level** | .261** | 1 | | | | | | | | | |
| **c** | **Number of JFOs per 800m population** | .508** | .070 | 1 | | | | | | | | |
| **d** | **Number of JFOs per 1600m population** | .630** | -.014 | .862** | 1 | | | | | | | |
| **e** | **Total count of JFOs within 800m** | .516** | .244** | .788** | .563** | 1 | | | | | | |
| **f** | **JFO density within 800m** | .459** | .262** | .669** | .411** | .920** | 1 | | | | | |
| **g** | **Total count of JFOs within 1600m** | .692** | .198* | .658** | .765** | .734** | .572** | 1 | | | | |
| **h** | **JFO density within 1600m** | .650** | .232** | .605** | .725** | .686** | .569** | .966** | 1 | | | |
| **i** | **Proximity to nearest JFO** | -.429** | -.142 | -.261** | -.208* | -.360** | -.353** | -.296** | -.327** | 1 | | |
| **j** | **Proximity to nearest convenience store** | -.491** | -.201* | -.292** | -.243** | -.408** | -.405** | -.361** | -.406** | .868** | 1 | |
| **k** | **Proximity to nearest grocery store** | -.454** | -.162 | -.284** | -.237** | -.393** | -.394** | -.360** | -.415** | .627** | .707** | 1 |

*. Correlation is significant at the 0.05 level.
**. Correlation is significant at the 0.01 level.

Based on Objective 1, correlation analysis (Table 4.2) indicates that urbanicity has a significant negative correlation with all proximity counts, and a significant positive correlation with number of JFOs per population at both 800m and 1600m, total count of JFOs at both 800m and 1600m, and JFO density at 1600m. A significant positive correlation between urbanicity and JFO density at 800m was also found. The results also show significant positive correlations between level of neighbourhood distress and both total count of JFOs and JFO density within 800m and 1600m, and a significant negative correlation between distress and proximity to nearest convenience store.

Figure 4.1 illustrates this, showing the schools within the urban boundary as having the heaviest concentration of JFOs per 800m school zone. Similarly, Figure 4.1 indicates some of the highly distressed urban areas as having school zones with a very high density of JFOs.

Linear regressions were also calculated to predict measures of junk food exposure based on school urbanicity and level of socioeconomic distress. Results indicate junk food outlet density at the 1600m threshold is significantly related to urbanicity ($p=0.02$) and to level of socioeconomic distress ($p=0.00$).

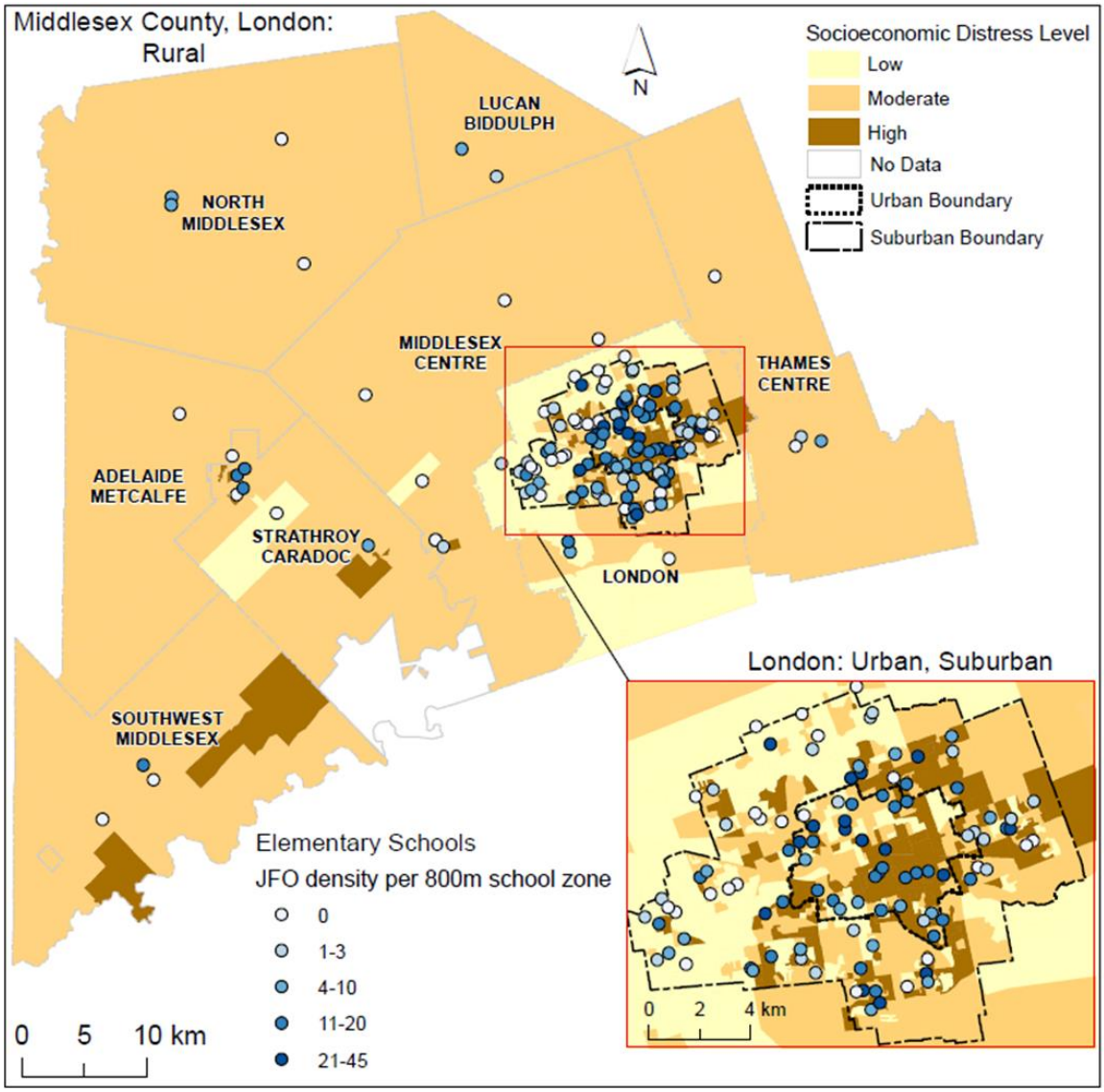


**Figure 4.1:** Community food environment for children in London-Middlesex, ON.

### 4.3.2 Consumer Food Environment Results

The original list included 1071 restaurants within London and Middlesex County, with 364 (33.9%) identified as having separate children's menus. After excluding duplicate restaurants (e.g. chain restaurants with identical menu options), establishments outside of the scope of this project (concession stands, etc.), and restaurants found to be closed at the time of study, 174 unique children's menus were found within the London-Middlesex area.

Total menu scores for all 174 unique menus ranged from -3 to 9 with a mean score of 1.02 and standard deviation (SD) of 2.27. These total scores, visualized in Figure 4.2, are comparable to total scores found in previous studies (Hill et al., 2015; Krukowski et al., 2011). Of these total scores, 49 scored negative, 43 scored zero, and 82 scored positive. Based on Objective 2, urban total menu scores ranged from -3 to 8 (mean=1.61, SD=2.61), suburban total menu scores ranged from -2 to 9 (mean=1.22, SD=2.40) and rural total menu scores ranged from -2 to 8 (mean=1.18, SD=2.38) and are seen following street corridors in Figure 4.2, rather than congregating in areas based on urbanicity or socioeconomic distress.

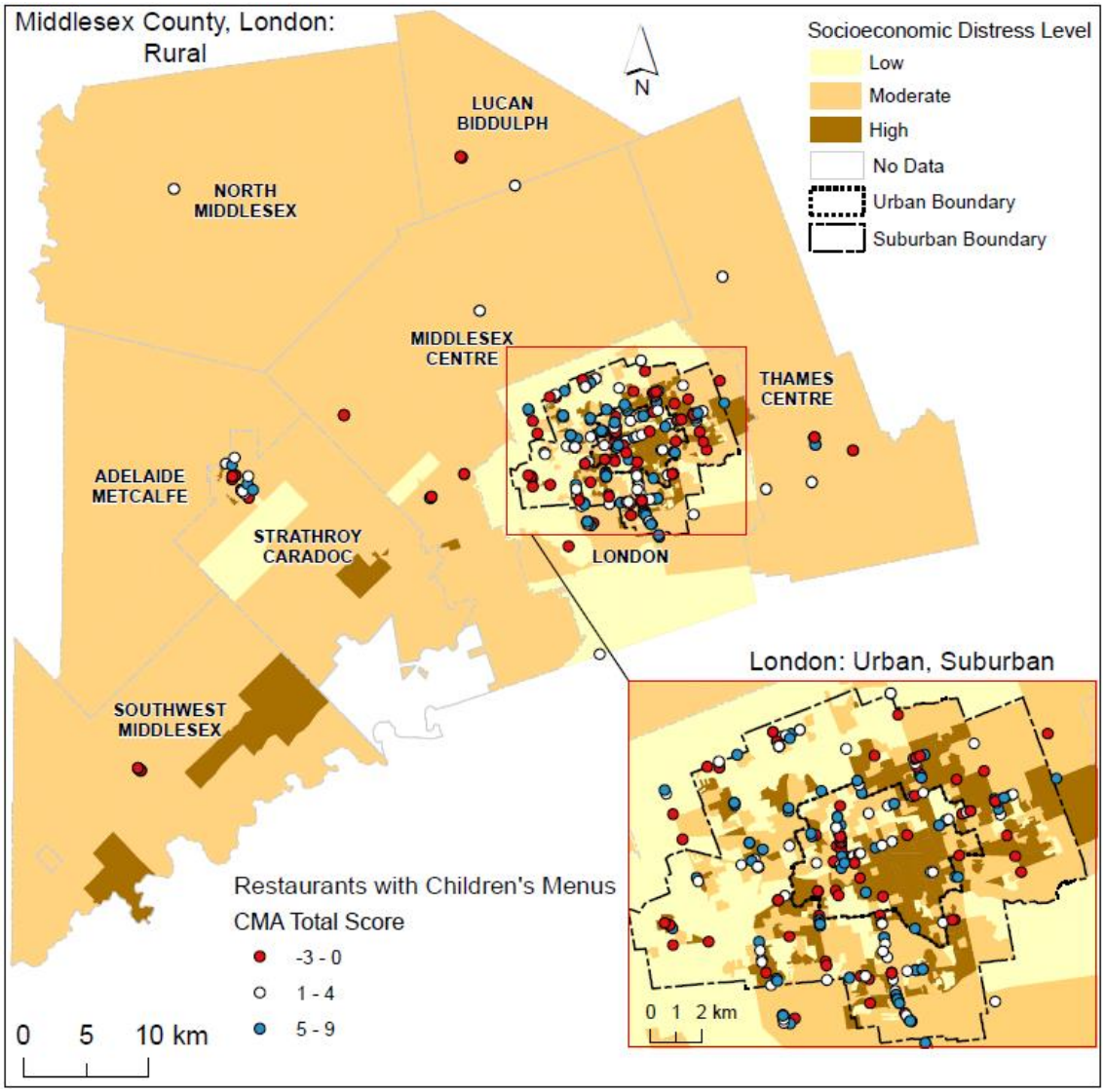


**Figure 4.2:** Restaurant consumer food environment for children in London-Middlesex, ON (2016).

Most locations (59.2%) did not specify an age range for the children's menu. However, 27.6% specified 12 years old or under, and 13.2% specified 10 years or under. Six unique menus (3.4%) were found to include a toy in the children's meal, and four (2.3%) used branded marketing as a means of promotion. Menus included in this study offered an average of six entrée choices per menu, with 25 of the 174 menus (14.4%) offering at least one healthy entrée. Just under one-third (31%) offered a non-fried vegetable side such as a salad or steamed broccoli. Twenty-one (12.1%) offered fruit, but only 12

(6.9%) specified fruit without added sugar. A large portion of the menus (43.6%) also included dessert with a children's meal but only seven (4%) offered healthy desserts such as fresh fruit. Additional results and the variation between urbanicity can be found in Table 4.6.

**Table 4.3:** Description of Children's Menu Assessment categories scored on restaurant children's menus in the London-Middlesex region of Ontario, Canada (2016).

| **Children's Menu Assessment Categories** | **Total (n=174)** | | **Urban (n=69)** | | **Suburban (n=104)** | | **Rural (n=56)** | |
|---|---|---|---|---|---|---|---|---|
| **Nutrition guidance** | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** |
| Any nutrition information | 9 | 5.2 | 7 | 10.1 | 8 | 7.7 | 4 | 7.1 |
| Symbol indicating healthy item | 8 | 4.6 | 3 | 4.3 | 8 | 7.7 | 0 | 0 |
| **Entrées** | | | | | | | | |
| Healthy entrée | 23 | 13.2 | 12 | 17.4 | 18 | 17.3 | 7 | 12.5 |
| Healthy entrée salad | 4 | 2.3 | 1 | 1.4 | 3 | 2.9 | 0 | 0 |
| Whole-grain option | 9 | 5.2 | 6 | 8.7 | 6 | 5.8 | 2 | 3.6 |
| **Beverages** | | | | | | | | |
| Juice, any | 89 | 51.1 | 33 | 47.8 | 57 | 54.8 | 30 | 53.6 |
| Juice, listed as 100% juice | 5 | 2.9 | 3 | 4.3 | 5 | 4.8 | 2 | 3.6 |
| Milk, any | 90 | 51.7 | 34 | 49.3 | 61 | 58.7 | 31 | 55.4 |
| Milk, listed as low-fat, 1%, or non-fat | 5 | 2.9 | 4 | 5.8 | 5 | 4.8 | 3 | 5.4 |
| Soda targeted at children | 98 | 56.3 | 31 | 44.9 | 63 | 60.6 | 33 | 58.9 |
| Opportunity for healthier beverage substitution | 83 | 47.7 | 35 | 50.7 | 55 | 52.9 | 31 | 55.4 |
| Free soda refills for children | 16 | 9.2 | 5 | 7.2 | 13 | 12.5 | 3 | 5.4 |
| **Side Dishes** | | | | | | | | |
| Non-fried vegetables | 54 | 31 | 21 | 30.4 | 30 | 28.8 | 17 | 30.4 |
| Fruit, any | 21 | 12.1 | 13 | 18.8 | 16 | 15.4 | 12 | 21.4 |
| Fruit, without added sugar | 12 | 6.9 | 9 | 13 | 11 | 10.6 | 7 | 12.5 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Dairy, any | 3 | 1.7 | 2 | 2.9 | 1 | 1 | 2 | 3.6 |
| Dairy, low-fat | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Opportunity for healthier side substitution | 54 | 31 | 26 | 37.7 | 36 | 34.6 | 23 | 41.1 |
| **Desserts** | | | | | | | | |
| Healthy desserts | 7 | 4 | 4 | 5.8 | 6 | 5.8 | 1 | 1.8 |
| Included in children's meal | 76 | 43.7 | 29 | 42 | 48 | 46.2 | 24 | 42.9 |
| **Toys/Marketing** | | | | | | | | |
| Branded marketing toward children | 6 | 3.4 | 2 | 2.9 | 3 | 2.9 | 5 | 8.9 |
| Toy included with children's meal | 4 | 2.3 | 3 | 4.3 | 3 | 2.9 | 4 | 7.1 |

Based on Objective 3, regression analysis did not indicate a significant relationship between children's menu total score and urbanicity, nor between children's menu total score and level of socioeconomic distress. Correlation analysis did not indicate a relationship between level of neighbourhood distress and children's menu total score. There was, however, a significant negative correlation between urbanicity and unhealthy dessert automatically included with children's meal (Spearman's Rho correlation= -0.121, significant at the 0.05 level), and a significant positive correlation between urbanicity and branded marketing used to promote children's menu items (Spearman's Rho correlation= 0.143, significant at the 0.01 level).

## 4.4 Discussion

### 4.4.1 Community Food Environment

The results addressing Objective 1 show level of socioeconomic distress was positively correlated with all measures of JFO exposure at the 800m level, and the total number of JFOs and JFO density per square kilometre at the 1600m level. Similarly, regression analysis showed a significant relationship between JFO outlet density at 1600m and both urbanicity and socioeconomic distress. This suggests students attending schools in areas with higher distress are exposed to more JFOs than students attending schools in areas with moderate or low distress. Socioeconomic distress level was negatively correlated

with the proximity to nearest convenience store, meaning schools in higher distressed areas have a shorter distance to the nearest convenience store than those in areas with moderate to low levels of distress.

