

# **A Canadian Perspective on Policies to Address Obesity in Populations of Low Socioeconomic Status**

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## **Abstract**

Obesity is one of the leading detrimental medical conditions in Canada; the Canadian adult population that is categorized as ‘obese’ now exceeds 25%, which is an increase from the 20% in 2000, and even more so from the 10% in 1986 (Raine, 2004). Across the globe, foods are becoming increasingly refined to enhance flavor, while keeping costs low. For individuals of a low socioeconomic status, already constrained by a budget, this change in the food environment they’re exposed to reflect on the types of foods they typically consume. To combat an increasingly prevalent problem, changes in policy can be used to alter the food environment. Considered in this systemic review were the strategies of financing initiatives for geographic access to fresh food, land-use control via zoning, and taxation of sugar-sweetened beverages (SSBs).

## **Introduction**

Obesity is a multifactorial disease that is becoming an increasingly prevalent issue across the world. The Canadian population that can now be classified as ‘obese’ exceeds 25%, which is a 25% increase from the 20% level in 2000, and a 150% increase from the 10% level in 1986 (Raine, 2004). The classification of obesity is based on the Body Mass Index (BMI) chart, which roughly calculates body fat based on the ratio of weight to height; when an individual’s BMI exceeds  $30.0 \text{ kg/m}^2$ , the term ‘obese’ is used (Raine, 2004). Although BMI can be used as a general guideline for characterizing obesity, caution should be noted when interpreting data; muscle mass weighs more than adipose tissue per unit of volume, and therefore an individual with much more lean mass per unit height may be wrongly characterized as per the BMI guideline (Rothman, 2008). As such, BMI may not be a perfect indicator of obesity for those

who are still growing, very lean, very muscular, very tall, or very short (Navaneelan & Janz, 2014). With this being noted, these outliers more than likely will still be characterized as ‘overweight’ by the BMI scale ( $25.0 - 29.9 \text{ kg/m}^2$ ), which is still an unfavourable situation for the individual. The BMI used in the majority of studies is based on self-reported data, typically via community health surveys (ie. Canadian Community Health Survey) which ask the respondent their height and weight (Navaneelan & Janz, 2014). However, respondent bias is commonly reported, as weight tends to be underestimated, and height overestimated; this can result in an obesity rate that is 7 to 8 percent lower than when directly measured (Navaneelan & Janz, 2014).

According to Tran et al. (2013), the aggregated annual costs of obesity in Canada ranges from \$1.27 – \$11.08 billion, with the direct costs amounting to 37.2 – 54.5% of the total; this accounts for between 2.2% and 12.0% of Canada’s total annual health care expenditures. With obesity on the rise, this number is expected to have increased in the recent years. Obesity indirectly strains the health care system due to increasing the risk for asthma, diabetes, high blood pressure, congestive heart failure, depression and anxiety, chronic pain, osteoarthritis, and heart disease (Raine, 2004).

With Canada recently being placed being fifth of the top 40 countries impacted by a higher prevalence of obesity, there has been extensive research and implementation on health-oriented physical education and individual-level assistance in appropriate dietary choices (Ogilvie & Eggleton, 2016). Some examples include the ParticiPACTION program to increase physical activity and *5 to 10 a Day*, outlining the need for vegetable and fruit consumption (Cismaru & Lavack, 2007). However, even with the continuous effort put on designing these programs, obesity is still clearly on the rise. Canada should move towards focusing additional

resources to health policies centered on changing food environments rather than changing societal dietary behaviours.

Our immediate food environment includes a variety of food retailers, ranging from fast food retailers to supermarkets; each type of food retailer ranges in their ratio of healthy foods (typically high in nutrients) to unhealthy foods (typically high in fats) (Boder et al., 2010). Typically, fast food retailers cater mostly unhealthy foods while supermarkets cater mostly healthy foods (Boder et al., 2010). It was commonly thought that this food environment determined dietary choices; the lack of fresh and healthy foods resulted in poor dietary choices (Pearson et al., 2005; Larson et al., 2009). This resulted in ‘food deserts’ being coined, indicative of areas where vulnerable populations have poor geographic access to healthy foods (Beaulac, Kristjansson, & Cummins, 2009). However, food deserts have been disputed in most large countries other than the United States of America, where there are clear links between areas of low mobility and SES and the ability to regularly and feasibly obtain healthy foods (Beaulac et al., 2009; Apparicio, Cloutier, & Shearmur, 2007; Pearson et al., 2005; Larson et al., 2009). In American cases where much of the jurisdiction’s population lives more than 1 mile from a supermarket in urban areas, it has been assumed that dietary problems are present largely due to a lack of supermarket availability. This lack of access results in an increased reliance on variety stores that have been documented charging a premium relative to comparable chain grocery stores for healthy foods and typically having a higher ratio of unhealthy to healthy foods (Latham & Moffat, 2007; Chung & Myers, 1999).

