

**Examining the impact of a restrictive retail food environment
intervention on pharmacy sales over time in Baddeck, Nova Scotia**

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners

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Abstract

Introduction: Sugar-sweetened beverages are a significant source of dietary sugar intake for both adults and children in Canada and around the world. Consumption of excessive amounts of sugar is a risk factor for a variety of chronic diseases, including obesity, type 2 diabetes and cardiovascular disease. The retail food environment influences how individuals choose and access food. This study examines the impact of removing all sugar-sweetened beverages from a rural pharmacy on the mean expenditure per transaction for four product categories: minimally processed beverages; minimally processed snack food; ultra-processed beverages; and ultra-processed snack food.

Methods: Sales data were obtained from a pharmacy in Baddeck, Nova Scotia, Canada, from September 1, 2013 to September 30, 2015. The NOVA classification system was used to categorize items for analysis. The primary outcome measure was mean expenditure per transaction for each of the four product categories.

Results: Overall, the number of beverage sold decreased substantially (-34%) after the intervention. Prior to the intervention, ultra-processed beverages accounted for half of all beverages sold. The intervention removed this entire product category, so while minimally processed beverages and other beverages saw an increase in the number of items sold, this increase did not compensate for the removal of all ultra-processed beverages. During the same time period, the number of food products and prescriptions sold increased slightly (4% and 9%, respectively) and the number of non-food products sold decreased slightly (-2%). Revenue from beverages decreased by 20% after the intervention, yet revenue from food and non-food products increased (17% and 2%, respectively). Revenue from prescriptions decreased by 2% after the intervention. While there was no significant change in the percentage of total store revenue that food and beverages accounted for before and after the intervention, the food and beverage category as a whole makes up such a small fraction of overall store sales that these changes result in a relatively minor loss of revenue at the pharmacy. After the intervention, a larger proportion of transactions contained at least one

minimally processed beverage; minimally processed snack food and processed snack food. The mean expenditure per transaction did not change significantly after the intervention.

Conclusions: This study is one of the first to examine the impact of a restrictive retail food environment intervention on pharmacy sales. With the expanding selection of food and beverage products available in pharmacies, pharmacies play an increasingly important role in creating healthy food environments.

Findings from this study suggest that this type of restrictive intervention can be implemented with a very minor loss to overall store revenue after the removal of all sugar-sweetened beverages. These findings also suggest opportunities for further research using sales data in different contexts and jurisdictions.

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1. Introduction and Overview

Excessive sugar consumption and its ill effects on health is of current interest. Recently, the World Health Organization has recommended people limit their free sugar intake to less than 10% of total daily caloric intake, or as low as 5% for added health benefits (World Health Organization [WHO], 2015). This equates to approximately six teaspoons a day. The Heart and Stroke Foundation of Canada has recommended that Canadians limit their consumption of added sugar to 10%, and ideally 5%, of their total calories (Heart & Stroke, 2016). While the recommendations are similar, definitions of sugar are not consistent. The total amount of sugar contained in food and beverages includes both the naturally occurring sugars in foods, such as sugars found in fruit or milk, as well as any sugar added to the food or beverage during processing. The WHO uses the term “free sugar” rather than “added sugar”, which includes both sugars added and sugars naturally present in fruit juice and fruit juice concentrate (Erickson & Slavin, 2015). As of 2004, Canadians were consuming on average 110 grams of total sugar, or 26 teaspoons, each day (Langlois & Garriguet, 2011).

The sources of dietary sugar vary by age, but for adults, 35% of daily sugar consumption is from beverages, whereas for children and adolescents, this number rises to 44% (Langlois & Garriguet, 2011). These sugar-sweetened beverages (SSBs) tend to be devoid of nutritional value, offer little satiety and yet are high in sugar and calories. One can of pop, for example, contains on average 10 teaspoons of added sugar (Heart & Stroke, 2016). Examples of SSBs include carbonated soft drinks, juice with sugar added, flavoured water and milk, sports drinks and energy drinks. Among Canadians aged 5 to 19 years old, 27.2% report drinking SSBs daily (Public Health Agency of Canada [PHAC], 2014). Consumption of SSBs has been associated with increased rates of overweight and obesity (Malik, Schulze, & Hu, 2006). Studies also link the consumption of SSBs with a variety of chronic diseases, including type 2 diabetes mellitus, and cardiovascular disease (Malik, Popki, Bray, Despre, & Hu, 2010).

Historically, most food consumed was relatively unprocessed – either consumed in its natural state, or combined with other culinary ingredients to prepare meals. In the last few decades, there has been a significant shift in dietary patterns away from whole foods and freshly prepared meals. Almost all food consumed in Canada is now processed in some way to increase shelf life, reduce preparation time (e.g., ready-to-consume meals or meals only needing to be reheated) and to make the food more attractive and appealing (Monteiro, Levy, Claro, de Castro, & Cannon, 2010). Despite the popularity of processed foods and beverages, food processing had been previously overlooked in food classification systems.

More recently, significant work has been done to develop food classification systems for processed foods and beverages that is valid as a tool for dietary guidelines and public health research. One classification system is known as the NOVA classification system, which groups all foods and beverages into one of four groups according to the level of processing they undergo and the purpose for the processing (e.g., to preserve, extract, modify or create) (Monteiro et al., 2016). In the NOVA classification system, food processing is defined as "all methods and techniques used by industry to turn whole fresh foods into food products" (Monteiro, Levy, Claro, de Castro, & Cannon, 2010). This system assigns foods and drinks into one of four categories: unprocessed or minimally processed foods; processed culinary ingredients; processed foods; or ultra-processed food and drink products. As of 2001, the Canadian diet was dominated by ultra-processed food, most of which are unhealthy (Moubarac, et al., 2013).