The results addressing Objective 1 also show urbanicity to be positively correlated with each measure of JFO exposure assessed. In other words, as the urbanicity of a school increases from rural to urban, the number of JFOs per school zone increases (Table 4.1), the school zones become more saturated with JFOs per square kilometre, and the distance to nearest JFO type decreases meaning urban schools are closer to JFOs. To use JFO density for 800m school zones, 58.8% of rural schools had zero JFOs per square kilometre compared to 25% of suburban schools and only 3.33% of urban schools. When accounting for the population within each school zone, similar results were found. As urbanicity of the school changes from rural to urban, the number of JFOs per population of the school zone at both 800m and 1600m was found to increase.

### 4.4.2 Consumer Food Environment

Despite including duplicate restaurants for correlation analysis and linking neighbourhood distress level with each menu total score, the results addressing Objective 2 did not find a relationship between restaurant neighbourhood distress level and presence of a children's menu, nor did they find a relationship between restaurant neighbourhood distress level and children's menu total score. Children's menus included in this study are in areas with low, moderate, and high socioeconomic distress, as Figure 4.2 shows. Within the City of London, the restaurants with children's menus can be seen following the street corridors, rather than congregating in areas with a certain level of distress. Thus, the likelihood of a children's menu being offered in a restaurant in a highly-distressed area is no greater than that of a restaurant in a minimally distressed area.

In addressing Objective 3, a positive correlation was found between urbanicity and restaurant use of branded marketing to promote children's menus, when including duplicate restaurants for analysis. This may relate back to the finding of JFO saturation

increasing with urbanicity and may be due to a larger number of chain restaurants locating in urban areas, as chain restaurants were found to be the type to most often employ branded marketing. A negative correlation was also found between urbanicity and unhealthy dessert automatically included with a children's meal. This suggests that children's menus in rural areas are more likely to automatically include unhealthy desserts (e.g. ice cream-based desserts or generic "frozen treats"). These correlations, however, were quite weak and confirm the need for further research to understand how children's menu content varies based on neighbourhood urbanicity.

Efforts to address Objective 3 do not, however, indicate that children's menus in areas with high levels of socioeconomic distress are more or less likely to have poorer quality children's menus. Poor quality menus were categorized as those with scores of -3 to 0. Over half (52.8%) of the children's menus included in this study received poor quality scores, but as seen in Figure 4.2, these are in areas of all levels of distress, not just the highly-distressed areas. In terms of quality, only 7.5% of included menus received a score indicating high quality. This suggests children's menus in general are of poorer quality, regardless of the neighbourhood distress level. Even though children's menus are generally unhealthy across all levels of neighbourhood distress, more JFOs were found in the highly-distressed neighbourhoods. This is consistent with other studies that higher distressed areas have greater access to unhealthy foods (Black, Moon, & Baird, 2014; Larson, Story, & Nelson, 2009; Walker, Keane, & Burke, 2010).

Of 174 total unique menus, over half (56.3%) list a type of soda as a beverage choice specifically on the children's menu, while only three menus were found to include a bottle of water as a choice and none of the menus were found to list tap water as a beverage choice. Without listing it on the menu as a specific choice, parents and children may not know water is available and may be more susceptible to ordering other beverages listed. This finding is extremely concerning as during the study period the London-Middlesex region was amid the Healthy Kids Community Challenge, a provincial-wide initiative funded by the Ministry of Health and Long Term Care with a goal of creating improvements for children in three main areas including healthy eating

and lifestyle. The second theme of the challenge was "Water Does Wonders", a theme intended to promote drinking more water and less sugary beverages. Given that only three menus offer water as a specific choice for children, however, there is still much to be done in terms of ensuring children are provided with healthy options when dining out, including reminding children when dining out that ordering a glass of water is always an option. Similarly, local restaurants could be incentivized to add water as a menu choice.

Some studies have found nutrition labelling and the inclusion of healthier options may indeed influence children's ordering (Anzman-Frasca et al., 2015; Hobin et al., 2016; McCluskey, Mittelhammer, & Asiseh, 2012). Just under one-third (31%) of London-Middlesex menus offer non-fried vegetable sides; the results of this study may therefore be used to initiate interventions or encourage local restaurants to shift promotions or add healthier options.

### 4.4.3 Strengths and Limitations

Food environment studies that examine the consumer FE tend to focus on what is available within grocery stores, or assess general restaurant menus. Though food environment research in Canada is a rapidly growing field (Minaker et al., 2016), a focus on food environments for children is still lacking. By using the CMA to explore the variation in children's menus specifically, not just in urban or rural regions, but suburban regions as well, and by analyzing children's menus with respect to level of socioeconomic distress, this study helps fill gaps in the literature.

Despite this strength, limitations exist within this study. The first relates to the menu collection. This study was conducted on the menus during the summer and fall of 2016, but a handful of new restaurants have opened within the study area since that time, and at least two more have closed, including some whose menus were included in this study. This is recognized and it is recommended that children's menus be assessed again in the future.

There are also limitations that exist within the CMA itself. Though three menus were found to offer water bottles as a beverage choice, the availability of water was not

included on the tool as a scored item. Future CMA studies may consider adding a category that accounts for water availability on the menu. Similarly, several restaurants called during the data collection period indicated there was no physical children's menu, but that the establishment served "kid-friendly items" or offered child-sized portions of entrées on request. Because there was no physical children's menu, these restaurants were excluded from the study because the CMA only assesses the separate children's menu.

A final limitation was the assessment of only children's menus. Though convenience stores and grocery stores were included as JFOs for the community food environment assessment, only restaurant children's menus were audited for the consumer food environment assessment. The environment within the elementary schools was not examined as there is no outside source of food within the London-Middlesex region elementary schools and the school food environment falls under the *organizational* food environment rather than community or consumer food environment. Children, however, are not just exposed to restaurants – nor only items from children's menus – and future research should include the assessment of all outlets, perhaps using variations of the NEMS tools for grocery stores, convenience stores, and restaurants, in the consumer food environment to better understand what is available for children.

## 4.5 Conclusion

These results suggest urbanicity and neighbourhood socioeconomic distress level are associated with children's exposure to junk food outlets within elementary school zones, while urbanicity is associated with the inclusion of branded marketing and unhealthy desserts on restaurant children's menus. This study provides new insight on children's community and consumer food environments as well as the spatial discrepancies that exist between those environments and levels of both urbanicity and neighbourhood socioeconomic distress. The results of this study have the potential to contribute to public health efforts in developing public policy changes or environmental interventions for the children's FE in the London-Middlesex region and beyond. Educators, especially those within highly distressed/urban areas, can use these results to increase food literacy

and children's understanding of healthy and unhealthy dietary behaviours. Public health and governmental officials can use these results to strengthen the relationship between restaurants and encourage or incentivize the inclusion of healthy menu choices, as well as use these results to tailor future interventions to focus on restaurant children's menus. These findings, though focused on one region, are broadly applicable to Southwestern Ontario, across Canada, and internationally, as well.

## 4.6 Acknowledgements

I would like to thank the Middlesex County and City of London Healthy Kids Community Challenge as well as the Children's Health Foundation and the Children's Health Research Institute for providing funding and support for this research. I would also like to thank the planning departments of the City of London and Middlesex County in addition to the Middlesex-London Health Unit for providing data. Finally, I want to acknowledge Taylor Bailey, Madisyn Fisher, Sana Homsi, Ellen Lakusiak, Liana Langley, Anne McNairn, Angela Piaskoski, Katarzyna Rabenda, Natalya Rayevskaya, and Zach Walters who assisted with the initial data collection process, as well as Dr. Jason Gilliland, Dr. Godwin Arku, and Dr. Richard Sadler for their support and patience.

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# Chapter 5

# 5 A Comparative Analysis of the Consumer Food Environment in Rochester (New York) and London (Ontario): Assessing Children's Menus by Neighbourhood Socioeconomic Characteristics

## 5.1 Introduction

Childhood obesity, which can result in a number of health issues including type 2 diabetes, poor emotional health, and hypertension, is increasing in Canada and the United States at an alarming rate (Reilly et al., 2003; Singh et al., 2008). Obese or overweight children are five times more likely to see that obesity, and those related health issues, continue into adulthood (Vikraman, Fryar, & Ogden, 2015). Obesity is not just the result of poor individual choices, however, and is influenced by the surrounding environment and area socioeconomic factors (Glanz, Sallis, Saelens, & Frank, 2005; Story, Kaphingst, Robinson-O'Brien, & Glanz, 2008; Gilliland et al., 2012). Food environments in North America, specifically in Canada and the United States, often promote high calorie, high fat, high sugar foods and beverages, especially in low-income and highly socioeconomically deprived neighbourhoods (Cummins & Macintyre, 2006). In the United States, over one-third of children consume these calorie-dense foods daily (Vikraman et al., 2015), and in Canada over one-quarter of children consume high sugar-sweetened beverages daily (Heart & Stroke, 2017).

As an increase is seen in unhealthy food and drinks purchased and consumed by children away from home, it is becoming more necessary to analyze the consumer food environment (FE), conceptualized by Glanz et al. (2005) as the price, promotion, placement, and availability of healthy options and nutrition information. While there has been an increase in consumer FE studies over the years, the primary focus tends to be on the FE within grocery stores. In a 2014 systematic review of FEs for children by Engler-Stringer and colleagues, only three of 26 studies assessed the consumer FE for children, all of which assessed how the FE impacts children's BMI or diet. None of these studies

assessed the content of restaurant children's menus or their relationship to the surrounding neighbourhood (Engler-Stringer, Le, Gerrard, & Muhajarine, 2014).

Studies of restaurant consumer FEs and the relationship with neighbourhood socioeconomic characteristics are increasing on a broad scale; for instance, Larson *et al.* (2009) found that restaurants in wealthier areas in the US offer healthier menu options than low income areas. This disparity comes as no surprise, as research continuously shows low income neighbourhoods in the US have worse access to healthy food (Black, Moon, & Baird, 2014; Larson, Story, & Nelson, 2009; Walker, Keane, & Burke, 2010). Other studies, meanwhile, have found that similar neighbourhoods in Canada have better access to unhealthy food outlets, when compared to high income neighbourhoods (Black et al., 2014; Health Canada, 2013).

Studies of the restaurant consumer FE are often conducted with a menu audit tool such as the Nutrition Environment Measures Survey for Restaurants (NEMS-R) (Saelens, Glanz, Sallis, & Frank, 2007). This tool has been applied in both Canada (Hobin, Lebenbaum, Rosella, & Hammond, 2015; Wang, Engler-Stringer, & Muhajarine, 2016) and the United States (Partington, Menzies, Colburn, Saelens, & Glanz, 2015; Pereira, Sidebottom, Boucher, Lindberg, & Werner, 2014; Saelens et al., 2012), but consistently without a focus on children.

In order to better assess the restaurant consumer FE for children, Krukowski and colleagues created the Children's Menu Assessment (CMA), a menu audit tool based off of the NEMS-R that focuses solely on the children's menu (Krukowski, Eddings, & Smith West, 2011). To date, this tool has been used in the US and Ireland, mainly to reveal a lack of healthy meal options for children or assist in restaurant interventions (Ayala et al., 2016; Crixell, Friedman, Fisher, & Biediger-Friedman, 2014; Diedrich & Otten, 2015; Hill et al., 2015; Krukowski et al., 2011; McGuffin et al., 2013; Otten et al., 2012). While the introduction of the CMA has aided in advancing the collective understanding of the consumer FE as it directly pertains to children, its use has been primarily descriptive in nature and falls short of in-depth analysis into how the children's

FE varies depending on country context or based on neighbourhood socioeconomic characteristics.

Thus, the purpose of this study is to assess the restaurant consumer FE for children using a previously unexplored approach: a cross-border comparative analysis of the restaurant consumer FE for children within and between two geographically proximate but internationally distinct North American cities: London, Ontario, Canada, and Rochester, New York, USA. The research objectives for this study are:

1. Determine whether the restaurant consumer food environment for children differs *between* the cities of London, Ontario in Canada and Rochester, New York in the United States.

2. Determine the relationship between neighbourhood restaurant quality for children and socioeconomic characteristics *within* the city of London, Ontario and *within* the city of Rochester, New York.

This study aims to first assess and compare the menu content and quality (with poor quality corresponding to low children's menu scores) in both cities through a descriptive analysis of restaurant children's menus. The study will then examine how the restaurant consumer FE differs within each city and between the two cities using the Neighbourhood Restaurant Quality Index for Children (NRQI-C), described in detail below.

## 5.2 Methods

### 5.2.1 Study Setting

This research was conducted within the city limits of London, Ontario, Canada, a city covering 420.35 $km^2$ of the province of Ontario with a population of 383,822 in 2016 (Statistics Canada, 2016), and Rochester, New York, USA, a smaller city which covers 96.1 $km^2$ of the state of New York with a population of 210,565 as per the 2010 census (Bureau of the Census, 2015). In the City of London, research has shown fast, calorie-dense food selling outlets are associated with poor diet quality and increased fast food

purchasing for children and youth (He et al., 2012a; He et al., 2012b; Sadler, Clark, Wilk, O'Connor, & Gilliland, 2016). Though there has been much less research on children's FEs in the City of Rochester, data from the New York State Department of Health shows childhood obesity rates, influenced by dietary behaviours, in Rochester over the last decade have been as high as nearly one-half (New York State Department of Health, 2016).

Both London and Rochester are geographically located within the Great Lakes region, with a major river winding through the city. The two cities also have similar economies, as former manufacturing cities turned medical/research centres: London with the University of Western Ontario, and Rochester with the University of Rochester. At the same time, London and Rochester have developed under different political and socioeconomic conditions, especially with respect to how food environments are incorporated into urban planning. Food environment planning in the United States has been on the rise through the American Planning Association and the implementation of the APA Policy on Community and Regional Food Planning (American Planning Association, 2007). Despite the encouraging attempt some cities in the US may have made to incorporate this aspect into their own plan, the official or comprehensive plan of the City of Rochester currently has no mention of food at all.

On the other hand, the Canadian Institute of Planners and the Ontario Professional Planner Institute have both encouraged more discussion around including the food environment as a key component of planning (Canadian Institute of Planners, 2013). Similarly, the government of Canada has been more involved in examining various aspects of the food environment through collaboration between stakeholders and Health Canada (Health Canada, 2013). Unlike the City of Rochester, the official plan of the City of London has over 100 mentions of the word "food" and addresses how the city will meet goals related to the food environment in the future including ensuring all Londoners have access to food sources providing affordable, safe, healthy, local foods (City of London, 2016).

By using two study areas, this chapter can assess the Canada-US differences in the consumer food environment for children.

### 5.2.2 Restaurant Assessment

Addresses were obtained for fast food and full service restaurants from the City of Rochester Planning Department and the Middlesex-London Health Unit. Address locations were geocoded in a GIS (ArcGIS 10.3, ESRI) and verified through websites, Google Maps and Streetview, phone calls, and site visits. Multiple types of restaurants were included rather than focusing solely on fast food restaurants because full service restaurants typically offer the same items as their fast food counterparts. Because of this, assessing fast food restaurants as the sole source of unhealthy restaurant entrées and options would vastly underestimate neighbourhood exposure to unhealthy foods in the restaurant consumer FE (Sharkey, Johnson, Dean, & Horel, 2011).

After verifying the addresses, all existing children's menus were collected within each study area between June and August 2016. The online menu of each restaurant in the study area was consulted and saved if the children's menu was posted. If the online menu did not include a children's menu, a phone call was made to the restaurant to confirm whether or not the restaurant offered a children's menu in-store. Restaurants confirmed as offering children's menus in-store were then visited in-person for collection.

Each children's menu was assessed and scored using the Children's Menu Assessment (CMA) tool, which consists of questions regarding healthfulness of entrées, proportion of whole to white grains, desserts, beverages, sides, nutritional information, toy promotions, and branded marketing (Krukowski et al., 2011). Total CMA scores range from -5 to 21, where higher scores correspond to greater availability of healthy choices (Krukowski et al., 2011). Previous CMA studies do not divide menu scores into various quality categories; however, based on the natural breaks in the menu scores, poor quality menus were categorized as those menus with CMA scores of 0 or lower, average quality menus

as those with CMA scores from 1 to 4, and high quality menus as those with CMA scores of 5 or higher.

The term “healthy” is used throughout this study to describe menu items and is based off the definitions and instructions listed on the CMA, which puts the burden of proof on the restaurant, rather than the researcher scoring the menu, to identify whether items are healthy or not. For example, the CMA instructs that an entrée prepared as grilled, baked, smoked, or broiled would be considered healthy when referring to proteins such as chicken or fish, while a sandwich that is grilled, such as grilled cheese, is not necessarily healthy even though it is described as grilled. Two raters assessed and scored each menu, and when discrepancies arose, a third rater was consulted.