In Canada, individuals of lower SES are still correlated with poor dietary choices even though food deserts have been refuted. This has led to the thought of ‘food swamps’, areas where unhealthy foods (high-fat and high-calorie) are easily accessible and found in relative abundance,

largely being responsible for determining the diet of the surrounding population (Spence et al., 2009). Increased availability of fast food, however, is meaningless if consumption is not positively correlated to it (Richardson et al., 2011; Boone-Heinonen et al., 2011). There are also negative correlations between socioeconomic status and higher densities of fast food retailers relative to supermarkets (Giskes et al., 2011). If food swamps are determining the food environment in areas of low SES, and obesity is on the rise, there may be a connection between low SES and obesity in Canada. If so, actions via policies are needed to moderate the effects of food swamps on dietary choices that ultimately impact the prevalence of obesity.

## Methods

To assess what policy options should be recommended and are best suited to my topic of interest, in terms of my hypothesis that socioeconomic status is related to obesity in Canada, I have employed a systematic review. The systematic review was conducted via Google Scholar, utilizing a variety of different journal articles found using key words such as: ‘food deserts Canada’; ‘food deserts’; ‘food swamps’; ‘fast food access’; ‘fast food socioeconomic status’; ‘fast food BMI’; ‘Canada SES Obesity’; ‘GIS obesity’; ‘Built environment obesity’; and ‘Healthy food access socioeconomic status’. References cited from peer-reviewed literature reviews were also explored.

It was important to analyze if and how the built environment, which encompasses buildings, parks and various transportation systems, impacts the prevalence of obesity. Stemming from this information, the food environment was critically considered; the proposed dominance of food deserts in regions and what effects they have on dietary choices was examined, as well as whether food swamps or food deserts are more influential on dietary choices. If food swamps

and/or food deserts are established in Canada and have an impact on dietary choices, it is necessary to explore the relationship between fast food retailer availability for food swamps, or the lack of healthy food availability for food deserts, and low SES populations. The relationship between low SES and possible healthy food price disparities, relative to unhealthy food prices, was explored to determine if this effected dietary choices; the role of energy density and costs with fast food retailers was explored to determine whether fast food provides a larger amount of energy per unit cost which may promote unhealthy diets when budgetary constraints exist.

### *Addressing the Research Gap*

While every effort was made to ensure that the research consulted in this systematic review pertained to Canadian food environments, the significant portion of applicable research was conducted internationally. The pertinence of these studies may be equivocal in a Canadian context, but may help to reinforce hypotheses that have not been heavily researched in Canada, as well as to provide a basis for additional inquiries within a Canadian context. Additionally, much of the literature is not standardized in regard to the definition of their terms, such as ‘healthy foods’, ‘unhealthy foods’, or ‘fast foods’.

This research gap should be addressed in future studies if appropriate interventional techniques are to be employed to reduce the incidence of obesity within Canada.

## **Results and Discussions**

### *The Obesogenic Environment – Food Deserts or Food Swamps?*

According to published Canadian literature, there does not seem to be significant evidence of the presence of food deserts. According to the report published by Health Canada in

2013, *Measuring the Food Environment in Canada*, of 13 studies that analyzed the relationship between vulnerable populations and geographic access to supermarkets, only 3 were in favour of the presence of food deserts, whereas 10 concluded that there was no statistically significant difference between populations of higher and lower socioeconomic status having access to healthier foods (Minaker, 2013). However, there are areas where the accessibility of healthy foods is lacking, which would technically be termed food deserts, but are a relatively regional issue that is currently not a broadly-applied concern (Minaker, 2013). Large systematic reviews are ineffective to accurately determine the location of these food deserts, as they can be small sections of urban cities and/or municipalities. Smoyer-Tomic et al. (2006) demonstrates this by including 212 neighbourhoods in an analysis of food deserts in areas populated with low SES individuals; in total, there were only 9 neighbourhoods across Edmonton, making up 20,125 of the total 647,000 individuals, that met both criteria, and there was no mention of the locations being correlated to one another.