The NOVA classification system is used widely to study dietary patterns (Moubarac, et al., 2014), the influence of the food environment (Costa, Claro, Martins, & Levy, 2013), as well as consumption of ultra-processed products (Franco, Rosa, Luiz, & de Oliveira, 2015). Some techniques for processing food such as drying, freezing, pasteurization and vacuum-packing have significant benefits in terms of food

preservation. However, other methods (e.g., adding salt, sugar or other preservatives, frying, alcoholic fermentation) pose potential negative impacts on health (Moubarac, Parra, Cannon, & Monteiro, 2014). The increase in consumption of processed food has been accompanied by an increase in overweight, obesity and other chronic diseases (Moubarac, et al. 2013). Food processing is of interest both for its influence on dietary patterns, as well as its impact on body weight and dietary-related diseases, such as obesity (Monterio et al., 2016).

Many components in the food environment influence how an individual chooses and accesses food. This paper will focus on two components of the food environment: community nutrition environment and consumer nutrition environment. The *community* nutrition environment includes the types and location of food outlets, such as stores and restaurants, and the accessibility of these outlets. The *consumer* nutrition environment includes the availability of food and beverages, the price, promotion and placement of food and beverages, and nutritional information available on the product (Health Canada, 2013). Several studies have found an association between the food environment and individual diet patterns (Herforth & Ahmed, 2015; Caspi, Sorensen, Subramanian, & Kawachi, 2012).

Within the consumer nutrition environment, interventions have focused on increasing the availability, the attractiveness, or lowering the price of nutritious food and beverage products. These are examples of permissive interventions. Contrarily, restrictive interventions aim to limit the availability of minimally nutritious food and beverages (Minaker et al., 2016).

The intervention examined for this study took place in the small, rural town of Baddeck, Nova Scotia, Canada. As of 2016, the year-round population of the town was just over 800 people (Statistics Canada, 2017), however, its location along the Cabot Trail on Cape Breton Island makes it a popular tourist stop

during the summer months. Residents of Baddeck have relatively few options when it comes to purchasing food and beverages, as there are only three retail food stores in the town. The community nutrition environment is, thus, rather restricted. The nearest community with large retail outlets is more than 80 kilometres from Baddeck, so it is likely that most residents purchase their food and beverages in Baddeck on a regular basis.

On September 11, 2014, Graham MacKenzie, the pharmacist and owner of Stone's Pharmacy in Baddeck removed all carbonated soft drinks (including artificially-sweetened diet varieties), juice, and vitamin water from the shelves of his business (CTV News, 2014; CBC News, 2014; Ayers, T., 2014). This is one of the first retailer-led interventions in Canada to remove all sugar-sweetened beverages (SSBs) and artificially sweetened beverages from a retail outlet. The pharmacy, perceived in the community as a source of nutritional and health information, also offers one on one nutraceutical consultation services, healthy grocery shopping tours, hormone and food testing, counselling services (Stone's Pharmasave, 2015) and more recently, healthy cooking classes for families (Stone's Pharmasave, 2017). When asked about his reason for removing these beverages, MacKenzie noted that, "We tell people don't drink pop, don't drink juice (but) on the way out the door, they're walking by these pop machines. It just didn't make sense to me." (CTV News, 2014). Having these beverages available in the pharmacy, especially in close proximity to sales registers, increases the likelihood of impulse purchases (Center for Science in the Public Interest, 2015).

For this type of population health intervention to be feasible and scalable to other pharmacies, it must prove to be sustainable as a business model, and thus not have a negative impact on retail performance. As the intervention will impact both the pharmacy's role in promoting health in the community, and profitability as a small business, the intervention will have to strike a balance between creating positive

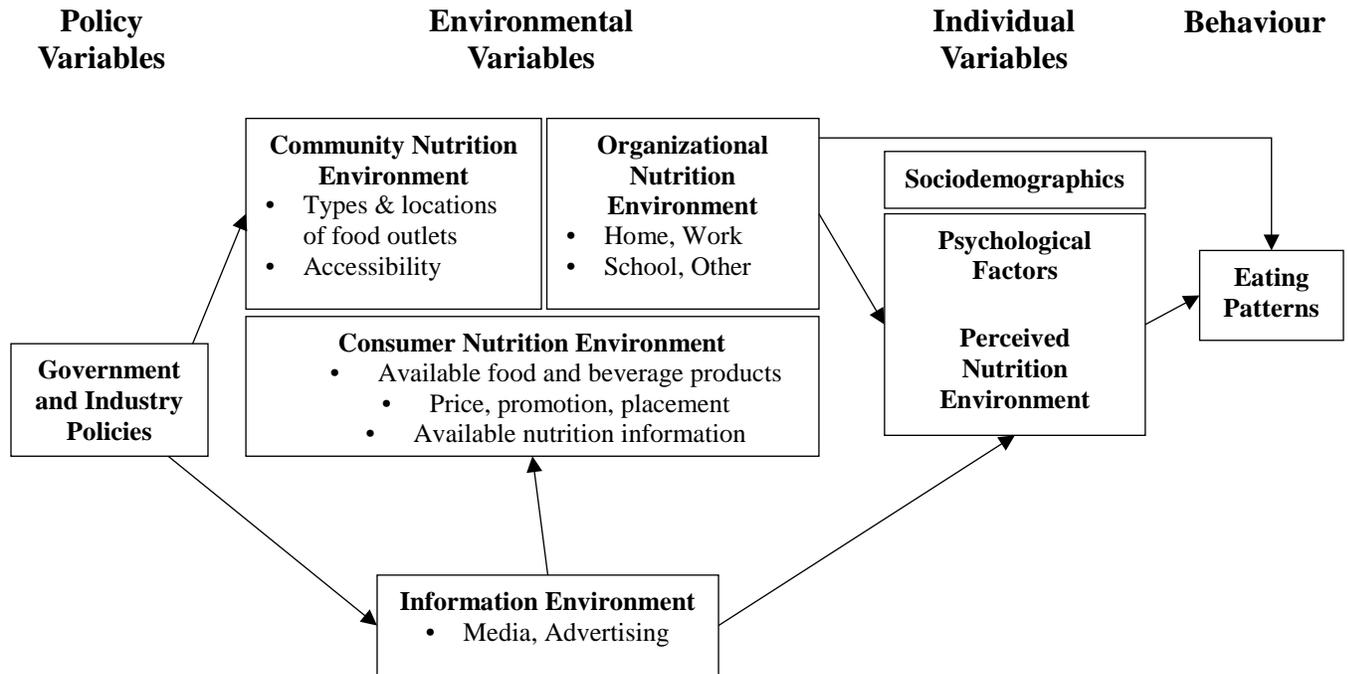
change through restricting sales of SSBs and allowing the business to continue to be profitable. Therefore, the objective of this study was to examine the impact of this type of restrictive food environment intervention on the retail performance and store sales of a rural community pharmacy. Specifically, this study explores the impact of a natural experiment restricting the availability of SSBs on mean expenditure per transaction of minimally processed foods and beverages and ultra-processed foods and beverages.