### 5.2.3 Quantifying Restaurant Accessibility/Opportunity

To make the children’s menu score more meaningful at the neighbourhood level, a new Neighbourhood Restaurant Quality Index for Children (NRQI-C) was created. This novel index represents restaurant accessibility/opportunity measures from each residential neighbourhood. The NRQI-C is best calculated at the block level, (census block in the United States or dissemination block in Canada) as this allows for a finer understanding of local-level variations in accessibility to restaurants and fast food outlets, and is calculated as follows:

NRQI-C = (sum of all children’s menu scores / total number of restaurants)

Restaurants that had a children’s menu were assigned the menu score calculated from the CMA. Restaurants that did not offer a children’s menu were assigned a score of 0. Using the Network Analyst extension of ArcGIS 10.3, 800m network service areas or network buffers were created from the centroid of each block. Network buffers were used as they more accurately depict the area that influences walking, whereas circular buffers are more likely to ignore barriers to walking (e.g. rivers and/or railroads that are difficult to cross) (Oliver, Schuurman, & Hall, 2007). As well, restaurants are destinations, and employing a network buffer around the block centroid better encapsulates the variety of restaurants around a neighbourhood. Without this network

buffer step, a restaurant just outside the block may be missed, resulting in an edge effect and inaccurate results (as explored in Sadler, Gilliland, & Arku, 2011). The buffer distance of 800m was chosen as it is commonly used among food access studies (Timperio et al., 2009, Jilcott et al., 2011), among children's FE studies (Engler-Stringer et al., 2014), and is a distance often recognized as walkable in 10-15 minutes (Gilliland et al., 2012).

After calculating the network buffers, the spatial join function was employed to determine the total number of restaurants and the sum of the children's menu scores within each buffer. With these two values, NRQI-C was then calculated and assigned that value to the buffer's respective block. This process was repeated for every block within the city limits for Rochester and London. To account for the fact that some blocks are parks and other unpopulated areas, NRQI-C scores was weighted by population. This was done by dividing the block population by the corresponding block group (BG) or dissemination area (DA) population, and multiplying that value by the NRQI-C for the block. This process ensures the NRQI-C score accurately reflects the population of the respective area. Because the smallest level at which demographic census data is released is the BG (in the US) and DA (in Canada) – one level up from block –the average weighted NRQI-C of all blocks was then calculated in the corresponding BG or DA using the summarize table tool.

### 5.2.4 Statistical Analysis

Once each BG or DA was assigned its corresponding NRQI-C value, correlation and regression models were run to assess the relationship between neighbourhood restaurant quality for children and variables of the social environment including population density, percent unemployed, percent of the population identifying as a visible minority, percentage of lone parent families, and median household income. Rochester and London were statistically analyzed individually, and then a binary variable representing London vs. Rochester was included to assess all data together and potentially identify any Canada-US differences in restaurant quality.

Before analyzing median household income across an international border, the data had to first be normalized. This was achieved by calculating the z-score for median household income for every DA in London and every BG in Rochester using the following equation:

$$z = (x - \mu) / \sigma$$

Where x = the median household income for the individual DA or BG, $\mu$ = the mean of median household income over all DAs or BGs, and $\sigma$ = the standard deviation of the median household income over all DAs or all BGs.

The z-score for median household income was calculated using the above equation rather than converting one currency to another because currency exchange rates fluctuate daily, and would not accurately reflect the overall values.

Similarly, the percent visible minority variable had to be made comparable between both cities. In Canada, a visible minority is anyone who identifies as a race/ethnicity other than Indigenous or Caucasian/white (Statistics Canada, 2016) so a similar variable for Rochester was created which included those who identified as a race/ethnicity other than Native American or Caucasian/white.

## 5.3 Results

The original list included 926 restaurants within London city limits, with 323 (34.9%) identified as having separate children's menus, and 242 restaurants within Rochester city limits, with 50 (20.7%) identified as having separate children's menus.

### 5.3.1 CMA Descriptive Results

After excluding restaurant duplicates (e.g. chain restaurants with identical menu options), the study sample included 145 unique children's menus in London and 40 unique children's menus in Rochester.

Age limits for the menus were specified on 60% of the menus in London and 42.5% of the menus in Rochester, and were for children 12 and under (London=28.3%,

Rochester=30%), or children 10 and under (London=13.1%, Rochester=12.5%). The remaining of the menus did not specify an age limit, meaning people of all ages are able to order from those menus.

Total menu scores for all 40 unique menus in Rochester ranged from -2 to 13 with a mean score of 2 and standard deviation (SD) of 3.31. Total menu scores for all 145 unique menus in London ranged from -3 to 9 (mean=1.19, SD=2.35). These total scores are described in Table 5.1. Poor quality menus were defined as those scoring 0 or lower. Of the total menus in Rochester, 21 (52.5%) scored 0 or lower, 11 (27.5%) had a score between 1 and 4, and eight (20%) had a score of 5 or higher. In London, 73 menus (50.3%) scored 0 or lower, 58 (40%) scored between 1 and 4, and 14 (9.7%) had a score of 5 or higher.

**Table 5.1** Number of unique menus that received a score within each category.

| | **Rochester (n=40)** | | **London (n=145)** | |
|---|---|---|---|---|
| **Total CMA Score** | **n** | **%** | **n** | **%** |
| **0 or lower** | 21 | 52.5 | 73 | 50.3 |
| **1 to 4** | 11 | 27.5 | 58 | 40 |
| **5 or higher** | 8 | 20 | 14 | 9.7 |
| **9 or higher** | 4 | 10 | 1 | 0.7 |

In London, three unique menus included a toy in the children's meal, and three used branded marketing as a means of promotion. Interestingly, the exact same is true for Rochester as well. In London, 17.2% of children's menus offered at least one healthy entrée while 22.5% were found in Rochester. While Rochester children's menus seem to offer more healthy entrées, only 20% offered a non-fried vegetable side such as a salad or steamed broccoli, while in London the figure stands at 30.3%. Conversely, more menus in Rochester offered fruit sides (30%) than in London (13.8%). Very few menus offered healthy desserts in either city (0% in Rochester, 1.4% in London), while 10% automatically included unhealthy desserts with meals in Rochester and 46.9% include unhealthy desserts with meals in London. Additional results and the comparison between the two cities can be found in Table 5.2.

**Table 5.2** Children's Menu Assessment categories scored.

| **Children's Menu Assessment Categories** | **Rochester (n=40)** | | | **London (n=145)** | | |
|---|---|---|---|---|---|---|
| **Nutrition guidance** | **n** | **%** | **Mean Score** | **n** | **%** | **Mean Score** |
| Any nutrition information | 3 | 7.5 | 0.6 | 8 | 5.5 | 0.11 |
| Symbol indicating healthy item | 2 | 5 | 0.02 | 7 | 4.8 | 0.05 |
| **Entrées** | | | | | | |
| Healthy entrée | 9 | 22.5 | 0.48 | 25 | 17.2 | 0.26 |
| Healthy entrée salad | 2 | 5 | 0.08 | 5 | 3.5 | 0.07 |
| Whole-grain option | 2 | 5 | 0.28 | 9 | 6.2 | 0.1 |
| **Beverages** | | | | | | |
| Juice, any | 17 | 42.5 | n/a | 78 | 53.8 | n/a |
| Juice, listed as 100% juice | 2 | 5 | 0.14 | 6 | 4.1 | 0.03 |
| Milk, any | 19 | 47.5 | n/a | 78 | 53.8 | n/a |
| Milk, listed as low-fat, 1%, or non-fat | 6 | 15 | 0.2 | 5 | 3.5 | 0.03 |
| Soda targeted at children | 12 | 30 | -0.2 | 79 | 54.5 | -0.55 |
| Opportunity for healthier beverage substitution | 16 | 40 | 0.54 | 71 | 49 | 0.49 |
| Free soda refills for children | 1 | 2.5 | -0.02 | 15 | 10.3 | -0.1 |
| **Side Dishes** | | | | | | |
| Non-fried vegetables | 8 | 20 | 0.32 | 44 | 30.3 | 0.61 |
| Fruit, any | 12 | 30 | 0.46 | 20 | 13.8 | 0.14 |
| Fruit, without added sugar | 5 | 12.5 | 0.2 | 12 | 8.3 | 0.08 |
| Dairy, any | 1 | 2.5 | 0.04 | 3 | 2.1 | 0.02 |
| Dairy, low-fat | 0 | 0 | 0 | 0 | 0 | 0 |
| Opportunity for healthier side substitution | 13 | 32.5 | 0.48 | 46 | 31.7 | 0.32 |
| **Desserts** | | | | | | |
| Healthy desserts | 0 | 0 | 0 | 2 | 1.4 | 0.05 |
| Included in children's meal | 4 | 10 | -0.1 | 68 | 46.9 | -0.44 |
| **Toys/Marketing** | | | | | | |
| Branded marketing toward children | 3 | 7.5 | -0.2 | 3 | 2.1 | -0.02 |
| Toy included with children's meal | 3 | 7.5 | -0.2 | 3 | 2.1 | -0.02 |
| **Total Score** | n/a | n/a | 1.97 | n/a | n/a | 1.19 |

As Table 5.3 shows, the mix of children's menu restaurant type and cuisine type was relatively similar. Because menus can offer multiple cuisine types or have full service

areas in addition to a fast-food counter, menus may be included in multiple categories. In Rochester, 70% of the children's menus came from full service restaurants, 5% from fast casual, 0% from buffets, and 27.5% from fast food establishments. American/Canadian cuisine (e.g., burgers, French fries, hot dogs, etc.) was served at 82.5% of the restaurants included, Asian cuisine was served at 7.5%, Mexican cuisine was served at 5%, Italian cuisine at 5%, pizza at 5%, deli sandwiches at 10%, and other cuisines at 7.5%. Cuisine deemed as other included Greek, Ethiopian, and Mediterranean. In London, 82.1% of children's menus came from full service restaurants, 7.6% from fast casual, 0.7% from buffets, and 11% from fast food establishments. American/Canadian cuisine was served at 78.6% of the restaurants included, Asian cuisine was served at 4.1%, Mexican cuisine was served at 4.8%, Italian cuisine at 4.8%, pizza at 4.1%, deli sandwiches at 4.8%, and other cuisines at 4.1%. Cuisine deemed as other included Hungarian, Mediterranean, British, and Indian. Buffets were generally outside the scope of this study as they have discounted children's pricing, but no separate children's menu. However, one buffet-style restaurant in London did have a separate children's menu so it was included in the study.

**Table 5.3** Number of children's menus per restaurant and cuisine type.

| | **Rochester (n=40)** | | **London (n=145)** | |
|---|---|---|---|---|
| **Restaurant Type** | **n** | **%** | **n** | **%** |
| Full Service | 28 | 70 | 119 | 82.1 |
| Fast Casual | 2 | 5 | 11 | 7.6 |
| Buffet | 0 | 0 | 1 | 0.7 |
| Fast Food | 11 | 27.5 | 16 | 11 |
| **Cuisine Type** | | | | |
| American/Canadian | 33 | 82.5 | 114 | 78.6 |
| Asian | 3 | 7.5 | 6 | 4.1 |
| Mexican | 2 | 5 | 7 | 4.8 |
| Italian | 2 | 5 | 7 | 4.8 |
| Pizza | 2 | 5 | 6 | 4.1 |
| Deli | 4 | 10 | 7 | 4.8 |
| Other | 3 | 7.5 | 6 | 4.1 |

In London, 872 entrée choices were available over 145 unique children's menus. The average number of entrée choices per menu was six (minimum=1, maximum=30). In Rochester, 305 entrée choices were available over 40 unique menus. The average number of entrée choices per menu was 7.6 (minimum=1, maximum=30). Out of the 872 menu choices in London, 7.9% were grilled cheese, 15.5% were burgers, 11.8% were chicken tenders or wings, 5.6% were pizza, and 13.7% were pasta or macaroni and cheese. Out of 305 entrée choices in Rochester, 6.9% were grilled cheese, 13.1% were burgers, 11.5% were chicken tenders or wings, 3.6% were pizza, and 8.5% were pasta or macaroni and cheese. In London, 4.2% were healthy entrees (both salads and other) while 16.7% of entrées were healthy in Rochester. These figures are reflected in Table 5.4.

**Table 5.4** Number of entrée types out of total number of entrée choices per city.

| | **Rochester (n=305)** | | **London (n=872)** | |
|---|---|---|---|---|
| **Entrée Type** | **n** | **%** | **n** | **%** |
| Grilled Cheese | 21 | 6.9 | 69 | 7.9 |
| Burger | 40 | 13.1 | 135 | 15.5 |
| Chicken Tenders or Wings | 35 | 11.5 | 103 | 11.8 |
| Pizza | 11 | 3.6 | 49 | 5.6 |
| Pasta or Macaroni and Cheese | 26 | 8.5 | 119 | 13.7 |
| Healthy Entrée | 51 | 16.7 | 37 | 4.2 |

### 5.3.2 NRQI-C Statistical Analysis Results

Pearson's correlation analysis (Table 5.5) for Rochester revealed a significant positive association between NRQI-C and median household income, suggesting menu quality increases as neighbourhood median household income increases. This association can be seen in Figure 5.1, where the higher income (lighter coloured) BGs have higher NRQI-C values. Additionally, there were significant negative associations between NRQI-C and percent unemployed as well as percent visible minority. This suggests that menu quality is worse in neighbourhoods where the unemployment rate is high or a larger percent of

the neighbourhood population is a visible minority. Regression analysis did find a significant relationship in Rochester between NRQI-C and the independent variables of population density, median household income, percent unemployed, percent visible minority, and percent lone parent families ($p<0.05$).

**Table 5.5** Correlations between Neighbourhood Restaurant Quality Index for Children and variables of the social environment in Rochester.

| | | a | b | c | d | e | f |
|---|---|---|---|---|---|---|---|
| **a** | **Population Density** | 1 | | | | | |
| **b** | **Median Household Income** | -0.077 | 1 | | | | |
| **c** | **Unemployment Rate** | 0.084 | -0.554** | 1 | | | |
| **d** | **Visible Minority Percentage** | 0.325** | -0.493** | 0.428** | 1 | | |
| **e** | **Lone Parent Percentage** | 0.063 | -0.406** | 0.208** | 0.292** | 1 | |
| **f** | **NRQI-C** | -0.002 | 0.149* | -0.170** | -0.244** | -0.119 | 1 |

*. Correlation is significant at the 0.05 level.
**. Correlation is significant at the 0.01 level.

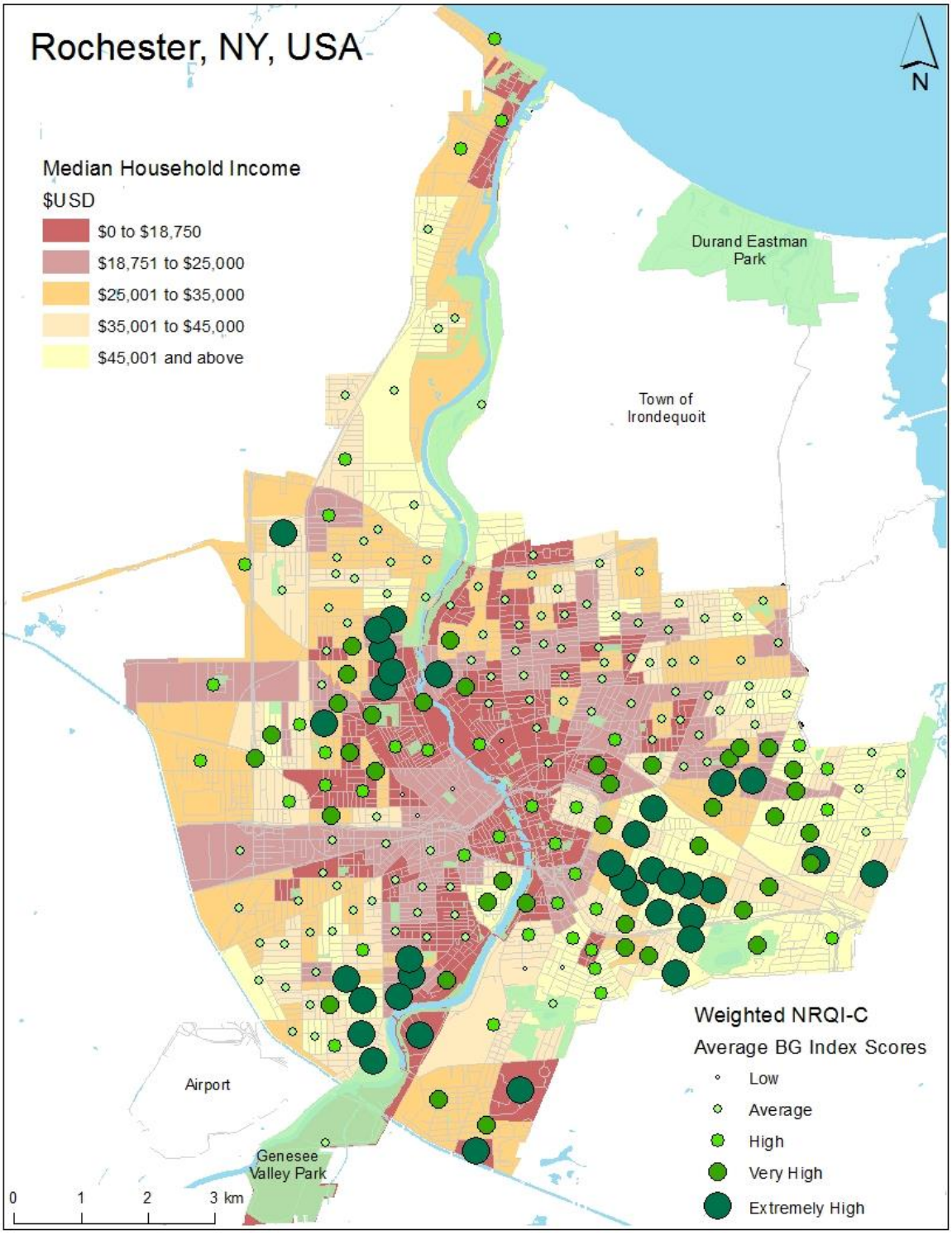


**Figure 5.1** A visualization of the relationship between the Neighbourhood Restaurant Quality Index for Children weighted by population and median household income in Rochester, NY per census block group (BG).