The ability to access healthy foods also seems to be temporally-dependant, according to Widener et al. (2011); the one-year study in Buffalo NY indicates that the average distance to markets with higher proportions of fresh foods in areas of low SES was greater in the winter and spring months, but was lower in the summer and fall, due to the presence of farmers' markets. The literature also indicates that when jurisdictions had more access to supermarkets to increase the availability of fresh foods, there had been no change in dietary behaviours (Boone-Heinonen, 2011). This indicates that increased accessibility to healthy foods does not inevitably result in a significant impact on the food environment when access is already reasonable. (Boone-Heinonen, 2011; Smoyer-Tomic et al., 2008). Contrary to this previous finding, Kamphius et al. (2006) outlines a positive relationship between fruits and vegetable (FV) consumption and

supermarket access; this discrepancy between results may be explained by inconsistent classifications of ‘healthy foods’ between studies. Healthy foods include more than just FV, as most studies considered in this systematic review indicate that foods with low-fat, unrefined grains, and minimal added-sugar are also encompassed under this definition. As an example, oatmeal does not count as a FV, but is still considered a healthy food as per the criteria used by Monteiro et al. (2010). It seems that a systematic approach to viewing the consumption of healthy foods may exclude consumption behaviours of individual food groups.

On the other hand, the literature indicates that food swamps have a large impact on the food environment; several studies indicate that when fast food is more readily available, it is also consumed in larger amounts (Fleischhacker et al., 2011; Inagami et al., 2009; Boone-Heinonen, 2011). Richardson et al. (2011), however, which Boone-Heinonen collaborated on, found that there is no relation between fast food availability and consumption, but does confirm that increased fast food availability is positive correlated to obesity prevalence. This discrepancy seems to exist because Richardson et al. (2011) did not include a variable for socioeconomic status, which Boone-Heinonen (2011) considered.

Specifically in Canada, Smoyer-Tomic et al. (2008) found that areas in Edmonton AB, Canada, with low SES had an increased prevalence of fast food retailers, but with no offsetting by better supermarket access for fresh foods. This, however, may not be relevant due to the general lack of evidence to indicate that better supermarket access results in healthier dietary choices. Kwate (2008) relates that this phenomenon may exist due to fast food retailers being attracted to communities with low SES because of lower rent, a less competitive retail climate, and often less restrictive land use regulations.

## *The Built Environment: Neighbourhood Socioeconomic Status, Fast-Food Retailers, and Obesity*

Communities with low SES may also be more prone to obesity as a result of the higher density of fast food retailers in such communities; although most studies have been conducted in the United States, Moffat et al. (2005) insinuates a positive correlation in Canada. In Hamilton ON, Canada, obesity rates in children belonging to vulnerable populations was abnormally high, relative to the rates of obesity from children in higher SES backgrounds throughout the 3 schools included in the study. A direct correlation between socioeconomic status and obesity due to the fast food retailer density is unable to be drawn, however, due to Moffat et al. (2005) not including the density of fast food retailers in the area within their scope of research. Spence et al. (2009) fills in the gaps on a positive relationship between local fast food density and obesity in adults living in Edmonton. This study was able to provide information on access to both fast food and supermarkets; the ratio of fast food retailers and convenience stores to supermarkets was calculated, which determined the “Retail Food Environment Index” (RFEI) (Spence et al., 2009). As per the results, a higher RFEI was significantly positively correlated with an increased likelihood of being obese. Considering that Smoyer-Tomic et al., (2007) found a negative relationship between SES and the prevalence of fast food retailers, it may be reasonable to assume that at least in Edmonton, populations with lower SES were more likely to be obese due to the food environment being dominated by unhealthy food retailers.