This thesis proceeds in seven parts. First, a literature review is presented. Second, the study rationale is described. Third, the methods are described, and next, statistical analyses are outlined. The results are then reported, and in the discussion section, implications of the results are discussed. The conclusion section is a brief summary of the findings and implications.

2. Literature Review

The term “food environment” can be used to describe the variety of factors that influence what people eat and drink. This can include the physical environment (e.g., homes, stores, or restaurants), social influences, and food marketing, among other influences (Johns Hopkins Center for a Livable Future, n.d.). Glanz, Sallis, Saelens, & Frank (2005) used an ecological model of health behaviour to describe constructs shown to affect an individual’s dietary pattern. This model (figure 1) illustrates how policy, environmental variables, and individual factors can each influence eating behaviours. On a long term scale, eating patterns influence risk of developing several chronic diseases. For example, the consumption of fruits and vegetables has been associated with a reduction in developing major chronic diseases like cardiovascular disease and cancer (Hung et al., 2004; Boeing et al., 2012), whereas consumption of too much sodium (Mugavero, Losby, Funn, Levings, & Lane, 2012), sugar (Malik et al., 2010), and trans fats (Mozaffarian, Katan, Ascherio, Stampfer, & Willett, 2006) are associated with increased risk of chronic diseases like stroke, coronary heart disease, diabetes, and cancer. While there is a wide variety of factors that influence individual eating behaviours, of particular relevance for this study are the concepts of *community nutrition environment* and *consumer nutrition environment*, which together comprise the retail food environment. Separating these concepts distinguishes between the distribution of food sources in the community (community nutrition environment) and what individuals are exposed to once they enter any given food outlet (consumer nutrition environment) (Caspi, Sorensen, Subramanian, & Kawachi, 2012). Community nutrition environments include the type, location, and accessibility of food outlets such as stores and restaurants (Green & Glanz, 2015). Consumer nutrition environments include the availability of food and beverages, their price, promotion and placement within the food outlet, and nutritional information available on the product (Green & Glanz, 2015).

Figure 1: Model of Community Nutrition Environments



Adapted from Glanz, K., Sallis, J. F., Saelens, B. E., & Frank, L.D., (2005). Healthy Nutrition Environments: Concepts and Measures. American Journal of Health Promotion, 19(5):330-333.

Within the consumer nutrition environment, interventions aimed at altering individual eating patterns can be categorized as either permissive or restrictive. The intention of permissive food interventions is to increase access to nutritious food and beverage options. This type of intervention could include strategies such as mandatory posting of calorie information in restaurants (Bollinger, Leslie, & Sorensen, 2011), promotion of nutritious food (Gittelsohn, Rowan, & Gadhoke, 2012; Escaron, Meinen, Nitzke, & Martinez-Donate, 2013; Foster et al., 2014), promotion and rewards-based incentives (Phipps et al., 2015; Phipps et al., 2012; Felgate & Fearne, 2012), and food retailer licensing (McLaughlin & Kramer, 2012).

Alternatively, restrictive food interventions are intended to decrease access to minimally nutritious food and beverages options. Given that traditional scientific experiments are challenging to conduct in the

social environment, natural experiments have been supported as a proxy method (Story et al, 2009). A natural experiment explores interventions that occur without researcher control. A benefit to conducting natural experiments is that they allow for a broader range of interventions to be assessed beyond those that can be evaluated using a fully experimental method (e.g., randomized control trials) (Craig et al., 2012). The intervention that took place in Baddeck was not designed by researchers, but introduced by the pharmacist. This meant that other more rigorous experimental methods were not available for this study. To assess the impact of the intervention, the mean expenditure on food and beverages per transaction was compared before and after the intervention. Natural experiments are a recommended method for assessing the impact of population health policies and interventions on health outcomes, and are of particular importance when interventions are put into practice in a way that makes conducting a planned experiment difficult (Craig et al., 2012). Research on restrictive food interventions is relatively limited (Gittelsohn et al., 2012) to date. Gittelsohn and colleagues (2012) systematically reviewed interventions aimed at improving the nutrition environment in small stores in the United States. The review emphasized the need for further research on the acceptability of restrictive interventions by the store owner and ensuring that profit margins are not reduced to ensure sustainability over time. Given the limited research on restrictive food environment interventions, much can potentially be learned from the experience of restrictions in the tobacco retail environment in Canada and other jurisdictions, as explored below.