Pearson's correlation analysis (Table 5.6) revealed opposite associations in London. A significant negative association was found between NRQI-C and median household income, and a significant positive association was found between NRQI-C and percent unemployed as well as percent lone parent. These results suggest menu quality is higher in neighbourhoods with lower median household income (Figure 5.2), higher unemployment rates, or higher percentages of lone parent families. A possible explanation of these surprising results is reviewed in the Discussion section. Regression analysis did find a significant relationship in London between NRQI-C and the independent variables of population density, median household income, percent unemployed, percent visible minority, and percent lone parent families ($p<0.05$).

**Table 5.6** Correlations between Neighbourhood Restaurant Quality Index for Children and variables of the social environment in London.

| | | a | b | c | d | e | f |
|---|---|---|---|---|---|---|---|
| **a** | **Population Density** | 1 | | | | | |
| **b** | **Median Household Income** | -0.225 | 1 | | | | |
| **c** | **Unemployment Rate** | 0.142** | -0.236 | 1 | | | |
| **d** | **Visible Minority Percentage** | 0.200** | -0.001 | 0.169** | 1 | | |
| **e** | **Lone Parent Percentage** | 0.287** | -0.621 | 0.184** | 0.108** | 1 | |
| **f** | **NRQI-C** | 0.013 | -0.095** | 0.091* | 0.022 | 0.111** | 1 |

*. Correlation is significant at the 0.05 level.
**. Correlation is significant at the 0.01 level.

When adding a binary variable to assess the Canada-US differences, regression analysis did indicate a significant relationship between NRQI-C and the independent variables of population density, median household income, percent unemployed, percent visible minority, and percent lone parent ($p<0.05$), suggesting there is a Canada-US difference in the neighbourhood restaurant quality for children.

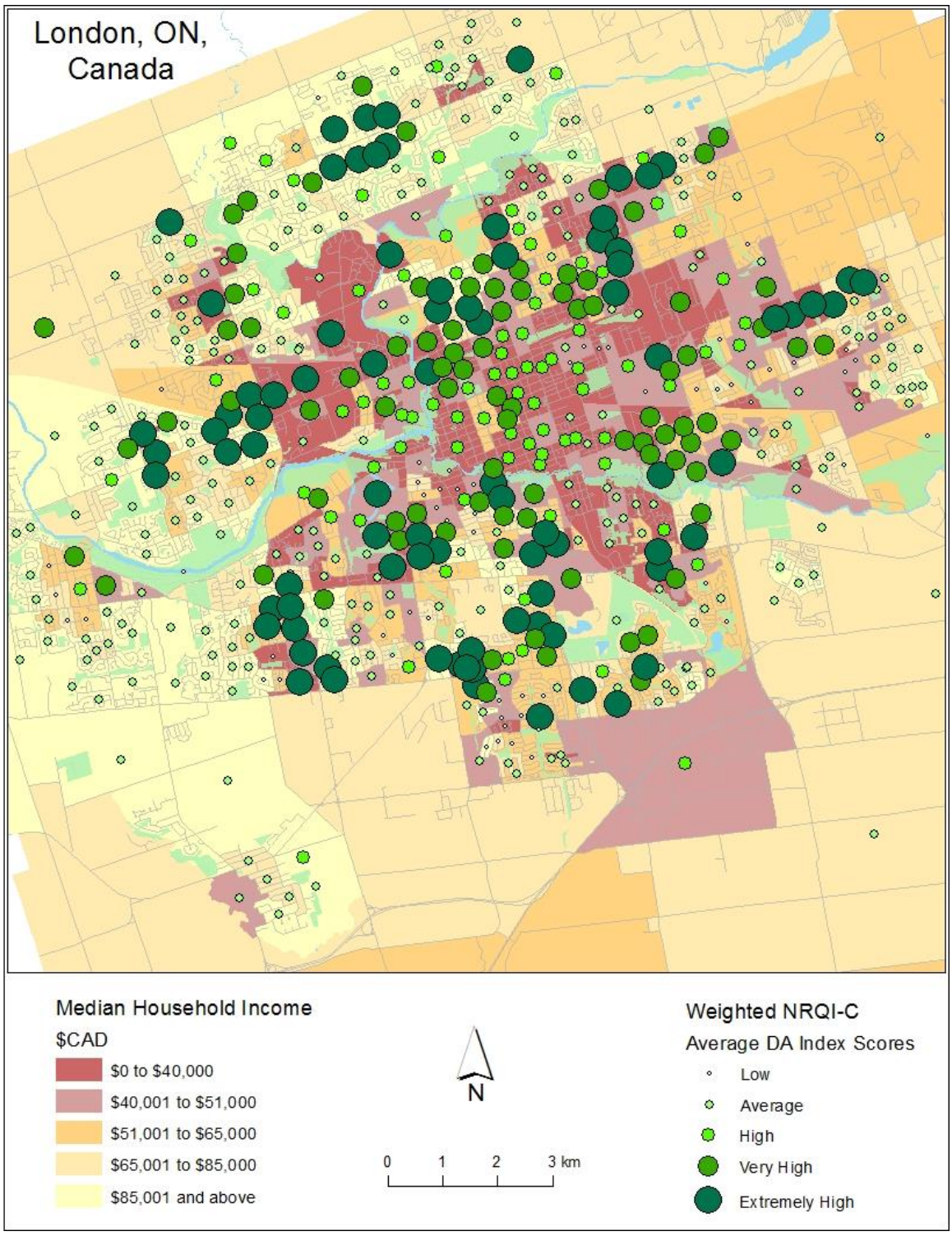


**Figure 5.2** A visualization of the relationship between the Neighbourhood Restaurant Quality Index for Children weighted by population and median household income in London, ON per census dissemination area (DA).

## 5.4 Discussion

To my knowledge, this study is the first to investigate the children's restaurant FE in two North American cities that differ internationally, and the first to develop and implement a Neighbourhood Restaurant Quality Index for Children. Several studies have employed the use of the CMA in various settings to examine the restaurant FE for children (Hill et al., 2015, Krukowski et al., 2011, Otten et al., 2012, Diedrich & Otten, 2015, Crixell et al., 2014, Ayala et al., 2016, McGuffin et al., 2013), but virtually none go beyond descriptive results to statistically analyze the FE. An exception is Hill *et al.* (2015), which explored how children's menu scores differ in urban and rural areas, as well as block group race/ethnicity. My study reports on the findings of the children's menu audits in two urban study areas, and expands to consider international variations as well.

In Rochester, a positive correlation was found between NRQI-C and median household income suggesting that as neighbourhood income increases, more neighbourhood restaurants not only offer a children's menu, but offer a children's menu with healthier options. This is consistent with FE literature in the United States which suggests those in higher income neighbourhoods have better access to healthier foods than those in lower income neighbourhoods (Black et al., 2014; Larson et al., 2009; Walker et al., 2010). Additionally, negative correlations were found between NRQI-C and percent unemployed, as well as percent visible minority. This suggests that neighbourhoods with more minorities or unemployed residents will have fewer restaurants offering children's menus, and if a children's menu does exist, the quality will be substantially poorer than a neighbourhood with a lower minority or unemployment rate. These results highlight the socioeconomic inequalities characterized by American FE literature, and are again consistent with the structural differences, characterized by planning in the United States which favours private-sector led development (i.e., restaurants). This can lead to landscapes that are naturally less protective of public health despite the paradoxical fact that modern zoning as a means of protecting public health was born in the US (Claeys, 2004). The results are also consistent with FE literature in the United States that suggests

high minority neighbourhoods have worse access to healthier options (Zenk et al., 2005; Hilmers, Hilmers, & Dave, 2012).

In London, a negative correlation was found between NRQI-C and median household income, suggesting that as neighbourhood income decreases, more neighbourhood restaurants have children's menus, and those children's menus have healthier options. One explanation for this is that many of the highest scoring children's menus were those found in fast food chains (e.g. McDonald's, Wendy's, and Subway). These chains, though stereotyped as unhealthy, have started offering more non-fried sides, healthier drink options, healthier entrée alternatives, and display nutritional information for children. Research in Canada suggests lower income neighbourhoods have better access to outlets such as fast food restaurants (Black et al., 2014; Health Canada, 2013) and since many of these restaurants had high scoring (healthy) children's menus, the NRQI-C was higher in those areas in London.

A positive correlation was also found between NRQI-C and the percentage of lone parent families in London, suggesting neighbourhoods with higher percentages of lone parent families have a higher quantity and quality of children's menus. Lone parent families are often linked with low income, and in Canada, low income neighbourhoods tend to be more saturated with fast food restaurants – many of which received high CMA scores. Knowing this, it is understandable that areas with more lone parent families would have higher NRQI-C values. This is a positive finding because from a health equity perspective, it indicates London is structured in a way that allows for children in the most disadvantaged areas to have the best quality food, as they may not be privileged to travel great distances to access better quality foods.

It is likely that there was no relationship with NRQI-C and percent visible minority in London because the presence of racial segregation and limited opportunities is not as prominent as that which exists in the US. In London, some of the high visible minority areas are also high income areas, so the stigmatization and barrier to healthy food access is not as distinguished. Some literature suggests the "Americanization" of recent immigrants where weight is rapidly gained after arriving to the U.S. as American-type

food is seen as a status symbol and a way to acclimate to American culture (Van Hook, Baker, Altman, & Frisco, 2012; Van Hook, Quiros, Frisco, & Fikru, 2016).

Despite the size difference between the two cities and the subsequent number of children's menus included, Rochester children's menus appear to be healthier overall (Table 5.2). Rochester had a higher percentage of menus offering nutrition information, symbols indicating healthy items, healthy entrées and healthy entrée salads, 100% fruit juice, low-fat or non-fat milk, fruit without added sugar, dairy, and the opportunity for a healthier side to be substituted at no additional charge. Rochester also had a lower percentage of menus offering soda and free refills for soda specifically targeted toward children, and unhealthy desserts included in a children's meal. This may be due to the fact that Rochester has several restaurants within the city limits that push eating healthy as part of the region's "5-2-1-0 Be a Healthy Hero" initiative and the "Healthy Hero Restaurant" program. Though as discussed earlier, these restaurants tend to be in the more privileged areas.

These initiatives within the Rochester area are similar to initiatives in other communities across the United States and encourage children to engage in healthier activities every day (5-2-1-0 corresponds to eating 5 fruits and vegetables per day, having 2 hours or less of screen time per day, engaging in physical activity for 1 hour per day, and consuming 0 sugar-sweetened beverages per day), as one in three children in the city and surrounding area are overweight (Greater Rochester Health Foundation, 2007). The highest scoring children's menu (CMA total score=13) was even titled "Healthy Hero Menu Choices" and included items such as whole wheat toast, grilled turkey and chicken, and broiled fish, fresh fruit, and broccoli – providing healthy options from which children can choose.

A similar children's healthy lifestyle initiative in the City of London is called the Healthy Kids Community Challenge (HKCC), a three-part province-wide program focusing on encouraging children to engage more in physical activity, drink more water, and eat more fruits and vegetables. Interestingly, although program promotion does exist within the city, none of the children's menus assessed in London advocated for the HKCC as the

Rochester menu did for Be a Healthy Hero. This is a clear opportunity for public health and government officials to use the results of this study to engage in conversations and interventions with local restaurants to create and promote healthier menus for children.

### 5.4.1 Policy Implications

In the US and Canada, both land use and nutrition policy have been approached with a focus on the private sector and property rights, leading to inequities in exposure to unhealthy food. Land use policy on both sides of the border supports large-scale food system interests by accommodating the suburban and auto-centric settlement pattern key to the deployment of cookie-cutter big box supermarkets and chain fast food restaurants (Sodano, 2012; Bellinger & Wang, 2011). Despite Canada's generally better efforts toward central control of land use planning and efficient delivery of infrastructure, the results here suggest even these efforts can backfire by over-exposing poorer children to unhealthy foods. Similarly, food policy's focus on agricultural interests rather than public health has no doubt contributed to the health problems associated with consumption of unhealthy food products (Goodman, 2009; Jetter & Cassady, 2006; Muller, Tagtow, Roberts, & MacDougall, 2009; Reidpath, Burns, Garrard, Mahoney, & Townsend, 2002). In the US, former President Barack Obama and First Lady Michelle's efforts toward improving FEs for children through the *Let's Move!* campaign may be responsible for some of the cross-border disparity in restaurant menu quality (White House Task Force, 2010).

Given these approaches, it is not surprising that a gap exists in current food-related policy to promote healthy living (Muller et al., 2009; Sadler, Gilliland, & Arku, 2014; Shill et al., 2012), despite the evidence base demonstrating the importance of policy in shaping health-promoting environments (Morgan, 2009). The influence of the global agri-food system cannot be understated: their interests are at odds with those of public health, therefore policymaking that explicitly defends public health at the expense of big business is cast aside in the current neoliberal framework (Gortmaker, Swinburn, Levy, Carter, & Mabry, 2011; Johnson et al., 2012; Sadler, Arku, & Gilliland 2015) dominant in both nations.

With mounting evidence that disparities in exposure to unhealthy foods are rooted in modifiable land use patterns – including in this paper and in past work in the study site of London (Sadler and Gilliland, 2015; Sadler et al., 2016) – public health practitioners on both sides of the border would be well-served by increasing their advocacy around this topic. That is, even in the absence of broader scale food system changes in the nutritional content of foods made available at conventional food outlets, local-level advocates have the capacity to effect change. Such built environment changes could include limiting the density of fast food restaurants in areas where children routinely go (such as near schools), enacting sign ordinances to limit the size of advertising, establishing urban design guidelines to minimize the visual abrasiveness of fast food façades, and promoting healthy environments in ways not directly tied to the food system (such as through safe and active living).

### 5.4.2 Limitations

This study has a few limitations, both as a whole and specific to each city. First, this study assumes that children only order from the children's menu. It is acknowledged that children often do order off the general menu and recommend menu audits be conducted in the future on all restaurant menus in each study area.

Second, this study was conducted on the children's menus available and the restaurants operating during the summer and fall of 2016, but since then at least two restaurants whose menus were included in the study have closed. Similarly, at least one restaurant has added a children's menu which did not previously exist. This is recognized and again it is recommended children's menus be assessed in the future. Longitudinal data would allow us to see how the changing food landscape may shift the burden of unhealthy food options over time.

The third limitation of this study relates to the novel statistical approach taken. The results from statistical analysis conducted using the newly created NRQI-C are consistent with previous FE literature; however, since this is the first time it has been implemented, there are no other studies using this index to which results can be compared. Thus, it is

recommended future studies incorporate the use of the NRQI-C as a means to measure the neighbourhood FE.

There are also limitations that exist within the CMA itself. A small number of menus were found to offer water bottles as a beverage choice but the availability of water was not included on the tool as a scored item. Future CMA studies may consider adding a category that accounts for water availability on the menu. Similarly, several restaurants called during the data collection period indicated there was no physical children's menu, but that the establishment served "kid-friendly items" or offered child-sized portions of entrées on request. Because there was no physical children's menu, these restaurants were excluded from the study because the CMA only assesses the separate children's menu.

Finally, due to safety concerns in the Rochester area (Klofas, Altheimer, & Sweadner, 2017), four restaurants were not visited, and thus their children's menus were not included. It is expected that this did not have a significant impact on the results.