The relationship between vehicle ownership, socioeconomic status, fast food retailer density, and obesity was explored by Inagami et al. (2009) within the Los Angeles County, United States. Unsurprisingly, they found that car owners generally have a higher BMI relative to non-car owners living in the same neighbourhood, and non-car owners living in neighbourhoods with high fast food retailer density have a higher BMI relative to non-car owners

living in neighbourhoods with low fast food retailer density. However, populations of low SES were overall less likely to own cars due to budgetary constraints (Inagami et al., 2009). Quantitatively, this relationship was physically determined for an individual standing 5 feet and 5 inches tall; the difference in weight for this individual if they belonged to the non-car owning group living with high fast food retail density rather than the non-car owning group living with low fast food retail density was approximately 12lb more (Inagami et al., 2009). Clearly, proximity to fast food retailers plays a large role in dietary choices in low SES populations, resulting in a BMI shift towards obesity. Boone-Heinonen et al. (2011) also determined that groups of low SES have up to 2.3 times more fast food retailers within 5 to 10 minutes of walking distance relative to populations of high SES. Within the group of low income men in the U.S., a 1% increase in fast food availability from 1.0km – 2.9km translates to a 0.34% increase in fast food consumption (Boone-Heinonen et al., 2011); in other words, if there were three fast food retailers originally in an area, and a fourth joins in, this would result in a 33% increase in the number of fast food retailers, which should hypothetically lead to statistically significant 11% increase in fast food consumption (Boone-Heinonen et al., 2011).

It is important to note that although relationships between SES, fast food retailer density, and obesity are implied in this systemic review of the literature, the mechanistic link itself has not yet been identified. Bowman et al. (2004), however, determined that on days when the children respondents consumed fast food, relative to when they did not consume fast food, they ingested more calories and had a poorer quality of diet. This is concerning, considering that weight gain, and further downstream, obesity, is simply when excess calories are consumed, where ‘excess’ is more than the body is able to expend (Pereira et al., 2005). Thus, it can be inferred that when children consumed fast food, they were subject to excessive calories, which

may then lead to weight gain, and ultimately obesity. Rosenheck (2008) confirms this by using cross-sectional evaluations, prospective cohort studies, and experimental studies to conclude that there is overwhelming evidence indicating a positive relationship between fast food consumption and a net increase in caloric intake. Furthermore, Hill & Peters (1998) mention that, “humans... have only weak physiological mechanisms to defend against body weight gain when food is abundant”, or in this case, when calories are abundant.

### *Inequitable costs of healthy foods for vulnerable populations*

Thus far, it has been established that food deserts do not play a significant role in the Canadian food environment, whereas food swamps predominantly effect this complex ecosystem. However, the difference in cost between healthy and unhealthy foods has not yet been discussed in this review; according to Drewnowski and Specter (2004), there is a negative correlation between the density of foods, measured in megajoules/kg, and the energy costs, measured in cents/10 megajoules. We may then infer that fast food retailers are able to offer the same caloric density as healthy foods offered by supermarkets, but at a lower price. Roa et al. (2013) conducted a systematic analysis via studies from across 10 countries to compare the price difference between healthy foods and unhealthy foods that would constitute 2000 calories and found that the latter type costed \$1.56 more than if the same number of calories were delivered via unhealthy foods. Assuming that the majority of low SES populations do not make dietary choices based on caloric quantity but instead on the price, due to dietary constraints, on average, fast food retailers would provide foods at a comparable price as supermarkets but at a greater caloric amount; typical fast food outlets have average energy densities of the entire menu that are 65% higher than that required of the average diet (Prentice & Jebb, 2003). Prentice & Jebb (2003) partially solidified these thoughts via literature review, stating that, “humans have a weak

innate ability to recognize foods with high energy density and to appropriately down-regulate the bulk of food eaten in order to maintain an energy balance”.

From 1972 to 1994 in the United States, the percentage of disposable income spent on food at home had decreased, while the percentage spent on food away from home had increased (Drewnowski & Specter, 2004). Superimposing the increasing incidence of obesity, there may be a direct link between rates of obesity, the increasing percentage of the dietary budget spent on food away from home, and the relatively lower price of fast foods. Reinforcing this claim in vulnerable populations, Darmon et al. (2002) investigated the food choices a rational individual would make when belonging to a low SES group in France. They noted that as they increased the cost restraint upon the individual’s dietary choices, the proportion of healthy foods to unhealthy foods purchased started to decline (Darmon et al., 2002). This finding validates that of Drewnowski and Specter (2004), as populations from a low SES background would be more likely to purchase unhealthy foods which are typically less costly and more energy dense. Drewnowski (2004) clearly states from his research in the United States that, “Obesity in America is, to a large extent, an economic issue”.