2.1. The experience of tobacco sales in pharmacies

Many health professionals feel that pharmacies, as part of the health care system, should not be selling tobacco products, as this sends inconsistent health messages to the public. Pharmacies are also a primary location where tobacco cessation products and advice can be acquired (State and Community Tobacco Control Research, 2014). Selling tobacco products reinforces positive social perceptions of smoking, infers approval of tobacco use, suggests that smoking is not as dangerous to one's health as it actually is (Katz, 2008; Hudmon, Fenlon, Corelli, Prokhorov, & Schroeder, 2006), and presents a conflict of interest

when tobacco products are sold alongside medicines to treat tobacco-related illnesses (Katz, 2008). Similar arguments have been made that pharmacies should weigh profits made from selling minimally nutritious foods and beverages and the best interests of their patients' health (Houle, Rosenthal, Campbell, Duhaney, & Tsuyuki, 2014). Regardless of the substance or approach, in order for interventions to be sustainable, they must reduce the risk of profit loss to the retailer.

The sale of tobacco products in pharmacies has been banned in Australia, the United Kingdom and all but one Canadian province (State and Community Tobacco Control Research, 2014). In 1994, a ban on tobacco sales in pharmacies came into effect in Ontario. Prior to the ban, pharmacists from one of the largest pharmacy chains in Ontario predicted that banning tobacco sales would result in job loss, store closures and a significant impact on the provincial economy (Taylor, n.d.). However, data from the Ontario College of Pharmacists indicates that in the year following the ban there were no significant differences in the number of store openings or closings compared with the two years before the ban (Taylor, n.d.; Wharry, 1997). Furthermore, the retailer profit margin on cigarette sales is approximately 4% per dollar and tobacco products only accounted for 0.9% of pharmacy sales (Statistics Canada, 2009), representing only a small proportion of total sales. In 2005, pharmaceuticals accounted for 64.2% of sales (Statistics Canada, 2009). Studies in other jurisdictions have also assessed the economic impact of tobacco control strategies in various retail settings and report no negative long-term impact on the economy (State and Community Tobacco Control Research, 2014).

Another common argument against banning tobacco sales in pharmacies is related to loss of profitability because consumers will shop elsewhere (Katz, 2013). However, a study by Kroon, Corelli, Roth, & Hudmon (2013), indicated that for a majority of customers in San Francisco, where tobacco sales in pharmacies were prohibited in 2008, the tobacco ban did not influence their shopping behaviour. In the

United States, CVS pharmacy, one of the largest pharmacy chains in the country, stopped selling tobacco products in October 2014 in all 7,600 stores (Berfield, 2014). The company expected a revenue loss of approximately two billion dollars a year (Berfield, 2014), however, its focus was to show the public its corporate social responsibility of caring more about the health of its customers than maximizing profits.

In regard to health promotion, there are several benefits to banning tobacco sales in pharmacies. Ease of access to, and promotion of tobacco products may influence consumers' decision to purchase tobacco, especially those trying to quit (Katz, 2013). Promotion of tobacco also increases the likelihood that youth will start to smoke (Paynter & Edwards, 2009). A high density of tobacco outlets is related to higher youth smoking rates (Lipperman-Kreda et al., 2014). Banning tobacco sales in pharmacies is a strategy to reduce the density of tobacco retailers in communities and may, therefore, impact youth smoking rates. Finally, banning tobacco sales in pharmacies influences social norms related to where tobacco is sold (Katz, 2013). In Canada, pharmacists are seen as a trusted source of health information (Canadian Pharmacists Journal, 2012), thus, the ethical question of whether pharmacies should sell products that kill 50% of regular users is prominent (World Health Organization, 2006). These same ethical considerations also apply to sales of sugar-sweetened beverages (SSBs). Banning tobacco sales in pharmacies seems logical given that there is no safe level of consumption, but the same argument may not be as clear cut with other products, like SSBs (Katz, 2008). While there is increasing evidence linking high consumption of SSBs with adverse health outcomes (Malik et al, 2006; Malik et al., 2010), these beverages are not perceived with the same negative connotation as tobacco, moderate consumption isn't considered dangerous, and there are no recommended daily limits.

2.2. In-store marketing impact on consumer purchasing behaviours

Sugar-sweetened beverages (SSBs) are the primary source of added sugar for children and youth in Canada (Langlois & Garriguet, 2012) and are widely available in locations where children and youth often spend time (e.g., cinemas, shopping malls, arenas, and community centres). These SSBs are present in traditional and non-traditional food outlets (e.g., vending machines, supermarkets, convenience stores, and pharmacies). In Canada, non-traditional food outlets, including pharmacies, account for 27% of total food and non-alcoholic beverage sales of the food retail sector (Agriculture and Agri-Food Canada, 2015). This results in an increase in the availability of food and beverages for consumers, and competition for retail outlets. In recent years, Canadian pharmacies have been expanding the variety of food offerings, including a wide assortment of SSBs (Coalition Québécoise sur la problématique du poids, 2012). While many pharmacies sell SSBs in a variety of formats (12-packs, 2-litre bottles, individual cans and bottles), individual-format varieties are the most common (Coalition Québécoise sur la problématique du poids, 2012). These varieties are often available for sale in close proximity to cash registers and are intended to be consumed shortly after purchase.

This type of in-store marketing practice impacts consumer food purchasing behaviours (Miller, Bodor, & Rose, 2012). The placement of products within the food environment (Desmet & Renaudin, 1998), shelf space allotted (Desmet & Renaudin, 1998), and number of display stands (Miller et al., 2012) influence sales for any given product. Products displayed near cash registers are more likely to be purchased (Kerr, Sallis, Bromby, & Glanz, 2012; Thornton, Cameron, McNaughton, Worsley, & Crawford, 2012) since this is an area that almost every shopper passes. Significant revenue is generated in the checkout aisle, primarily from beverages, magazines, gum, mints, and candy (Food Marketing Institute, 2012).