## 5.5 Conclusion

Childhood obesity is on the rise and research suggests the rise in childhood obesity rates is linked with dietary behaviours. Several studies examine the quality of restaurant children's menus specifically using the CMA, but none have applied the tool in two different countries to compare the results internationally and incorporated the use of a child-focused restaurant quality index. The novel approach of this study is useful in highlighting the variety of categories that exist on children's menus that warrant further research both within and between cities. This study adds to the consumer FE literature for children, specifically within inner city neighbourhoods. Researchers are given a further understanding into the quality and options available among North American children's menus. The study builds off previous research on children's menus in Southwestern Ontario, and is the first study to employ the CMA in Rochester, NY, as well as the first to compare children's menus across an international border. Children's menus are rarely the focal point of consumer FE research, but there is still much to be

learned, and much to be done as childhood obesity rates, influenced by poor dietary habits, continue to rise on a global scale.

This study shines a light onto how the way food is marketed to children needs to be changed and provides concise figures that policy makers can use to intervene, whether in a localized area or on a local, provincial/state or federal level. Public health and governmental officials can use these results to improve relationships with restaurants and to encourage the inclusion of healthy menu choices for children, as well as use these results to tailor future interventions to focus on restaurant children's menus. Researchers should continue to employ the Children's Menu Assessment in other cities to continue to build a collective understanding of restaurant consumer FEs for children.

## 5.6 Acknowledgements

I would like to acknowledge the city planning departments of both London and Rochester, as well as the Middlesex-London Health Unit for providing data. I would also like to acknowledge the City of London Healthy Kids Community Challenge, the Children's Health Foundation, and the Children's Health Research Institute providing funding and support for this project. For all of their help, I want to thank Dave DuBreck for providing assistance with menu collection in Rochester, as well as Taylor Bailey, Madisyn Fisher, Sana Homsi, Anne McNairn, Angela Piaskoski, Natalya Rayevskaya, and Zach Walters for assisting with the initial data collection process in London. Finally, I want to thank Dr. Jason Gilliland, Dr. Godwin Arku, and Dr. Richard Sadler for their support and guidance throughout this research.

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# Chapter 6

# 6 Synthesis

The purpose of this chapter is to summarize and discuss the research presented in this thesis, which investigated the geographic variations in children's community and consumer food environments in the City of London, Ontario, Middlesex County, Ontario, and Rochester, New York. This thesis examined the geographic variations through five research objectives:

1. Determine how junk food outlet density in a school zone varies by neighbourhood level of socioeconomic distress and level of urbanicity in the City of London and Middlesex County, Ontario in Canada.

2. Determine how the likelihood of neighbourhood restaurants offering children's menus varies by neighbourhood level of socioeconomic distress and level of urbanicity in the City of London and Middlesex County, Ontario in Canada.

3. Determine how the quality of restaurant children's menus varies by level of socioeconomic distress in a neighbourhood and urbanicity in the City of London and Middlesex County, Ontario in Canada.

4. Determine whether the restaurant consumer food environment for children differs between the cities of London, Ontario in Canada and Rochester, New York in the United States.

5. Determine the relationship between neighbourhood restaurant quality for children and socioeconomic characteristics within the city of London, Ontario and within the city of Rochester, New York.

The chapter consists of six sections: Section 6.1 summarizes the two independent studies described in Chapters 4 and 5, Section 6.2 discusses the research and methodologic contributions of this thesis to the literature, Section 6.3 outlines the limitations of this thesis as well as the limitations within each study area, Section 6.4 provides an overview

of possible policy implications, Section 6.5 describes suggestions for future research, and finally, the chapter concludes with Section 6.6.

## 6.1 Summary of Studies

This thesis explores the geographic variations in children's community and consumer food environments (FE) in separate but related ways. Study 1 (Chapter 4) evaluated how retail FEs for children in the City of London and Middlesex County, Ontario, Canada vary according to level of urbanicity and level of socioeconomic distress. Urbanicity in this study was defined as the neighbourhood's designation of urban, suburban, or rural based on the city boundaries discussed in the chapter. Socioeconomic distress was an index representing the sum of the z-scores for the percentage of lone parent families in the area, incidence of low income, unemployment rate, and low educational attainment. If an area is more socioeconomically distressed, the distress index is higher. The community FE (e.g., the type, location, and accessibility of food outlets) was assessed using 800m and 1600m network buffers around all public and private elementary schools, and junk food outlet (e.g., fast food and full service restaurants, grocery stores, and convenience stores) density and proximity were calculated and compared within each school zone. The study also assessed the consumer FE (e.g., the price, promotion, placement, and availability of healthy options and nutrition information) through restaurant children's menu audits using the CMA.

Through correlation analysis, the study found that junk food outlet (JFO) density is significantly higher around elementary schools in areas with higher levels of socioeconomic distress and urbanicity when examining the community FE for children. This suggests schools located in areas that are more urban and more socioeconomically distressed have more JFOs within 800m and 1600m of the school. Additionally, the study found a significant negative relationship between level of socioeconomic distress and proximity to nearest convenience store, suggesting schools in more distressed areas have a shorter distance to the nearest convenience store. Again, through correlation analysis, the study found that urbanicity is associated with greater use of branded marketing and inclusion of an unhealthy dessert on children's menus when examining the

restaurant consumer FE for children; suggesting children's menus at restaurants in more urban areas use branded marketing more often, while children's menus at restaurants in more rural areas automatically include unhealthy desserts (i.e., ice cream) with entrées more often.

In order to statistically analyze the relationship between children's menu quality/content and urbanicity and socioeconomic distress, the distress level and urbanicity of the dissemination area (DA) within which the restaurant offering a children's menu was located was spatially joined to the restaurant. Expanding on this methodology, Study 2 aimed to examine both the intra-urban and inter-urban variation in restaurant consumer FEs in Rochester, New York and London, Ontario through the use of the CMA and the newly created Neighbourhood Restaurant Quality Index for Children (NRQI-C). Restaurant children's menus were assessed, scored, and compared using the CMA. Network buffers at 800m were used again, similar to Study 1, but in this study, the buffers were created around the centroid of each block to calculate the NRQI-C, the sum of the menu scores divided by the total number of restaurants within each network buffer or "service area". After weighting by population, the relationship between NRQI-C and urbanicity as well as neighbourhood socioeconomic characteristics was examined using correlation and regression analyses.

Because both cities in Study 2 are urban, urbanicity for each restaurant was instead a restaurant's designation as either Canadian or American. A distress index was not calculated for this study, but rather socioeconomic variables were examined individually. These variables included median household income, percent visible minority, percent lone parent families, percent unemployed, and population density. A descriptive analysis was conducted within each city to examine the content and quality of children's menus. The results indicate Rochester has a lower number of children's menus available but a larger number of high quality children's menus and a larger number of healthy menu choices when compared to London.

After calculating the NRQI-C for each city, results indicated NRQI-C was positively correlated with income, and negatively correlated with unemployment and percentage of

visible minorities in Rochester. In London, NRQI-C was negatively correlated with income, and positively correlated with unemployment and percentage of lone parent families. Despite Rochester children's menus having higher scores and offering healthier menu choices, the findings highlight the socioeconomic inequity that exists within Rochester where more disadvantaged residents (living in low income, high unemployment, and high visible minority areas) have worse access to better quality menus. In London, the opposite was found; disadvantaged residents had better access to better quality menus. Regression analysis indicated significant relationships within each city and found a significant relationship when accounting for a city's Canada-US designation.

## 6.2 Research Contributions

The findings from the two studies summarized above are consistent with the literature regarding FEs in both Canada and the United States. Previous research indicates there are individual factors that may influence dietary behaviours and food choice; however, significant relationships were found in both studies between FE and the physical environment (e.g., food outlet access, availability, barriers, and opportunities) especially when considering urbanicity and socioeconomic characteristics at a neighbourhood level. This supports the use of an ecological framework to investigate the geographic variation in FEs. The results from these studies also reinforce the idea that FEs are complex and that there are different categories of the FE that ultimately influence eating patterns and dietary behaviours. This highlights the importance of considering the model of community nutrition environments when examining the physical environment aspect of the ecological model as it pertains to food studies.

Both Study 1 and Study 2, using a combination of restaurant children's menus audits and GIS-based methods of food retail accessibility (e.g., proximity and density analysis) to contextualize spatial differences in food availability, highlight the importance of examining the environmental neighbourhood setting.

Study 1 specifically investigates how children's community and consumer FEs in a Canadian region vary based on urbanicity and socioeconomic distress. This study contributes to the knowledge gap that exists within children's FE studies as little research exists which combines these two aspects of the FE together in one study (as discussed in Engler-Stringer et al., 2014).

Analysis in Study 1 revealed the influence urbanicity and socioeconomic distress have on the community FEs in elementary school neighbourhoods, where more urban and more distressed school neighbourhoods have community FEs more saturated with junk food outlets. These results, though they expand on the definition of junk food outlets to include grocery stores and full service restaurants in addition to fast food and convenience stores, support existing research that also finds geographic disparities in the school neighbourhood FE (Zenk and Powell, 2008; Sturm, 2008). These results are also consistent with previous research which suggests higher distressed areas have greater access to unhealthy foods (Black, Moon, & Baird, 2014; Larson, Story, & Nelson, 2009; Walker, Keane, & Burke, 2010).

Study 1 also revealed the influence urbanicity has on the restaurant consumer FE for children, where children's menus in urban neighbourhoods employ a greater use of branded marketing while children's menus in rural neighbourhoods include more unhealthy desserts with entrées. This was the first time the CMA was used in a Canadian setting; however, these results build off previous CMA research in the United States which found minor relationships between children's menus and urban/rural designation (Hill et al., 2015).

The comparative analysis in Study 2 revealed Rochester had overall better quality children's menus and more healthy menu choices when compared to London, despite having a fewer number of menus in the sample. This was the first time the CMA was used in Rochester, New York and was the first time children's menu results were compared across an international border. Additionally, this study was the first time the novel NRQI-C was used to examine the restaurant accessibility/opportunity measures from each residential neighbourhood and quantify the CMA audit scores in a more

meaningful way. Results indicate a significant relationship when accounting for a city's Canada-US designation, and that high NRQI-C scores (synonymous with better neighbourhood restaurant consumer FEs) were correlated to lower income, higher unemployment, and more lone parent families in London, while high NRQI-C scores were correlated to higher income, lower unemployment, and fewer visible minorities in Rochester.

The Study 2 results regarding Rochester are consistent with FE literature in the United States which suggests the following: 1) that those in higher income neighbourhoods have better access to healthier foods than those in lower income neighbourhoods (Black et al., 2014; Larson et al., 2009; Walker et al., 2010); 2) that structural differences in American cities, characterized by planning in the United States which favours private-sector development (i.e., restaurants), can lead to landscapes that are naturally less protective of public health despite the fact that modern zoning as a means of protecting public health was born in the US (Claeys, 2004); and 3) that high minority neighbourhoods have worse access to healthier options (Zenk et al., 2005; Hilmers, Hilmers, & Dave, 2012). There is a socio-spatial inequity seen in Rochester that reinforces the typical understanding of disadvantaged, inner-city, high minority neighbourhoods being characteristically representative of poorer quality food environments.

Regarding the London results in Study 2, these are consistent with FE research in Canada which suggests lower income neighbourhoods have better access to food outlets such as fast food restaurants (Black et al., 2014; Health Canada, 2013). While these neighbourhoods may have a greater number of fast food and chain restaurants than higher income neighbourhoods, many of these chain restaurants were found to have the highest scoring (healthiest) children's menus. Thus, the socio-spatial inequity that exists in Rochester is virtually non-existent in London, as the most socioeconomically disadvantaged households, households normally having the fewest options available and the most difficulty in driving out of the neighbourhood to acquire healthy foods, actually have the healthiest menu options.

These results highlight the importance of differentiating between the various aspects of the FE and conducting research specific to each. The results also emphasize the importance of using a socioecological model to frame FE research, as dietary behaviours are complex and are not just influenced at the individual level, but by the neighbourhood (physical) level as well.

The findings from this thesis will be shared with the London-Middlesex region Healthy Kids Community Challenge through a workshop and symposium, publications, presentations, and written reports to support future development of local policy and interventions focusing on children's FEs. The results will also be shared with the City of Rochester Planning Department and the Greater Rochester Health Foundation through publications and presentations. The findings suggest policymakers and public health officials should consider focusing on developing future programs and interventions on the availability of healthy foods and the advocacy for healthy FEs for children.

This thesis contains critical results pertaining to the availability of healthy food within community and consumer FEs for children in Canada and the United States. Both studies begin to expose the influence urbanicity and socioeconomic status have on children's FEs, and reinforce the need to explore these relationships further.

## 6.3 Limitations

Despite the research contributions of this thesis, there are several limitations. The first limitation is simply the nature of using large data sets – after a certain length of time, the data become outdated. This was true for the children's menus used in this research, as well; therefore, the thesis data may be considered accurate as of August 2016. At least two of the menus included in this research are from restaurants that existed at the time of data collection but are now no longer in business. For example, Chapter 5 reports that there was a buffet in London that offered a children's menu. Despite operating in the summer of 2016, that restaurant is now permanently closed. Similarly, at least one restaurant during the data collection phase was identified as not having a separate children's menu but has since added one. The restaurant is a plant-based, vegan

restaurant, with a children's menu that includes healthy entrées such as a cucumber, hummus, and tomato sandwich, veggies and dip, and hummus with corn chips. Though not drastically, scoring and including this restaurant in the studies would likely change the restaurant consumer FE for children.

Another limitation has to do with the size of the urban study areas. London is much larger in size than Rochester, and its city limits incorporate urban, suburban, and rural areas. The city limits of Rochester only encompass an urban area. The suburban and rural areas of Rochester are technically part of the Greater Rochester area and are all separate towns and villages. Because of this, there is a difference in menu sample size between these two urban areas.

Additionally, a limitation arises when defining neighbourhoods as census units. For the purpose of GIS mapping and statistical analysis, the neighbourhood was defined as the dissemination area or census block group, but it should be noted that neighbourhoods may be more broadly defined than that in a real-life setting.

A final limitation in both studies comes with the use of the CMA. While a small number of menus were found to offer water bottles as a beverage choice, the availability of water was not included on the tool as a scored item, while the availability of milk, juice, and soda was included. Future CMA studies may consider adding a category that accounts for water availability on the menu. Similarly, several restaurants called during the data collection period indicated there was no physical children's menu, but that the establishment served "kid-friendly items" or offered child-sized portions of entrées on request. Because there was no physical children's menu, these restaurants were excluded from the study because the CMA only assesses the separate children's menu.

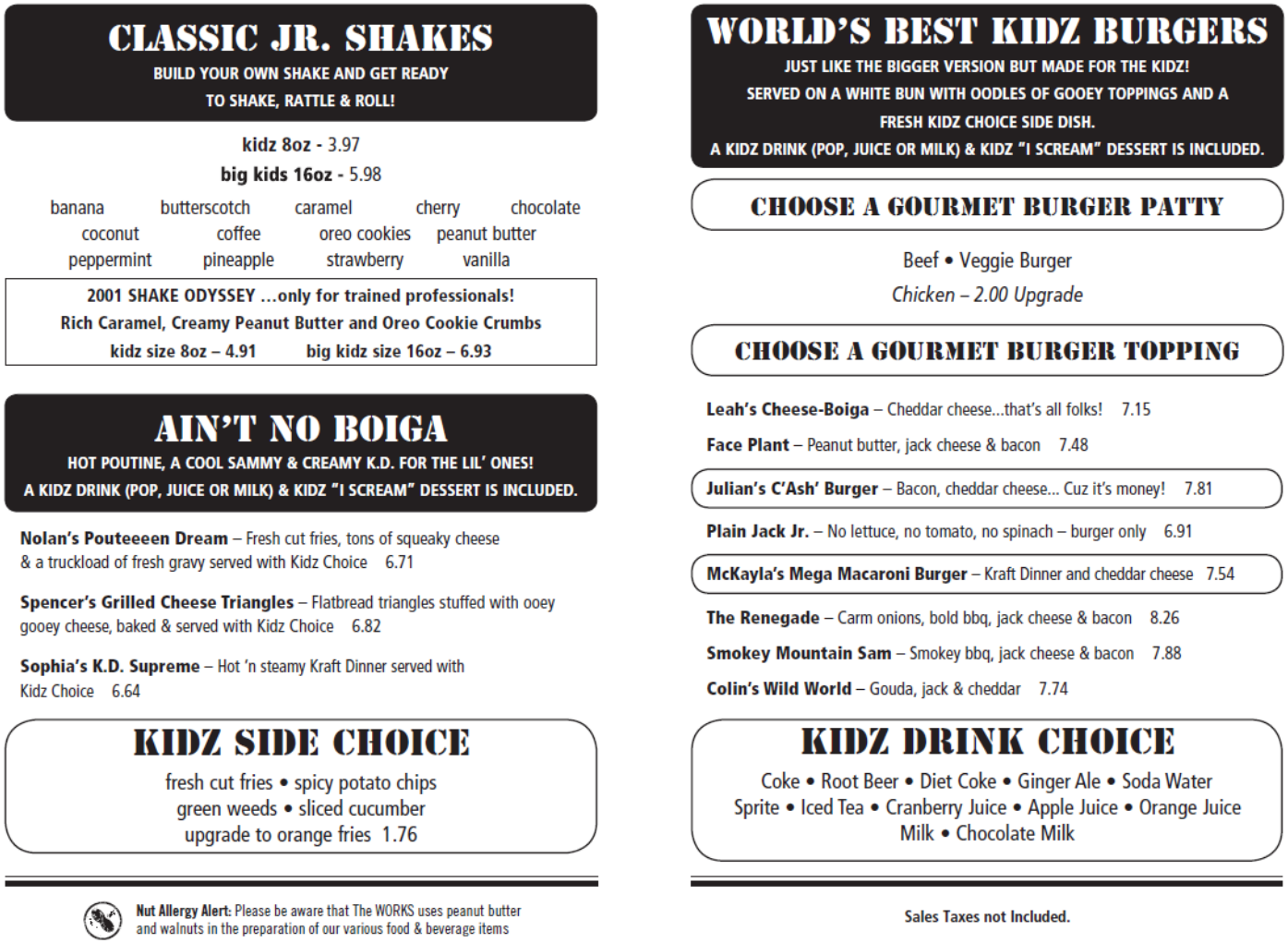
There are also limitations specific to each urban study area described below.