In regard to the price of healthy foods in supermarkets located in areas of high SES and low SES, there was no difference (Chung & Myers, 1999). However, it is noteworthy to point out that although there was no significant difference in pricing across supermarket chains, variety stores, belonging to the classification of food swamps, carried fresh foods at significantly higher prices while commonly being inferior in quality; produce, meat and dairy, dry goods, canned goods, and grains were also all more expensive at variety stores than at supermarket chains (Chung & Myers, 1999). Kerr et al. (1984) indicate that for a weekly home food plan meeting the minimum federal dietary standard in 1984, a supermarket chain would charge \$93.28, whereas a

variety store would charge \$109.90, a relative premium of 17.8% over the supermarket chain.

Specific to a Canadian food environment context, Latham and Moffat (2007) explored food costs and availability in different neighbourhoods with contrasting SES situations in Hamilton. Similarly, to the study conducted by Chung and Myers (1999) that determined similar pricing between supermarket chains, food costs were similar between supermarkets regardless of the neighbourhood SES. Additionally, food costs were elevated in variety stores that dominated the low SES neighbourhood relative to the high SES neighbourhood (Latham & Moffat, 2007). On top of a higher price, the variety stores only had limited healthy food options relative to the supermarket chains, exposing a barrier for accessing healthy foods in low SES neighbourhoods (Latham & Moffat, 2007; Chung and Myers, 1999). The main reasons for the lack of healthy options in variety stores stemmed from the lack of frequent customers resulting in frequent food spoilage, a lack of customer expectation for buying healthy foods at variety stores, and the competition with supermarkets that had access to more shelving space and could stock shelves at a lower price (Latham & Moffat, 2007).

## **Policy Recommendations**

### *Priorities in Policy*

As a starting point for determining what policy options may be well-suited to alter food environments and cause a community-level shift in body weight towards more healthy levels, the “State of the Evidence Review on Urban Health and Healthy Weights” was used as a ‘background check’ to see what policies researchers and decision-makers thought would be most impactful (Raine et al., 2008). According to the 90 responses, the physical environment would be most impactful on healthy weights in urban environments, with the socio-cultural environment

and economic environment being second and third priorities, respectfully (Raine et al., 2008). However, when consulted on whether these environments could be altered by policies, only 7 of 11 responses deemed the socio-cultural environment being changeable by policy interventions, whereas 51 of 52 and 8 of 9 responses deemed the physical environment and economic environment being changeable by policy interventions, respectfully (Raine et al., 2008). Therefore, the focus of the following policies will be on changing the physical environment, also referred to as the built environment, and the economic environment in communities.

### *Financing Initiatives to Attract Supermarket Chains*

Offering incentives for supermarket chains to establish a store may result in increased competition with existing supermarkets (Lal & Rao, 1997). Ideally, this would lead to more competitive prices, as competition typically drives prices down due to the lack of a monopoly in those areas. However, the main goal of this strategy would be to directly cause more competition between supermarkets and grocery retailers, as the literature is lacking to suggest that supermarket presence has a strong impact on the food environment in areas of low SES. Instead, the goal would be to increase physical accessibility, hopefully discouraging individuals from buying groceries from variety stores that may charge significantly more for healthy foods (Boone-Heinonen et al., 2011; Latham & Moffat, 2007).

FV consumption and its positive correlation to supermarket accessibility also suggests that better access to supermarkets will not only allow individuals of low SES to purchase higher quality FV cheaper than in variety stores, but on a more regular basis, even if other healthy foods are not being purchased more frequently (Dubowitz et al., 2008; Kamphuis et al., 2006). Due to the high levels of fibre and water, an increase in FV consumption may promote satiety that may otherwise be subdued by the consumption of fast foods (Rolls, Ello-Martin, & Tohill, 2004). As

FV only make up a small proportion of the majority of the population's caloric intake, opening new supermarket chains may not lead to a significant difference in terms of overall caloric intake, which is the fundamental cornerstone of obesity (Kamphuis et al., 2006). However, it is clear that a higher intake of FV adds nutrients that are not typically available in fast foods (Jaworowska et al., 2013).