Furthermore, the larger the shelf space, the more likely a product will be purchased (Desmet & Renaudin, 1998). A study by Farley et al., (2009) indicated that, second only to supermarkets, pharmacies allocate the most shelf space to ultra-processed foods, and only 5-10% of pharmacies sell fresh fruits and

vegetables. Small, rural, and independent stores may stock even fewer fresh fruits, vegetables and nutritious beverages (Centers for Disease Control and Prevention [CDC], 2014). Additionally, increasing the number of display stands increases the chances of a consumer noticing a product, and thus purchasing that product (Miller et al., 2012). Studies indicate that ultra-processed foods are more frequently available at check-out than minimally processed foods (Barker et al., 2015), SSBs are often more available than water (Barker et al., 2015), and up to 83% of confectionery sales are purchased on impulse (Miller et al., 2012).

Checkout aisles and other prominent locations in retail stores also have the potential to promote health. Since items sold in the checkout aisle are frequently purchased on impulse by consumers, retailers could influence customers to purchase either minimally processed food (e.g., fresh fruit, nuts and seeds, etc.), minimally processed beverages (e.g., bottled water) or non-food items (e.g., gift cards, magazines, flowers, hand sanitizer, lip balm, etc.) (Center for Science in the Public Interest, 2015). Several case examples throughout the USA have been used to demonstrate how a healthy checkout aisle would work in a variety of retail settings (Center for Science in the Public Interest, 2015). While these case examples offer some insight into different strategies for creating healthier checkout aisles, to date, the implementation of these strategies has not permeated to large retail outlets in the USA, and some of these pioneering cases have not been sustained. Other jurisdictions, like the United Kingdom, have recently seen several major retailers remove all candy from their checkout aisles (Center for Science in the Public Interest, 2015). Revamping checkout aisles is not the only way retailers can promote healthier foods and beverages. Other retail interventions include advertising healthier products, lowering the price of healthier options and placing healthier items at eye level (CDC, 2014).

2.3. Sales data used as population health metric

Using industry sales data as a population health metric has several benefits: it is a relatively cost-effective method; it provides an opportunity to access regular and up-to-date information; it has potential to be used at a variety of levels (e.g., local, regional and national) to monitor the sale of specific products (New South Wales Department of Health, 2000); it is an objective measure of customer purchasing behaviour (National Collaborating Centre for Environmental Health, 2017); and findings are easily communicated with a variety of audiences (e.g., policy makers, business owners) (De Marco, Chauvenet, Chapman, & Noriega-Goodwin, 2017).

Working with industry sales data to assess the effectiveness of food and beverage interventions in retail settings also has several challenges. Business owners may perceive that being involved in research is time consuming and they may not fully understand the benefits of their involvement; business owners may be reluctant to share sales data due to worries about competitors accessing their data; and depending on the point of sale tracking system, there may be substantial variability in the level of detail available for each transaction among retailers (De Marco, Chauvenet, Chapman, & Noriega-Goodwin, 2017).

De Marco and colleagues (2017) have suggested aspects to consider in order to successfully use sales data to assess the effectiveness of healthy retail interventions. This includes: co-developing the research question with the business owner so that the research question aligns with the data available; building a partnership with the business owner to counter potential challenges and reiterate benefits of involvement to the business owner; attaining sales data at the transaction level, as opposed to an aggregate level, to allow for analysis of both individual sales and storewide sales; assuring the security of the sales data and allowing the business owner the opportunity to review research products; accessing sales data before and after the interventions, ideally for at least 12 months with the purpose of being able to see changes in sales

over time and during different seasons; monitoring changes within the business (e.g., changes in weekly promotional flyers), as well as external factors that may affect sales (e.g., introduction of a new policy, economic conditions, campaigns); and selecting a comparison store so as to allow researchers to associate changes in sales with the intervention of interest.

Industry sales data are useful for monitoring food and beverage purchasing patterns and can be used to estimate trends in corresponding consumption. Retail sales data has recently been used to assess the purchasing trends of products as an estimate for consumption/use. For example, industry sales data has been used to estimate alcohol consumption in Great Britain (Robinson, Shipton, Walsh, Whyte, & McCartney, 2015) and trends in flavoured tobacco product use among youth in the United States (Corey, Ambrose, Apelberg, & King, 2015).

Sales data can also be used to assess interventions focused on changing the retail food environment, such as whether in-store promotions affect sales. While research on retail food interventions is expanding, to date, only a limited number of studies have used industry sales data for this purpose and largely focus on permissive food interventions. Sales data was used by Fuller, Engler-Stringer and Muhajarine (2015) to examine nutritious and minimally nutritious food purchasing among consumers in a recently opened grocery store. This study assessed differences in the total dollar amount spent on foods in 11 categories.

A second study in small stores looked at retail sales data as a method of assessing the impact of in-store nutritious food interventions (e.g., promotion of nutritious food, food stocking practices, signage, etc.). Findings from this study indicate a positive impact of in-store promotion of nutritious food and increased consumption of these foods (Gittelsohn et al., 2012).

A recent study by Schwartz and colleagues (2017) used supermarket sales data to evaluate a multifaceted, multi-year community campaign to reduce consumption of sugar-sweetened beverages. The analysis focused specifically on the drinks highlighted in the campaign (soda [regular and diet], sports drinks, fruit drinks, and juice) and assessed weekly changes in mean fluid ounces sold per product. Data obtained from the supermarkets contained weekly sales information of unit sales, dollar amounts and volume sales in fluid ounces. This was the first study to use sales data as the objective measure of a community campaign.