### 6.3.1 London-Middlesex

The main limitation, and also an interesting policy enactment which justifies the importance of this research topic, relates to the London-Middlesex children's menus. All

of the menus included in the two studies were collected and assessed in the summer of 2016. Several menus received 0 out of 2 points on the section regarding the presence of nutritional information, as the information was missing. However, as of January 1, 2017, the Ontario Ministry of Health and Long Term Care enforced a new Healthy Menu Choices Act. This act is part of Ontario law's Bill 45, the Making Healthier Choices Act, which aims to increase public health through the aforementioned act, the Smoke-Free Ontario Act, and the Electronic Cigarettes Act (Legislative Assembly of Ontario, 2015). The Healthy Menu Choices Act requires restaurants and other "chain of food service premises" with 20+ locations in Ontario to display nutritional information including the number of calories for every food item (Legislative Assembly of Ontario, 2015). If a restaurant that meets this criteria in non-compliant, it is fined until the information is listed for all items offered.

Several children's menus included in the study did not have nutritional information listed at the time of assessment, but now include that information. Figures 6.1 and 6.2 are an example of this. Figure 6.1 shows a page of the children's menu from The Works Gourmet Burger Bistro in London, collected August 10, 2016. This was the menu scored and used for analysis in the previous two chapters. Based on this menu, The Works received a CMA total score of 2. Figure 6.2 shows the same page of the children's menu after the Healthy Menu Choices Act was enforced starting January 1, 2017. The new menu lists calorie information for every item choice, as well as a note at the bottom on how many calories on average a child should have based on age. Based on this new menu, The Works would receive a CMA total score of 4. Because of this, it is advised that children's menu audits in London-Middlesex be conducted again to assess how the nutritional information on these menus may have impacted the overall menu score.



## CLASSIC JR. SHAKES

BUILD YOUR OWN SHAKE AND GET READY
TO SHAKE, RATTLE & ROLL!

**kidz 8oz** - 3.97
**big kids 16oz** - 5.98

banana butterscotch caramel cherry chocolate
coconut coffee oreo cookies peanut butter
peppermint pineapple strawberry vanilla

**2001 SHAKE ODYSSEY ...only for trained professionals!**
**Rich Caramel, Creamy Peanut Butter and Oreo Cookie Crumbs**
**kidz size 8oz – 4.91 big kidz size 16oz – 6.93**

## AIN'T NO BOIGA

HOT POUTINE, A COOL SAMMY & CREAMY K.D. FOR THE LIL' ONES!
A KIDZ DRINK (POP, JUICE OR MILK) & KIDZ "I SCREAM" DESSERT IS INCLUDED.

**Nolan's Pouteeeen Dream** – Fresh cut fries, tons of squeaky cheese & a truckload of fresh gravy served with Kidz Choice 6.71

**Spencer's Grilled Cheese Triangles** – Flatbread triangles stuffed with ooey gooey cheese, baked & served with Kidz Choice 6.82

**Sophia's K.D. Supreme** – Hot 'n steamy Kraft Dinner served with Kidz Choice 6.64

## KIDZ SIDE CHOICE

fresh cut fries • spicy potato chips
green weeds • sliced cucumber
upgrade to orange fries 1.76

**Nut Allergy Alert:** Please be aware that The WORKS uses peanut butter and walnuts in the preparation of our various food & beverage items

## WORLD'S BEST KIDZ BURGERS

JUST LIKE THE BIGGER VERSION BUT MADE FOR THE KIDZ!
SERVED ON A WHITE BUN WITH OODLES OF GOOEY TOPPINGS AND A FRESH KIDZ CHOICE SIDE DISH.
A KIDZ DRINK (POP, JUICE OR MILK) & KIDZ "I SCREAM" DESSERT IS INCLUDED.

## CHOOSE A GOURMET BURGER PATTY

Beef • Veggie Burger
*Chicken – 2.00 Upgrade*

## CHOOSE A GOURMET BURGER TOPPING

**Leah's Cheese-Boiga** – Cheddar cheese...that's all folks! 7.15

**Face Plant** – Peanut butter, jack cheese & bacon 7.48

**Julian's C'Ash' Burger** – Bacon, cheddar cheese... Cuz it's money! 7.81

**Plain Jack Jr.** – No lettuce, no tomato, no spinach – burger only 6.91

**McKayla's Mega Macaroni Burger** – Kraft Dinner and cheddar cheese 7.54

**The Renegade** – Carm onions, bold bbq, jack cheese & bacon 8.26

**Smokey Mountain Sam** – Smokey bbq, jack cheese & bacon 7.88

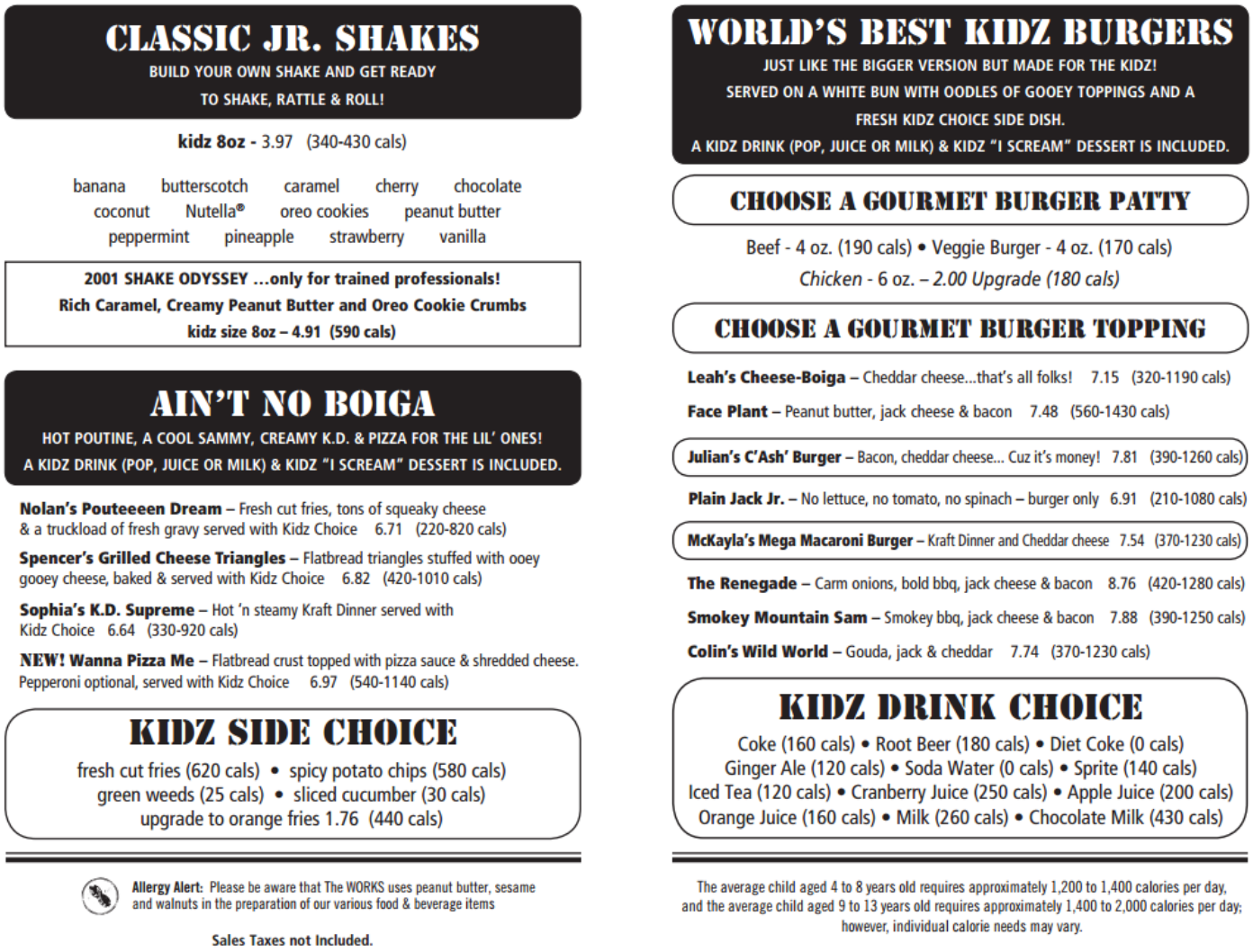
**Colin's Wild World** – Gouda, jack & cheddar 7.74

## KIDZ DRINK CHOICE

Coke • Root Beer • Diet Coke • Ginger Ale • Soda Water
Sprite • Iced Tea • Cranberry Juice • Apple Juice • Orange Juice
Milk • Chocolate Milk

**Sales Taxes not Included.**

**Figure 6.1:** A portion of the children's menu from The Works Gourmet Burger Bistro in London collected on August 10, 2016.



## CLASSIC JR. SHAKES

BUILD YOUR OWN SHAKE AND GET READY
TO SHAKE, RATTLE & ROLL!

**kidz 8oz -** 3.97 (340-430 cals)

banana butterscotch caramel cherry chocolate
coconut Nutella® oreo cookies peanut butter
peppermint pineapple strawberry vanilla

**2001 SHAKE ODYSSEY ...only for trained professionals!**
**Rich Caramel, Creamy Peanut Butter and Oreo Cookie Crumbs**
**kidz size 8oz – 4.91 (590 cals)**

## AIN'T NO BOIGA

HOT POUTINE, A COOL SAMMY, CREAMY K.D. & PIZZA FOR THE LIL' ONES!
A KIDZ DRINK (POP, JUICE OR MILK) & KIDZ "I SCREAM" DESSERT IS INCLUDED.

**Nolan's Pouteeeen Dream** – Fresh cut fries, tons of squeaky cheese & a truckload of fresh gravy served with Kidz Choice 6.71 (220-820 cals)

**Spencer's Grilled Cheese Triangles** – Flatbread triangles stuffed with ooey gooey cheese, baked & served with Kidz Choice 6.82 (420-1010 cals)

**Sophia's K.D. Supreme** – Hot 'n steamy Kraft Dinner served with Kidz Choice 6.64 (330-920 cals)

**NEW! Wanna Pizza Me** – Flatbread crust topped with pizza sauce & shredded cheese. Pepperoni optional, served with Kidz Choice 6.97 (540-1140 cals)

## KIDZ SIDE CHOICE

fresh cut fries (620 cals) • spicy potato chips (580 cals)
green weeds (25 cals) • sliced cucumber (30 cals)
upgrade to orange fries 1.76 (440 cals)

**Allergy Alert:** Please be aware that The WORKS uses peanut butter, sesame and walnuts in the preparation of our various food & beverage items

**Sales Taxes not Included.**

## WORLD'S BEST KIDZ BURGERS

JUST LIKE THE BIGGER VERSION BUT MADE FOR THE KIDZ!
SERVED ON A WHITE BUN WITH OODLES OF GOOEY TOPPINGS AND A FRESH KIDZ CHOICE SIDE DISH.
A KIDZ DRINK (POP, JUICE OR MILK) & KIDZ "I SCREAM" DESSERT IS INCLUDED.

## CHOOSE A GOURMET BURGER PATTY

Beef - 4 oz. (190 cals) • Veggie Burger - 4 oz. (170 cals)
*Chicken - 6 oz. – 2.00 Upgrade (180 cals)*

## CHOOSE A GOURMET BURGER TOPPING

**Leah's Cheese-Boiga** – Cheddar cheese...that's all folks! 7.15 (320-1190 cals)

**Face Plant** – Peanut butter, jack cheese & bacon 7.48 (560-1430 cals)

**Julian's C'Ash' Burger** – Bacon, cheddar cheese... Cuz it's money! 7.81 (390-1260 cals)

**Plain Jack Jr.** – No lettuce, no tomato, no spinach – burger only 6.91 (210-1080 cals)

**McKayla's Mega Macaroni Burger** – Kraft Dinner and Cheddar cheese 7.54 (370-1230 cals)

**The Renegade** – Carm onions, bold bbq, jack cheese & bacon 8.76 (420-1280 cals)

**Smokey Mountain Sam** – Smokey bbq, jack cheese & bacon 7.88 (390-1250 cals)

**Colin's Wild World** – Gouda, jack & cheddar 7.74 (370-1230 cals)

## KIDZ DRINK CHOICE

Coke (160 cals) • Root Beer (180 cals) • Diet Coke (0 cals)
Ginger Ale (120 cals) • Soda Water (0 cals) • Sprite (140 cals)
Iced Tea (120 cals) • Cranberry Juice (250 cals) • Apple Juice (200 cals)
Orange Juice (160 cals) • Milk (260 cals) • Chocolate Milk (430 cals)

The average child aged 4 to 8 years old requires approximately 1,200 to 1,400 calories per day, and the average child aged 9 to 13 years old requires approximately 1,400 to 2,000 calories per day; however, individual calorie needs may vary.

**Figure 6.2:** The same page of the children's menu from The Works Gourmet Burger Bistro in London collected after January 1, 2017.

### 6.3.2 Rochester

One of the limitations with Rochester relates to the restaurant address location list provided by the City of Rochester Planning Department. This list contains all of the bars and restaurants in Rochester in possession of a city business permit. If a location on this list obtains another city permit, such as for amusement or for entertainment, then it no longer has the business permit. For example, several restaurants in Rochester are known to have children's menus, but have stages for live music. Thus, these restaurants would be on the entertainment permit list, a list that was unable to be obtained for the purpose of this research. Simply put, the data used for Rochester is limited to only the 242 locations included on the business permit list.

Additionally, due to high rates of violent crimes and homicides in Rochester (Klofas, Altheimer, & Sweadner, 2017; Federal Bureau of Investigation, 2016), four children's menus were not collected due to safety concerns regarding the location of these restaurants in certain high crime areas. It is, however, expected that this did not have a significant impact on the results.

## 6.4 Implications for Policy and Practice

The results of this thesis have the potential for developing policies and interventions with the goal of improving FEs for children at the local level in the London-Middlesex region and the City of Rochester, at the provincial level in Ontario and state level in New York, and in cities, provinces, and states across Canada and the United States.

### 6.4.1 Community Food Environment

One policy implication these results have regarding improving the community FE for children may be in limiting the density of fast food restaurants in areas where children routinely go (such as near schools). Internationally, several regions have zoning policies regarding the sale of unhealthy foods around schools, including areas within South Korea, Ireland, the United States, and the United Kingdom (Bae et al., 2016; Times, 2016; Ministry of Food and Drug Safety, 2017; Office de la Protection du

Consommateur, 2013); unfortunately, the ban of these items is within 200-500m of the school, a distance that is much too small when considering the school neighbourhood. Distances of 800m and 1600m were used in this thesis; 800m is commonly recognized as walkable in 10-15 minutes while 1600m is the maximum distance a child can live from a school before being bussed in. Policymakers have the ability to implement policies and programs that limit the availability of unhealthy foods in the community FE, but need to consider both how large the school neighbourhood truly is and the distance that children are walking before creating such policies around schools. If a restriction on the location of food outlets selling highly processed foods, sugar-sweetened beverages, and other unhealthy items is being considered around schools, the distance considered should be a minimum of 800m. Unfortunately, policymakers and legislators are beholden to their constituents and, as long as the voters approve of the current situation and those same voters vote with their dollars to purchase nutritionally lower value foods, this pattern will continue.