To increase the geographic distribution of healthy food retailers in 2007, the Mayor and City Council, in partnership with the Community Redevelopment Agency of the City of Los Angeles (CRA/LA) developed an incentive package for retailers that met specific criteria; to be eligible for this incentive package, the size of a grocery store needed to be 12,000 square feet or larger, while produce markets needed to dedicate at least 80% of the floor space to fresh fruits and vegetables (City of Los Angeles, n.d.). Some of the incentives from the package included: priority assistance from the CRA/LA façade improvement conditional grant program, providing \$150,000 for existing building projects and \$250,000 for historic building projects; pre-development loans for acquisition or site preparation work from CRA/LA; low-interest acquisition loans; hiring tax credits to aid in employee recruitment; a discount of up to 35% on electricity rates for the first year; and an expedited plan review by the City Planning Department (City of Los Angeles, n.d.). The geographic locations that were being given consideration for this incentive package were based from the purchasing power of the neighbourhoods, which took into account the current density of fresh food retailers (City of Los Angeles, n.d.). Unfortunately, the results of this program are not well documented in the literature. However, the City of Hamilton successful implemented a similar incentive via a grant with the recruitment of the 'Nations' supermarket located in the heart of their downtown where there was poor access to supermarkets (Milsome, 2012). A one-time non-repayable loan of \$650,000 was extended to any full-service

grocery chains to utilize an empty 55,000 ft<sup>2</sup> lease in Jackson Square (Milsome, 2012).

Comparing the City of Hamilton and City of Los Angeles grant program, there seems to a similar ratio of dollars offered to minimum square foot for existing buildings; the City of Los Angeles offered \$12.5/square foot, whereas the City of Hamilton offered \$11.8/square foot (not accounting for the rate of inflation or conversion rates at the time of the offers). Additionally, the City of Hamilton added a stipulation to ensure the appropriate use of the grant, whereby the supermarket needs to be operating within certain days of the week, certain times in a day, and for a certain amount of years, but may have the ability to terminate the contract if a net loss equal to or exceeding \$650,000 is accumulated (Milsome, 2012).

One of the major results that this option may have on the local economy is that surrounding variety stores may close, leading to new food deserts, although this may not have an impact on the food environment, as previously discussed (Clarke, Eyre, & Guy, 2002). In terms of the local economy, it would have negative impacts on the owners of such small businesses that may already not have been doing financially well in an area of low SES. However, the presence of small stores such as variety stores may lead to more accessible unhealthy foods, and therefore a closure of variety stores may lead to a food environment with healthier choices (Latham & Moffat, 2007). As variety stores are positively correlated to obesity and fall under the umbrella of ‘food swamps’, this may have a positive effect on obesity levels in such areas.

### *Various Zoning Techniques*

To control the food environment in areas of low SES, zoning can be implemented to exclude fast food retailers via municipal by-laws with the aim of reducing obesity. With this technique, it is important to specifically define what a ‘fast food retailer’ is classified as, so that loopholes can not be exploited. By using controlled-use permits or performance zoning,

municipalities can limit fast food establishments instead of completely banning them (Juergensmeyer & Roberts, 1998).

The City of Arcata, California, used by-laws to limit the number of chain fast food retailers to a maximum of 9 within a certain geographic location; the by-law ensured that the definition of a ‘chain’ was extended to any restaurant that had 12 or more locations with the same name, design, menu, or trademark (Fernandez, 2006). Because there was no direct intervention by the City of Arcata, there was a relatively low expenditure on the technique, and local businesses were still able to grow, which would otherwise become obsolete in such a competitive environment (Fernandez, 2006). Overall, the use of controlled-use permits was primarily to prevent the establishment of new fast food retailer chains in the area (Mair, Pierce, & Teret, 2005).