Another recent study in Baltimore evaluated a supermarket intervention that compared sales of commonly purchased food to foods promoted as healthier alternatives (Surkan, Tabrizi, Lee, Palmer, & Frick, 2016). In this study, researchers examined the number of items sold and the absolute and percent differences in sales between intervention and comparison stores pre- and post-intervention. Similar to what De Marco et al. suggested, one of the co-authors of this study noted that being able to illustrate the benefits of the research to business owners was key to gaining buy-in from business owners (Krisberg, 2016).

Finally, Minaker and colleagues (2017) analysed sales data from a corner store intervention aimed to increase the availability of nutritious foods and beverages in a low-income neighbourhood. This study assessed changes in mean daily sales of different product categories, including non-nutritious snacks and beverages, and fruits and vegetables. Findings from this study emphasize the importance of using sales data to tailor retail interventions (Minaker, Lynch, Cooke, & Mah, 2017).

Limited research exists on restrictive food interventions that aim to reduce the number of unhealthy items in a store. While not completely restrictive, some corner store programs have asked businesses to display

highly processed snack foods and sugar-sweetened beverages less prominently and replace front of store displays with attractive displays of produce (Ogilvie, 2013).

Currently, there does not appear to be consistent methods of analyzing sales data. Some studies have examined changes in revenue, including absolute changes in dollars spent, percent differences in sales, and changes in mean daily sales (Fuller, Engler-Stringer and Muhajarine, 2015; Surkan, Tabrizi, Lee, Palmer, & Frick, 2016; Minaker, Lynch, Cook, Mah, 2017), while other studies assessed changes in volume sales in fluid ounces (Schwartz, et al., 2017). While most businesses have systems available to track store purchases, the outcome measured may be dependent on the level of detail available (e.g., some stores may not track unit volume, only total items purchased; some stores may aggregate product categories instead of tracking individual products). To reduce burden on the business owners, researchers should work with the current system available in stores, where possible, and co-develop research questions with the business owner based on the data available (De Marco, Chauvenet, Chapman, & Noriega-Goodwin, 2017).

Considering how widely available SSBs are, banning the sale of SSBs at pharmacies will likely not have an impact on overall consumption of these beverages. However, it could be one part of a comprehensive strategy used to reduce sugar consumption and, consequently, decrease the prevalence of obesity and other chronic diseases. Given the important health promotion role that pharmacies play, especially in small, rural communities, a conflict of interest presents when pharmacies sell products that impede health rather than support health. Although individual food environment interventions may be effective in changing dietary patterns and obesity rates, interventions must be sustainable and pose little profit risk in order for small business owners to adopt the intervention.

2.4. NOVA classification system in population health

Terms used to describe the level of processing have not been well defined (e.g., ‘highly’, ‘heavily’, etc.) and as such it was difficult to make any correlations between food processing and its impact on health (Monteiro, Cannon, Moubarac, Levy, Louzada, & Jaime, 2017). The NOVA classification system is used to describe how the nature, extent and purpose of food processing relates to nutrition, health and disease (Monteiro, Cannon, Moubarac, Levy, Louzada, & Jaime, 2017). This system uses operational definitions that identify the type, use and effect of processing, allowing for comparable analyses, and thus, correlations to be made. Food processing is of interest both for its influence on dietary patterns and its impact on dietary-related chronic diseases (Monterio et al., 2016).

The system has been included as part of Brazil’s national dietary guidelines (Brazilian Ministry of Health, 2014) and has been used widely throughout the world to study dietary patterns; changes in the consumption of ultra-processed products; and to assess the association between consumption of ultra-processed products and health outcomes (Monteiro, Cannon, Moubarac, Levy, Louzada, & Jaime, 2017).

The NOVA system has been used by researchers in the United States to examine how ultra-processed food contributes to added sugar intake (Martinez Steele, Baraldi, Louzada, Moubarac, Mozaffarian, & Monteiro, 2015). The researchers found that ultra-processed food contributed nearly 90% of the added sugar in participants’ diet, suggesting that reducing consumption of these products would be a helpful way to decrease excessive added sugar consumption in the United States (Martinez Steele, Baraldi, Louzada, Moubarac, Mozaffarian, & Monteiro, 2015). Similarly, Moubarac et al. (2017) used the NOVA classification to describe the association between ultra-processed food consumption and diet quality in Canada. Their findings suggest that reducing the quantity of ultra-processed food consumed and

increasing the quantity of minimally processed and processed foods would improve the diet quality of Canadians (Moubarac, Matal, Lozada, Martinez Steele, & Monteiro, 2017).

The NOVA system has also been used to demonstrate changes over time in the consumption of ultra-processed products. Findings from a study by Monterio and colleagues (2013) show that ultra-processed products continue to make up the greatest proportion of the food supply in high-income countries and are quickly increasing in middle-income countries. Consumption of ultra-processed products replaces meals that were traditionally prepared with minimally processed food and processed foods. The components of the ultra-processed products tend to be energy-dense, high in fat, sugar and salt, and low in fibre (Monteiro, Moubarac, Cannon, Ng, & Popkin, 2013). This composition suggests harmful impacts on health.

The NOVA system has also been used to assess the association between consumption of ultra-processed food and chronic disease. In Sweden, researchers examined trends in food consumption between 1960 and 2010 for changes in consumption of ultra-processed food and corresponding changes in the prevalence of obesity (Juil & Hemmingsson, 2015). During this time, both the consumption of ultra-processed food and the prevalence of obesity have increased. A prospective study in a Spanish cohort found an association between consumption of ultra-processed foods and a higher risk of overweight and obesity (Mendonça, et al., 2016) and hypertension (Mendonça, Lopes, Pimenta, Gea, Martinez-Gonzalez, & Bes-Rastrollo, 2017).

According to leading researchers in the field of food classification, the NOVA classification “will be a firmer basis for rational policies and effective actions designed to protect and improve public health at all levels from global to local” (Moubarac, Parra, Cannon, & Monteiro, 2014, p. 256).