### 6.4.2 Consumer Food Environment

The results of this thesis also have the potential to improve the consumer FE for children as well by influencing policies which encourage food outlets to increase promotion and availability of healthy foods while decreasing promotion and availability of unhealthy foods.

At the time of writing this thesis, results from the menu audits in Middlesex County, Ontario are being used by registered dieticians (RDs) in conjunction with the Human Environments Analysis Laboratory to implement restaurant interventions to create healthier children's menus and restaurant FEs. RDs will be reaching out to restaurant owners to sit down and discuss the benefits of having healthier children's menus. Restaurant owners will be given a checklist consisting of recommendations based on the results of the children's menu audits in the area, and will be able to check off the items they would like to work towards in order to create a healthier menu.

Several menus were found to include familiar characters from television and movies as well as include toys with meals. The use of these promotions is not harmful in theory, but when used to push the consumption of unhealthy options by children, it becomes problematic. The results from this thesis can be used to implement toy ordinances, similar to that in San Francisco, where restaurants were banned from including toys and other incentives with children's meals exceeding calorie, sodium, and fat requirements (World Cancer Research Fund, 2016c). By only including toys with healthy entrées, or by using branded marketing for healthy items such as stickers of familiar characters on fruits or milk cartons, children may be more susceptible to ordering healthy options.

Many children's menus offer soda as the default beverage with an entrée and charge an additional fee for milk or juice. Similarly, many menus offer healthy sides like salads or vegetables at an additional cost, whereas fried sides are included in the price. Policymakers could use the results from this thesis to target restaurants and place a tax on these unhealthy beverages and sides. Mexico, Hungary, French Polynesia, St. Helena, and the United Kingdom all have taxes on sugary drinks and foods with high caloric density, though not specifically targeting restaurant children's menus (Biro, 2015; Triggle, 2016; Colchero, Popkin, Rivera, & Ng, 2016; World Cancer Research Fund, 2016a). Both federal and provincial/state policymakers have the ability to create and enforce taxes like this, or ban unlimited refills of soda and other sugar-sweetened beverages altogether as has been done in France (World Cancer Research Fund, 2016b). Currently no policies exist in Ontario or the rest of Canada despite some provincial discussion and planning regarding future implementation.

Similarly, policymakers especially at the local level may consider an intervention targeting children's dessert options. Acknowledging the size difference between the two cities, almost half of the children's menus in London automatically include an unhealthy dessert with a meal when compared to Rochester. These are generally ice-cream based desserts such as sundaes and milkshakes. One restaurant in London includes one of these desserts, listed as having 270 calories. This children's menu's dessert section also lists several other desserts that can be purchased at an additional cost and are up to 750

calories. The menu includes a reminder of how many calories a child needs per day depending on their age, but by automatically including unhealthy desserts and specifically promoting unhealthy desserts for consumption by children, their calorie needs are met or exceeded by items high in sugar and fat. Policymakers can use this information to offer incentives for restaurants to implement dessert-free children's menus, or menus that offer healthier desserts such as fresh fruits.

## 6.5 Future Research

Despite the contributions this thesis has, there remains a need for more research pertaining to children's community and consumer FEs.

First and foremost, children's menu audits in the London-Middlesex region should be conducted again. Section 6.3 discussed how several menus did not list nutrition information during the data collection phase but now do list that information as per the Healthy Menu Choices Act. Additionally, Section 6.3 made note of the fact that some menus included in this research are from restaurants that are now closed. It is critical for menu audits to be conducted again in the region to account for this and assess how the enactment of the new provincial law, which justifies this research topic, has affected the restaurant consumer FE for children.

Chapter 5 compared the consumer FEs in the cities of London and Rochester. However, the city limits for London encompass urban, suburban, and rural neighbourhoods while the city limits for Rochester are confined to the urban core. A future study may be conducted that compares Middlesex County, Ontario to Monroe County, New York. By comparing the counties rather than the cities, this future study would account for the suburban and rural neighbourhoods surrounding Rochester, and would allow researchers to better understand what Canada-US differences may exist between restaurant consumer FEs for children. Similarly, by expanding the study area to the county level, the sample of restaurants and children's menus in the Rochester area would be larger, thus allowing for better comparison and analysis. Future studies should also add more study areas or

consider border cities (e.g. Niagara Falls, Ontario and Niagara Falls, New York) to further examine the Canada-US differences.

Similarly, future research may consider employing the CMA in other Canadian cities. This would provide further insight into the restaurant consumer FE for children, and would be especially useful considering the different provincial policies that may be influencing the restaurant environment. Children's FEs are actively being researched out west in Saskatoon, Saskatchewan (Engler-Stringer, Shah, Bell, & Muhajarine, 2014; Wang, Engler-Stringer, & Muhajarine, 2016; Le, Engler-Stringer, & Muhajarine, 2016). Despite the application of the Nutrition Environment Measures Survey for Restaurants (NEMS-R), the CMA has never been used in Saskatoon. A future study may use the CMA to conduct children's menu audits in this city to not only examine menu content and quality within Saskatoon, but to also compare those results to London in order to see how two cities within Canada differ, as well as investigate any regional (east-west) differences.

More research is needed using the CMA in the United States as well. To date, seven studies have been published that make use of the CMA in the United States (Hill et al., 2015, Krukowski, Eddings, & Smith West, 2011; Otten et al., 2012; Diedrich & Otten, 2015; Crixell, Friedman, Fisher, & Biediger-Friedman, 2014; Ayala et al., 2016; Krukowski and West, 2013). These studies have been in the South or along the West Coast. The CMA needs to be applied in other regions of the United States to better understand the geographic variation of children's FEs. These studies need to statistically analyze the disparities in the study area and how those are related to the menu content and quality, rather than just outline the descriptive results from the CMA.

Future CMA studies may employ the use of the NRQI-C. A common index used within food environment literature is the Retail Food Environment Index which represents the ratio of healthy to unhealthy food outlets in a given area. This index, however, is not appropriate when researching consumer FEs, especially for children. It considers all food outlets rather than only restaurants, and does not consider what exists *within* the outlets. The NRQI-C allows researchers to quantify neighbourhood restaurant accessibility and

quality. It also makes the children's menu scores more meaningful with respect to the entire neighbourhood rather than comparing to only other restaurants with children's menus. Higher indices correspond to a neighbourhood having a better quality restaurant consumer FE for children. By calculating the index at the block level and accounting for population, future CMA studies will be better able to statistically analyze the relationship between CMA score and environmental variables such as socioeconomic characteristics or neighbourhood urbanicity.

There is room for future studies to be conducted in Rochester, New York. Several FE studies have been conducted in nearby Buffalo, New York (Lee & Lim, 2009; Raja et al., 2010; Raja, Ma, & Yadav, 2008; Widener, Metcalf, & Bar-Yam, 2011), but no community or consumer FE studies conducted in Rochester were found. This is unfortunate given the on-going interventions taking place within the region such as the "Be a Healthy Hero" campaign and the childhood obesity prevention plan funded by the Greater Rochester Health Foundation. Future studies may use the CMA in other mid-size cities to examine how Rochester compares within the state of New York or within the country.

Finally, this research highlights what choices are available to children in restaurants, but does not examine what items children are actually ordering off of these menus. Future studies may build on this research and explore what food choices children are making within the restaurant consumer food environment.

## 6.6 Conclusion

The purpose of this research was to examine how children's community and consumer food environments (FE) vary geographically when considering level of neighbourhood form (urban, suburban, rural), socioeconomic characteristics, and location in Canada or the United States. Several associations were found between the FE, neighbourhood form, and socioeconomic characteristics. When examining the community FE in a Canadian setting, findings suggest elementary schools in areas with higher levels of socioeconomic distress and urbanicity are more saturated with junk food outlets. When examining the

consumer FE in the same Canadian setting, findings suggest children's menus in areas with greater urbanicity (more urban) employ greater use of branded marketing while children's menus in areas with lower urbanicity (more rural) more often include an unhealthy dessert with a children's entrée. When examining the geographic variation in consumer FEs for children within and between an American city and a Canadian city, findings suggest international differences exist. Neighbourhood restaurant quality for children in the American city was better in areas with high income, low unemployment, and a small percentage of minorities (indicating socioeconomic inequities that exist within American food environments where disadvantaged residents with fewer resources have poor access to better quality foods), while in the Canadian city, neighbourhood restaurant quality for children was better in areas with low income, high unemployment, and a large percentage of lone parent families (indicating from a health equity perspective that disadvantaged residents with fewer resources actually have better access to better quality foods).

This research emphasizes the need for continued research and consideration of new local approaches, and/or developing policies and interventions specific to children in each country, highlighting the complexity between American and Canadian FEs. Both studies provide meaningful findings for policymakers, planners, public health officials, and researchers who are concerned with food environments for children.

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# Appendices

**Appendix A** Children's Menu Assessment (Krukowski et al., 2011)

Complete ☐

DATE: __/__/__ __ __ __ (MO/DD/YYYY) RATER ID: __ __

Start Time: __:__ AM/PM RESTAURANT ID __ __-__ __ __

End Time: __:__ AM/PM

**Children's Lunch/Dinner Menu Assessment**

★ **DOES THIS MENU CONTAIN A CHILDREN'S MENU?** ☐ YES ☐ NO

IF NO CHILDREN'S MENU, ANSWER Q1 AND Q2, AND THEN DISCONTINUE MEASURE.

*INSTRUCTIONS: PLEASE CHECK THE APPROPRIATE CIRCLE OR FILL IN THE CORRESPONDING TOTAL NUMBER ON THE LINE. UNLESS OTHERWISE INDICATED, PLEASE CHECK ONLY ONE CIRCLE FOR EACH QUESTION.*

| | |
|---|---|
| 1) Type of restaurant | ◯ Full Service<br>◯ Fast Casual<br>◯ Buffet<br>◯ Fast Food |
| 2) Cuisine type | ◯ American (hamburgers, wings, Southern-style, steaks, seafood)<br>◯ Asian (Chinese, Vietnamese, Korean, Thai, Japanese)<br>◯ Mexican or Tex-Mex<br>◯ Italian<br>◯ Pizza<br>◯ Sandwich/Deli<br>◯ Other – Greek, Indian, French, African/Moroccan, etc. |
| **NOTE: Discontinue HERE if there is no children's menu for the restaurant.** | |
| 3) Age limit for children's menu | ◯ 10 and under<br>◯ 12 and under<br>◯ Other<br>◯ NA |
| 4) Is nutrition information (e.g., calories) available on the children's menu? | ◯ yes ◯ no |
| 5) Are healthy entrees identified on the children's menu by a symbol or words that indicate "light", "low-calorie" or "low-fat" (e.g., fit)? | ◯ yes ◯ no |
| 6) Entrees on the children's menu | |
| *6a) How many total entrees are available?* | ____ Total from Table 1 |
| *6b) How many healthy entrées are offered (baked, grilled, broiled, or boiled and do not have bacon, cheese, cream or butter sauce added)?* | ____ Total from Table 1 |
| *6c) How many healthy entrée salads offered (do not have bacon, sausage, cheese, fried chips/croutons/ wontons, or fried meat)?* | ____ Total from Table 1 |

Complete ☐

| | |
|---|---|
| *6d) How many whole grain/wheat products are offered?* | ____ Total from Table 2 |
| *6e) How many white grain products are offered?* | ____ Total from Table 2 |
| **7) Beverages** | |
| *7a) Is fruit juice available (on the children's menu or on the general menu)?* | ◯ yes ◯ no/can't tell |
| *7a.1) If juice is available are one or more varieties specified as 100% fruit juice?* | ◯ yes ◯ no/can't tell |
| *7b) Is milk available (on the children's menu or on the general menu)?* | ◯ yes ◯ no/can't tell |
| *7b.1) If available, is it (select all that apply):* | ◯ Skim/non-fat<br>◯ 1%<br>◯ 2%<br>◯ Whole<br>◯ All types of flavored milk<br>◯ Can't tell<br>◯ NA |
| *7c) Is soda noted as a beverage choice, specifically for children?* | ◯ yes ◯ no/can't tell |
| *7d) If available, can 100% juice, low-fat milk, or water be substituted without an additional charge in combination meals?* | ◯ yes ◯ no/NA |
| *7e) Does the menu indicate that there are free refills on sugar-sweetened beverages for children?* | ◯ yes ◯ no ◯ NA |
| **8) Side dishes on the children's menu** | |
| *8a) Are non-fried vegetables or salad offered as a side dish?* | ◯ yes ◯ no/can't tell |
| *8b) Are fruits offered as a side dish?* | ◯ yes ◯ no/can't tell |
| *8b.1) Does the menu specify that the fruit is without added sugar?* | ◯ yes ◯ no ◯ NA |
| *8c) Are dairy products (e.g., cottage cheese, yogurt) offered as a side dish?* | ◯ yes ◯ no/can't tell |
| *8c.1) Does the menu specify that any of the dairy products are low-fat?* | ◯ yes ◯ no ◯ NA |
| *8d) If any healthier side is available, does the menu indicate that a non-fried vegetable, fruit (with or without added sugar) or a dairy product (regular or low-fat) can be substituted for an assigned side at no extra charge?* | ◯ yes ◯ no ◯ NA |

Complete ☐

| | |
|---|---|
| **9) Desserts on the children's menu** | |
| *9a) How many desserts are available on the children's menu?* | ____ Total from Table 3 |
| *9b) How many healthy desserts are available on the children's menu?* | ____ Total from Table 3 |
| *9c) Is an unhealthy dessert automatically included in a kid's meal?* | ◯ yes ◯ no/can't tell |
| **10) General information** | |
| *10a) If salads are on the children's menu, is reduced-fat, light or reduced-calorie salad dressing available (on the children's menu or on the general menu)?* | ◯ yes ◯ no/can't tell ◯ NA |
| *10b) Is branded marketing used to promote children's menu items or meals?* | ◯ yes ◯ no |
| *10c) Are toys used to promote children's menu items or meals?* | ◯ yes ◯ no |

| **Comments Regarding the Assessment:** |
|---|
| |

*For information about the development and test-retest and inter-rater reliability of the measure, please refer to:*

*Krukowski RA, Eddings K & West DS. (2011). The Children's Menu Assessment: Development, Evaluation, and Relevance of a Tool for Evaluating Children's Menus. Journal of the American Dietetic Association, 111(6), 884-888.*

*This measure and instructions are an expansion/adaptation of the Nutrition Environment Measures Survey-Restaurant (Saelens, Glanz, Sallis, & Frank, 2007). Please see this article for more information about the Nutrition Environment Measures Survey-Restaurant.*

*Saelens B, Glanz K, Sallis J, & Frank L. (2007). Nutrition Environment Measures Study in Restaurants (NEMS-R): Development and Evaluation. American Journal of Preventive Medicine, 32(4), 273-281.*

Complete ☐

*Table 1: Entrée Assessment*

| Entrees and entrée salads | Healthy entrée? | Healthy entrée salad? | Price |
|---|---|---|---|
| 1 | Y N | Y N | $ |
| 2 | Y N | Y N | $ |
| 3 | Y N | Y N | $ |
| 4 | Y N | Y N | $ |
| 5 | Y N | Y N | $ |
| 6 | Y N | Y N | $ |
| 7 | Y N | Y N | $ |
| 8 | Y N | Y N | $ |
| 9 | Y N | Y N | $ |
| 10 | Y N | Y N | $ |
| 11 | Y N | Y N | $ |
| 12 | Y N | Y N | $ |
| 13 | Y N | Y N | $ |
| 14 | Y N | Y N | $ |
| 15 | Y N | Y N | $ |
| 16 | Y N | Y N | $ |
| 17 | Y N | Y N | $ |
| 18 | Y N | Y N | $ |
| 19 | Y N | Y N | $ |
| 20 | Y N | Y N | $ |
| 21 | Y N | Y N | $ |
| 22 | Y N | Y N | $ |
| 23 | Y N | Y N | $ |
| 24 | Y N | Y N | $ |