Boone-Heinonen et al. (2011) also promote the implementation of zoning practices to restrict fast food retailers within 3 km of low-income residents, which would significantly reduce the amount of consumption due to the restriction of fast food availability in lower income groups. This study also supports the ban of fast food retailers from within 500 feet of schools implemented in Detroit, which had successful results in mitigating fast food consumption (Diller & Graff, 2011). This technique may be particularly effective for reducing childhood obesity, and further on translate to reduced adult obesity. According to a relatively recent study by Currie et al. (2010) that investigated 3 million school children in the United States, among ninth graders, a fast food retailer within 0.1 miles resulted in a 5.2% increase in obesity. Using information from the literature provided from Moffat et al. (2005) and GIS data of fast food retailers, this technique may also be implemented in the City of Hamilton according to schools with students from a low SES.

Zoning to reduce the impact of fast food retailers was also implemented in South Los Angeles CA, United States, by halting all permits given for projects to expand fast food retailers for a total of 365 days (Sturm & Cohen, 2009). This zoning was also temporally coordinated and implemented with the incentive package for healthy food retailers, to ensure maximum efficiency of resources. Ultimately, this plan failed and instead resulted in an increase in fast food consumption (Sturm & Cohen, 2009). This was suspected to occur due to the zoning parameters only restricting the addition of fast food retailers in standalone buildings, while strip malls were not included in the zoning by-law, an exception that fast food retailers ended up taking advantage of (Sturm & Cohen, 2009). This example provides some awareness that zoning would be largely beneficial in jurisdictions that have a rapid growth rate; Edmonton would be a prime city to establish zoning laws limiting additional fast foods retailers, as it has the second highest population growth rate for a large city in Canada at 12.1% from 2006 to 2011 (Statistics Canada, 2011). Other jurisdictions where urban sprawl is a problem would also be eligible candidates, such as the Greater Toronto Area that continues to expand rapidly (Statistics Canada, 2011). For the specific case of South Los Angeles, Sturm & Cohen (2009) claim that menu labelling would have been more effective than the zoning techniques used. Fortunately, the provincial *Healthy Manu Act* was passed in 2015 and was implemented on January 1, 2017; future literature on the impact this Act will have will provide clarification on how effective menu labelling truly is, and whether it may be better than zoning, in Ontario.

Finally, zoning to restrict drive-through services from fast food retailers may also be easily implemented, but would likely be unsuccessful in areas of low SES as lower income families are less likely to be able to afford automobiles (Mair et al., 2005).

## *Taxation of Sugar-Sweetened Beverages*

Babey et al. (2011) found that the percent of 12-17 year olds drinking soda more than 1 time per day was significantly highest in areas with a high Home and School Retail Food Environment Index (HSRFEI) in the United States; this was a measure developed by them that uses the following formula: (# fast food retailers + # convenience stores + # liquor stores + # dollar stores + # pharmacies)/(# grocery stores + # warehouse stores + # produce vendors) within 0.5 miles of the adolescent's school, as well as within a given radius around their home (one mile in urban areas, two miles in smaller cities and suburban areas, and five miles in rural areas). Bringing this to a Canadian context, Vanderlee et al. (2013) found that 80% of 10,188 youth that were studied consumed at least 1 serving of a sugar-sweetened beverage (SSB) the previous day. Additionally, Jones et al. (2017) found that in 2015, the average amount of purchased SSB was 341 mL per day. Note that the definition of an SSB is strictly contained to a “regular carbonated soft drinks, regular fruit drinks, non-diet sports drinks, non-diet energy drinks, sugar-sweetened coffee and tea, hot chocolate, non-diet flavoured water, sugar-sweetened milk (e.g., chocolate milk), and sugar-sweetened drinkable yogurt” (Jones et al., 2017). From this literature, it is evident that SSB consumption may be pertinent as a problem. According to a recent study by Jones et al. (2017), the direct health care costs from SSB consumption are estimated to be \$33.7B and will be responsible for approximately 2,101,399 cases of obesity in Canada, over the next 25 years.

To reduce the consumption of SSBs in Berkeley CA, United States, a tax was implemented for SSBs at 1 cent per ounce (Falbe et al., 2016). This tax clearly made an impact on dietary choices, as sugar drink consumption in Berkeley dropped by 21% in the year it was implemented (Falbe et al., 2016). The tax revenues were then allocated to fund educational

programs in local communities (Falbe et al., 2016). However, as mentioned these strategies are not as effective as they were once thought to be. To further support the tax levied in Berkeley, Rivard et al. (2012) found that 36% of 592 individuals across the United States were in favour of a hefty 20% excise tax applied on sugar-sweetened beverages per ounce. This 20% rate of taxation is supported by several studies that suggest that purchasing behaviours only start to change significantly at this tax point (Powell & Chaloupka, 2009).

In a Canadian context, with a federally-mandated 20% excise tax on SSBs, 519,292 cases of obesity and overweight (classified from the BMI scale) would be avoided, ultimately saving the health care system \$7.35B and generating \$29.65B in tax revenue (Jones et al., 2017). Seeing as this tax would be federal, provinces would then be given a proportional amount of revenue, which would subsequently be passed on to municipalities based on need. Instead of allocating the tax revenues towards funding community educational programs to reduce obesity, which do not typically have a large impact on the food environment or purchasing behaviours, the tax revenues can be used to directly fund the incentive package that was outlined earlier, to attract more fresh food retailers. Subsidizing healthier options would also aid in reducing the price discrepancy between unhealthier energy-dense foods and healthier options, but classifying what foods to be subsidized would be an extremely difficult task (Drewnowski & Specter, 2004). Using these tax revenues to fund local incentives that are investments into communities also provides transparency, so that citizens understand that the money from the tax is being reinvested back to directly promote their wellbeing.

One of the largest problems for implementing a significant excise tax would be that producers of the unhealthy foods may decide to absorb the additional costs, and it would not be reflected in the consumer pricing, since it would result in a significant decrease in sales (Franck

et al., 2013). However, this may also result in the decreased expansion of SSBs, as profit margins would not be as high. Another problem suggested by Franck et al. (2013) is the regressive nature of an excise tax on unhealthy foods; as low-income households typically spend a larger proportion of their income on fast foods, this tax would affect them more than it would for families of higher SES. However, looking at the situation of regressive taxes arbitrarily, because individuals from a low SES background have a higher risk of obesity, this regressive nature of the tax can be viewed as a positive (Drewnowski & Specter, 2004). Additionally, although the low SES population would be hurt more because a 20% tax costs them a larger proportion of their income, this would not be the case with individuals from higher SES, and therefore the latter group may not cut down their consumption of SSBs as much as individuals from low SES backgrounds (Drewnowski & Specter, 2004). This would result in a larger proportion of the taxes to be coming from individuals from a higher SES, and subsequently individuals from a low SES background would reap the benefits of having fresh food retailers potentially cater to their neighbourhoods.

It is much more feasible and effective to change the food environment of Canadians of low SES to better favour healthy foods than to change societal behaviours. Therefore, this option is the most feasible and is recommended. This method would allow all levels of government to be involved in the active movement to reduce obesity in Canada. This excise tax may be progressive, starting at a lower rate of 10% so that SSB manufacturers are not too overwhelmed with the added cost to their production. It would then be increased to 20% after 2 years, giving retailers a chance to test the market with fluctuating prices and to see whether consumer purchasing behaviour changes, which may result in the prioritization of other beverages to maximize profit. In either case, the food environment in Canada will be shifted to become more

health conscious, and the projected result is a lower rate of obesity.

### *A Three-Pronged Approach*

Combining incentivization, zoning, and taxation would most likely result in the most effective policy option. Controlled-use zoning can be used to mitigate the subsequent addition of chain fast food retailers within neighbourhoods, while taxation of SSBs can be applied to the already existing fast food retailers, with the tax revenues being used on a municipal-level to fund incentive packages for fresh food retailers. However, this would take considerable coordination between all 3 levels of government to ensure a successful implementation. Additionally, not all municipalities would require incentivization of fresh foods, depending on the current standing of their food environment. With obesity on the rise in Canada, a radical and bold policy intervention such as this three-pronged approach may be necessary as a preventative measure.

## **Conclusion**

Complicating the issue of Canada's obesogenic food environment is the lack of Canadian-specific literature, which results in most of the Canadian research being primarily rooted in international research, completed in other first-world countries such as the United States, and Commonwealth countries. With such a complex food environment, a singular approach may not be sufficient to address the rising rate of obesity; a three-pronged policy intervention was recommended in this systematic review, which could be implemented concurrently. Such an aggressive method is recommended to act as a preventative measure, rather than an adaptive measure in Canada, as health care spending on obesity-related health problems continues to rise the longer government prolongs active intervention.

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