Please enter total number of entrees ☐ ☐ ☐

Transfer total to Question 6a

Transfer total Y's to Question 6b

Transfer total Y's to Question 6c

Complete ☐

| *Table 2: Grain Availability* | | | | |
|---|---|---|---|---|
| Y N | Whole grain/wheat bread | Y N | White bread |
| Y N | Brown/wild rice | Y N | White rice |
| Y N | Whole grain/wheat roll/bun | Y N | White roll/bun |
| Y N | Whole grain/wheat tortilla | Y N | White tortilla |
| Y N | Whole grain/wheat pasta | Y N | White pasta |
| Y N | Whole grain/wheat pizza crust | Y N | White pizza crust |
| Y N | Whole grain cracker/chip | Y N | White cracker |
| **Total Y's:** ☐ | | **Total Y's:** ☐ | |
| **Transfer total Y's to Question 6d** | | **Transfer total Y's to Question 6e** | |

| **Table 3: Dessert Assessment** | | |
|---|---|---|
| | **Desserts** | **Healthy Dessert?** |
| **1** | | Y N |
| **2** | | Y N |
| **3** | | Y N |
| **4** | | Y N |
| **5** | | Y N |
| **6** | | Y N |
| **7** | | Y N |
| **8** | | Y N |
| **9** | | Y N |
| **10** | | Y N |
| | **Total number of desserts:** ☐ | ☐ |
| | **Transfer total to Question 9a** ← | **Transfer total number of healthy dessert Y's to Question 9b** ↓ |

**Children's Menu Assessment (CMA) Completion Instructions:**

★ **Menu selection:** **If a restaurant serves dinner, the rater should only rate the dinner menu. If the restaurant serves only lunch, the rater should rate the lunch menu.**

**Definitions:**

**1. Restaurant type:**

- ❖ Full service - food is served to patrons, such as in family and fine-dining restaurants (ex. Chili's)
- ❖ Fast casual – patrons order and pay at the register for menu items that are more upscale and wider in variety than in fast food restaurants (ex. Chipotle Grill)
- ❖ Buffet—patrons pay one price for their choice of numerous items
  a. Complete the possible items on the measure, and then discontinue
- ❖ Fast food – patrons order and pay at a register or drive through (ex. Chick-fil-A)

**2. Cuisine type: indicate the cuisine type that best describes the majority of food on the full menu.**

**3. Children's Menu: a children's menu is defined as a menu that specifically targets individuals who are under the age of 18.**

- ❖ Promotions that do not include specific menu items for children do not meet the criteria of being a children's menu (ex. Children under 4 eat free at a buffet with a paying adult)

**4. Lunch/Dinner Entrée:**

a. In assessing all of the entrée items, only examine those on the children's menu.
b. To count an item as a separate entrée, it must be distinctly different, either in ingredients, proportion of ingredients, or preparation method and differ in ways other than size or quantity.
c. If the same entrée is prepared with different sauces, count them as different entrées.
d. If breakfast items are offered all day, count them as entrees.
e. Soup is counted as an entrée if it is priced similarly to other entrees.
f. As an example of distinct entrees, a cheeseburger and a double cheeseburger have proportionately different ingredients, making one higher in percent fat than the other. Proportionally, a double cheeseburger is higher in percent fat than a cheeseburger, because it has a smaller percentage of bread, lettuce and tomato (lower fat ingredients) than meat and cheese (higher fat and saturated fat ingredients). Thus, each of these would be counted as two separate entrees. Similarly, separate listings of cheese pizza and pepperoni pizza can be considered two separate entrees, given the difference in ingredients and fat.
g. If the entrée is offered in different sizes, count it only once.
   *Example: Baby Back Ribs (Count as one entrée)*
   *½ Rack Baby Back Ribs*
h. If the entrée is listed with an option of "chicken or beef" or similar choices, count each item as a separate entree.
i. If entrees are listed together in a section, but are distinctly different, count each one as an entrée.
   *Example: (Count as 5 entrees, not 1)*
   *Blimpies Hot Subs—Grilled*
   *Buffalo Chicken*
   *Ultimate Club*
   *Beef, Turkey & Cheddar*
   *Pastrami Special*
   *Reuben*

j. If various preparation options, e.g., broiled, fried, or grilled, are available, count each preparation option as an entrée.

*Example: Farm-raised Catfish, grilled or breaded and pan-fried (Count as 2 entrées, <u>not</u> 1)*

k. Count "build your own" as one item.

*Example: Build your own pizza (Count as 1 entrée) or an entrée vegetable plate (e.g., the customer can select a set number of vegetables from a list of possibilities—count as an entrée if priced similar to other entrées on the menu).*

**5. Healthy Entrée: The burden of proof must be on the kid's menu to identify that an entrée is healthy or prepared in a more healthy way. Use the following guidelines:**

a. Healthy preparations such as "grilled", "baked" "smoked" or "broiled" generally are considered a healthy choice (e.g., grilled chicken), with the exception of "grilled" sandwiches (e.g., grilled cheese).

b. Preparations such as "fried" are not considered healthy. Unless otherwise noted, fish and chicken entrees should be considered fried (e.g., chicken fingers or chicken wings).

c. Anything with "cheese", "butter" or a cream sauce as a significant ingredient (e.g., mac 'n cheese, cheese ravioli, pasta with butter) is generally not considered healthy.

d. Anything with red meat is not considered healthy (e.g., hamburger, taco, hotdog), unless it is specified that the meat is lower-fat or calories.

e. Only rate a sandwich as healthy, if it is "modified" to be made with whole wheat bread, lower-calorie/fat condiments (e.g., light mayo) or all fruit preserves (lower sugar).

f. Only rate a daily entrée soup special as a healthy entrée, if it is specified that the soup is consistently a healthy choice (i.e., not made with cream, cheese, or red meat).

**6. Healthy Entree Salad: An entree salad is of sufficient size to be the central part of a kids' meal (or a meal in itself) and typically contains at least one protein source as an integral ingredient.**

a. Do not count salads that are indicated for sharing, as is typical in an Italian restaurant.

b. If in doubt, and the price is similar to other main dishes on the menu, count it as an entrée salad.

c. Do not count pasta, Caesar or House salads as a main dish, unless they have a high-protein ingredient (tofu, chicken or turkey (poultry), fish or seafood, beef or pork (do not count bacon as a protein source), vegetarian chili, pinto beans, soybeans, chickpeas (or hummus) or other legumes, egg (unless used only as a garnish)).

d. A salad is not considered a healthy entrée salad if it has fried meat on it.

e. If the restaurant specifically promotes the salad bar for children (e.g., a lower price for children to choose this option) and the price for this option is similar to other main dishes on the menu, count it as a <u>healthy</u> entrée salad, as the children are likely to have the option of choosing healthy components for their salad.

f. A vegetable plate can be counted as a healthy entrée salad if it is possible for the child to select all healthier items for this plate (i.e. healthier items include non-fried vegetables, fruits without added sugar, low-fat dairy products (as outlined below in section 7), and whole grain items (as outlined below in section 5).)

**7. Grain Products:**

a. When the menu does not indicate the type of grain (e.g., Whole or Wheat), the rater is to assume that the grain source is white.

b. For an item to be rated as wheat/whole grain, the item must be specifically described as a whole grain, including wheat, whole wheat, whole grain, brown rice, oats, wheatberries, bulgur, quinoa, amaranth, buckwheat, spelt, kamut, barley, millet, wild rice, corn, and rye.

c. Items that should be counted as bread include: sandwich bread, hoagie roll, submarine sandwich bread, breadsticks, flatbread (with the exception of flatbread pizza, which should be counted as pizza crust), gyro or naan.

d. Items that should be counted a roll include: dinner rolls, yeast rolls, etc.

e. "Buns" include hotdog and hamburger buns.

f. Chips or hard shell tacos should not be counted in the grain category as either white or whole grain.

**8. Beverages: The burden of proof must be on the kid's menu to identify that the fruit juice is "100% fruit juice" or the milk is low-fat.**

a. Assess the availability of 100% fruit juice and milk on the whole menu, but restrict the assessment of soda to the children's menu (i.e., soda as a choice specifically targeted at children).

b. Low fat milk is defined as skim or 1% milk.

c. Sugar sweetened beverages are soft drinks, sports drinks, fruit drinks and punches, sweetened tea, and other sweetened beverages.

**9. Side Dishes:**

a. Only assess the side dishes specifically listed on the children's menu. The side can either be included in a combination meal or be available separately. When determining whether a fruit is a side or dessert, consider how the restaurant refers to it (i.e., as a side or dessert) as well as whether it is similar to a side that is clearly not a dessert (e.g., French fries and apple fries).

b. Non-fried Vegetable– will include any raw, boiled, steamed, poached, sautéed, stir-fried, baked, stewed, grilled, roasted, braised, pickled, or dried vegetable. Vegetables will include potatoes, sweet potatoes, corn and peas. Vegetables will also include beans such as pintos, black beans, lentils, garbanzos (chick peas), kidney beans, navy beans, red beans, and soy beans.

   i. Mayonnaise or oil-based sides (e.g., coleslaw, potato salad, etc.) are not considered healthy

   ii. Other sides where oil, cream or butter is typically added to the preparation are not considered healthy (e.g., mashed potatoes, stuffing or dressing, potato chips)

c. Fruits with added sugar: Products such as cinnamon apples, fruit canned in syrup, fruit salad with dressing, and applesauce.

d. Fruits without added sugar: Items such as whole fruit, raisins, unsweetened applesauce and apple fries.

e. Low-fat dairy products: Products such as cottage cheese or yogurt that are specifically listed as "no-fat," "low-fat," and "reduced fat."

**10. Desserts:**

a. Only assess desserts that are specifically listed on the children's menu.

b. Healthy desserts include fruit without added sugar or unhealthy topping, fruit with a healthy topping added (e.g., low-fat yogurt), or a lower calorie/fat/sugar dairy product.

c. Unhealthy desserts include ice cream-based desserts (e.g., sundaes, ice cream smoothies, milkshakes) and other sugar-based desserts (e.g., slushees). If a dessert is not specifically listed (e.g., labeled generically as a "special treat"), consider it an unhealthy dessert.

**11. Salad dressing: only assess salad dressing options, if the children's menu includes either an entrée salad or a side dish salad. The rater can refer to the general menu to assess salad dressing options.**

**12. Branded marketing – logos or characters that are desired by children and commonly seen in pop culture (ex. Sponge Bob, Hot Wheels, etc.)**

**Appendix B** Children's Menu Assessment scoring (Krukowski et al., 2011)

Restaurant ID _____ **Children's Menu Assessment Scoring** Rater ID: _____

| Item | Calculation | Point Allocation | Score |
|---|---|---|---|
| **Nutritional Guidance** | | | |
| **Nutrition Information** | | If Yes = 2 points<br>If No = 0 points | |
| **Identification of Healthier Entrees** | | If Yes = 1 points<br>If No = 0 points | |
| **Entrees** | | | |
| **Healthy Entrees** | Item 6b _____(# Healthy Entrees) /<br>Item 6a _____(# Total Entrees) =<br>_____ | ≥ 0.2 healthy entrees = 2 points<br>0.10-0.19 healthy entrees = 1 point<br>0.09- 0.0 healthy entrees= 0 points | |
| **Healthy Salads** | Item 6c _____ (# Healthy Entrée Salads) | ≥ 1 healthy entrée salads = 2 point<br>0 healthy entrée salads= 0 point | |
| **Grains** | | | |
| **Whole Grain** | Item 6d _____(# Whole Wheat/Grains) /<br>Item 6e _____(# Whole Grain + # White) =<br>_____ | ≥ 0.2 grains = 2 points<br>0.10 to 0.19 grains = 1 point<br>0.09 to 0.0 grains = 0 points | |
| **Beverages** | | | |
| **100% Fruit Juice** | Item 7a __Y / N__ (100% Fruit Juice) | Yes, 100% fruit juice = 1 point<br>No 100% fruit juice = 0 points | |
| **Skim or 1% Milk** | Item 7b __Y / N__ (Skim or 1% Milk) | Yes, skim or 1% milk = 1 points<br>No skim or 1% milk = 0 points | |
| **Soda for children** | Item 7c __Y / N__ (Soda) | Yes, soda for children = **-1 points**<br>No soda for children= 0 points | |
| **Healthy Beverage Substitution** | Item 7d __Y / N__ (Healthy Beverage Substitution) | Yes, healthy beverage substitution = 1 points<br>No healthy beverage substitution= 0 points | |
| **Free Refills on Sugar Sweetened Beverages for Children** | Item 7e __Y / N__ (Soda) | Yes, free refills = **-1 points**<br>No free refills= 0 points | |
| | | **Subtotal Score (this page)** | |

Restaurant ID _____ **Children's Menu Assessment Scoring** Rater ID: _____

| | | | |
|---|---|---|---|
| **Side Dishes** | | | |
| **Non-fried Vegetable** | Item 8a __Y / N__ (Non-fried Vegetable/Salad) | Yes, non-fried vegetable/salad = 2 points<br>No non-fried vegetables/salads = 0 points | |
| **Fruit** | Item 8b __Y / N__ (Fruit) | Yes, fruit side = 1 points<br>No fruit side = 0 points | |
| **Fruit Without Sugar** | Item 8b __Y / N__ (Fruit Without Sugar) | Yes, fruit without sugar = 1 points<br>No fruit without sugar = 0 points | |
| **Dairy** | Item 8c __Y / N__ (Dairy) | Yes, dairy side= 1 points<br>No dairy side= 0 points | |
| **Low-fat Dairy** | Item 8c __Y / N__ (Low-fat Dairy) | Yes, low-fat dairy side = 1 points<br>No low-fat dairy side = 0 points | |
| **Healthy Side Substitution** | Item 8c __Y / N__ (Healthy Side Substitution) | Yes, healthy side substitution = 1 points<br>No healthy side substitution = 0 points | |
| **Desserts** | | | |
| **Healthy Desserts** | Item 9b _____ (# Healthy Desserts) /<br>Item 9a _____ (# Total Desserts) =<br>_____ | ≥ 0.10 healthy desserts = 1 points<br><0.10 healthy desserts = 0 points | |
| **Unhealthy Dessert Included** | Item 9c __Y / N__ (Unhealthy Dessert Included ) | Yes, unhealthy dessert included = **-1 points**<br>No unhealthy dessert = 0 points | |
| **Healthy Salad Dressing** | Item 10a __Y / N__ (Healthy Salad Dressing) | Yes, healthy dressing available = 1 points<br>No healthy dressing = 0 points | |
| **Toys/Marketing** | | | |
| **Branded Marketing** | Item 10a __Y / N__ (Branded Marketing ) | Yes, branded marketing = **-1 points**<br>No branded marketing= 0 points | |
| **Toys Promoting** | Item 10a __Y / N__ (Toys Promoting) | Yes, toys promoting = **-1 points**<br>No toys promoting = 0 points | |
| | | **Subtotal Score (this page)** | |
| | | | + |
| | | **Subtotal Score (from first page)** | |
| | | **Total Score (subtotal + subtotal) =** | |

# Curriculum Vitae

**Name:** Catherine M. DuBreck

**Post-secondary Education and Degrees:**

University of Western Ontario
London, Ontario, Canada
2015-2017 (Expected) M.Sc. Geography

State University of New York at Geneseo
Geneseo, New York, USA
2011-2015 B.A. Geography

**Honours and Awards:**

Public Service Alliance of Canada Local 610
Community Involvement Scholarship
2017

University of Western Ontario
Western Graduate Research Scholarship
2015-2017

National Council for Geographic Education
Outstanding Geography Major
2015

State University of New York at Geneseo
President's List
2014

State University of New York at Geneseo
Dean's List
2013-2015

State University of New York at Geneseo
Dr. Spencer J. Roemer Memorial Endowed Scholarship
2011-2012

**Related Work Experience:**

Teaching Assistant – Geography, 2015-2017
GEOG 1100, 3461F, 2460G
University of Western Ontario

Research Associate, 2015-2017
Human Environments Analysis Laboratory
London, Ontario, Canada

**Conference Presentations:**

Children's Health & the Environment Workshop/Symposium 2017
London, Ontario
An exploratory analysis of the consumer food environment in London, Ontario: assessing children's menus by neighbourhood socioeconomic characteristics
Poster Presentation

Association of American Geographers – Annual Meeting 2017
Boston, Massachusetts
Examining community and consumer food environments for children: an urban-suburban-rural comparison in Southwestern Ontario
Oral Presentation

University of Western Ontario – GIS Day 2016
London, Ontario
Examining the community food environments for elementary school-aged children in the City of London and Middlesex County, Ontario
Poster Presentation

ESRI Canada – GIS in Education & Research Conference 2015
Toronto, Ontario
Exploring socioeconomic influence on drug arrests: Boston, Massachusetts
Poster Presentation

Council of Public Liberal Arts Colleges – Northeast Region 2014
Keene, New Hampshire
Food insecurity: a Rochester, NY case study
Oral Presentation

Association of American Geographers Middle States Division 2014
York, Pennsylvania
Ice hockey geography: exploring the paradox of performance, attendance, and revenue in the core and margins of the NHL's domain
Oral Presentation