3. Study Rationale

3.1. Study purpose

The purpose of this study was to assess the impact of a retailer-led food environment intervention, in which all sugar-sweetened beverages (SSBs) were removed from the store, on the retail performance of the community pharmacy. The intervention has been well received in the community to date and the pharmacy is viewed as a source for nutritional information (personal communication, G. MacKenzie, 2015). Given that consumers often purchase snack foods in tandem with ready-to-consume beverages, it was anticipated that the store intervention may have also impacted consumer choices regarding snack foods. Other food products sold at the pharmacy are not ready-to-consume products, but rather ingredients that would be used to prepare beverages (e.g., coffee, tea) and meals (e.g., condiments, baking ingredients, canned foods), and were not included in this study.

As previously mentioned, there are examples of permissive interventions that have been successful in increasing the availability of healthy foods and beverages, increasing sales of healthy foods as reported by the store owner, and improving customer knowledge and dietary behaviours (Gittelsohn, Laska, Karpyn, Klingler, & Ayala, 2016). This study, however, was one of the first examples of a retailer-led restrictive food environment intervention and, therefore, advances the literature by investigating a natural experiment on food interventions in the retail setting. This approach to changing the food environment is much less common than permissive interventions, and as such, the process of implementation and impact are somewhat unknown.

Gittelshon et al., (2014) have described several lessons learned from small store interventions that influence the success of the intervention. Lessons include the importance of the relationship between the

store owner and customers, the underlying motivation for the intervention, and the need to involve the store owner in the design of the intervention. For this study in particular, these potential challenges were mitigated. The store owner had a positive relationship with local customers, his motivation for promoting better health through this intervention was the well-being of customers, and the pharmacist attempted to mitigate potential financial losses by actively publicizing his concern for nutrition; this intervention was both designed and implemented by the store owner himself (G. Mackenzie, personal communication, 2015).

Presumably, this retailer-led intervention is more likely to be sustainable, as compared to a public health or researcher-led intervention with little to no buy-in from the retailer since the retailer is committed to and has ownership over the intervention, and has a vested interest in the intervention becoming a sustainable and profitable business model. This type of intervention, if sustainable as a business model, could be used as support for other locally owned businesses to make similar changes. Additionally, if this type of intervention is sustainable as a business model, it could allow retailers to make further restrictions to the food environment, such as removing other types of ultra-processed foods, like chocolate bars.

Small-scale interventions like this emphasize the opportunity for small, local retailers to change the food environment in a way that is conducive to promoting health. While this type of intervention may be a small step in tackling a much larger problem, it strengthens local and small-scale advocacy to support large-scale change in the food system by building from the grassroots level. This intervention received significant media attention, both at the time of the intervention (CTV News, 2014; CBC News, 2014; Ayers, 2014) and in the years following (Cape Breton Post, 2015; MacLennan, N., 2015), and the pharmacist continues to actively educate his clients on the importance proper nutrition plays in overall well-being and in improving numerous health issues (G. Mackenzie, personal communication, 2015).

3.2. Scholarly implications

Few studies have used natural experiments as an opportunity to assess the link between food environment and health outcomes (e.g., Pinard, Shanks, Harden, & Yaroch, 2016; Gittelsohn, Rowan, & Gadhoke, 2012). Using sales data as the primary outcome being measured, rather than assessing dietary intake, is a unique method of conducting research and this type of analysis is novel for public health practitioners. Assessing sales data is one method of determining whether or not an intervention is sustainable prior to determining if the intervention has an impact on dietary intake. Ultimately, the expectation is that interventions will have an impact on dietary intake. The pharmacist has undertaken this intervention at his own financial risk with the belief that it will result in ongoing prevention of health problems for his clients. If the intervention is not sustainable at the retail level because of significant financial costs, it will not have enough time to gain traction in order to have an impact on dietary intake.

4. Research Questions and Hypotheses

4.1. Research Questions

The present study examines weekly sales data before and after the removal of SSBs from one location of a national chain pharmacy in Baddeck, NS, Canada. This study addresses the change in mean expenditure per transaction on four product categories (minimally processed beverages, minimally processed snack food, ultra-processed beverages, and ultra-processed snack food).

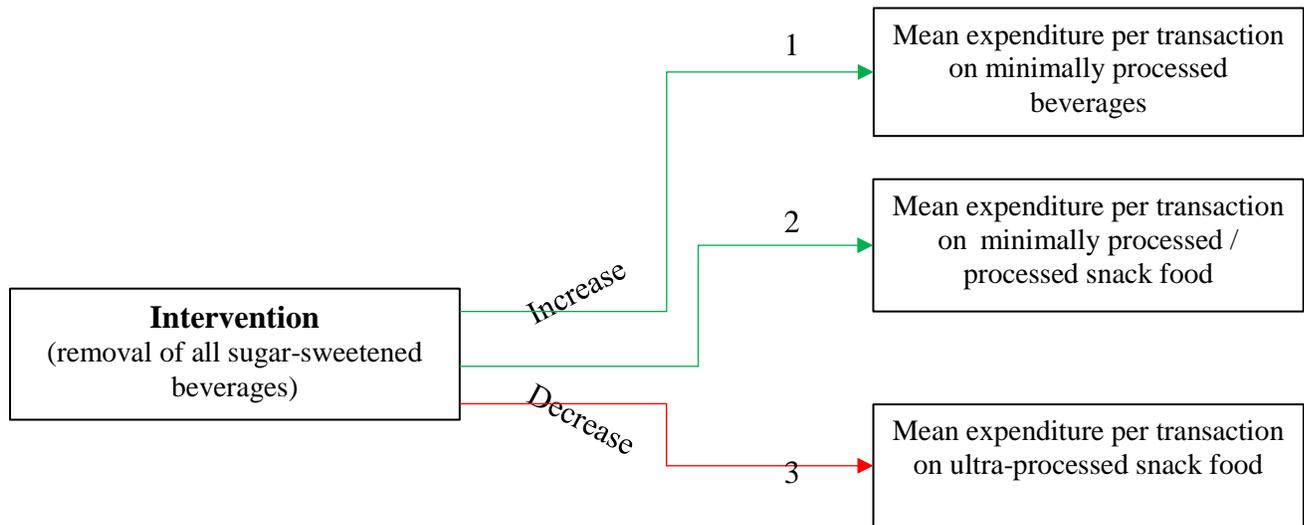
The specific research questions addressed by this study are:

1. Was there any change in mean expenditure on food and beverages per transaction before and after the intervention?
2. Was there any change in mean expenditure on beverage categories per transaction before and after the intervention?
3. Was there any change in mean expenditure on snack food categories per transaction before and after the intervention?

4.2. Hypotheses

Figure 2 below illustrates the hypothesized change in mean expenditure per transaction for minimally processed beverages, minimally processed / processed snack food, and ultra-processed snack food.

Figure 2: Hypothesized change in sales



It is hypothesized that 1) the mean expenditure per transaction on minimally processed beverages will increase after the intervention. Ultra-processed beverages, which includes all sugar-sweetened beverages, especially in single serving bottles, are regularly purchased on impulse at the checkout rather than as a pre-planned purchase (Center for Science in the Public Interest, 2015; Minaker et al., 2016). Given that post-intervention minimally processed beverages are the only beverages available in the pharmacy, if consumers continue to make impulse beverage purchases, they will by default be minimally processed products. It is also hypothesized that 2) the mean expenditure per transaction on minimally processed and processed snack food options will increase, while 3) the mean expenditure per transaction on ultra-processed snack food will decrease after the intervention. Many local shoppers are aware of the intervention and pharmacy patrons may notice the lack of ultra-processed beverages.

5. Methods

5.1. Setting

Baddeck is a small, rural town located in Nova Scotia, Canada, with a year-round population of just over 800 people (Statistics Canada, 2017). Given its location as the start and end of the Cabot Trail loop on Cape Breton Island, the town is a popular tourist destination during the summer months. The seasonal peaks in tourism in Baddeck contribute to seasonal sales variations experienced at all retailers in the town. Baddeck is a fairly isolated community, with the nearest large municipal centre (Sydney, NS, population 31,597 (2011)) approximately 80 kilometres away. Residents of Baddeck have few options when it comes to purchasing food and beverages as there are only three retail stores in the town (a regional chain grocery store, a regional chain convenience store, and an Atlantic pharmacy franchise outlet). Since Sydney, NS is an hour drive from Baddeck, it is likely that the retail food environment in Baddeck influences the diets of residents.

Previous research on sales of carbonated soft drinks, including diet and regular varieties, in Baddeck showed that the pharmacy's sales accounted for 6% of all carbonated soft drink sales in the community prior to the intervention at the pharmacy (Minaker et al., 2016). To determine if residents continued to purchase carbonated soft drinks at the other community retailers after the pharmacy intervention, Minaker et al. (2016) assessed weekly sales data from the other retailers post-intervention at the pharmacy. They found that, while accounting for seasonal fluctuations in weekly sales of carbonated soft drinks, the pharmacy intervention was not associated with a statistically significant decline in carbonated soft drink sales, despite 11% to 21% lower absolute carbonated soft drink sales in Baddeck after the intervention (Minaker et al., 2016). This could suggest that, since sales at the other retailers did not increase after the

pharmacy intervention, carbonated soft drinks at the pharmacy were often purchased on impulse (Minaker et al., 2016).

5.2. Ethical Clearance

Ethical clearance from the University of Waterloo Ethics Review Committee was not sought, as this study did not involve data collection from human subjects.

5.3. Data Source

The current study is part of a larger study on the impact of a restrictive retail food environment intervention conducted by a research team based at the Propel Centre for Population Health Impact at the University of Waterloo, and led by Dr. Leia Minaker.

Permission to use the data was granted from the owner of Stone's Pharamsave. Sales data for the current study was acquired from the owner for the period from January 1, 2013 to December 31, 2015 (n=156 weeks). This retail food environment intervention (the removal of all ultra-processed beverages from the pharmacy shelves) was retailer-led, and as such, there was no comparison data available for this study. However, because this intervention was retailer-led, it will likely be more sustainable, assuming the financial burden is manageable, than research-led interventions on retail food environments that can be difficult to support once initial funding is discontinued.

Given that Baddeck experiences an influx of tourists during the summer months (June, July and August) and, thus, an increase in overall gross sales, seasonal effects on sales were accounted for. By calculating the percent change in sales pre-intervention and post-intervention during the same season (peak season or

normal) of the previous year (see table 1), the data were less likely to be affected by seasonality (Ogawa et al., 2011). In order to have comparable pre- and post-intervention seasons, sales data included in the analysis were restricted to the period of September 1, 2013 to September 30, 2015 (n= 108 weeks). The pre-intervention period included transactions between September 1, 2013 and September 10, 2014 (months highlighted in green in table 1), while the post-intervention period included transactions between September 11, 2014 and September 30, 2015 (months highlighted in orange in table 1). Transactions that occurred in the months without highlighting in table 1 were not included in the analysis.

Table 1: Pre- and Post-Intervention Periods

Year	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2013	Not included in analysis											
2014												
2015										Not included in analysis		

*Intervention took place on September 11, 2014

5.4. Data Cleaning

Point of sale data at the transaction level were obtained from the pharmacist via email. The raw data set included transaction ID, product stock keeping unit (SKU) and description, number of units of product purchased, price per item, profit (sale price minus wholesale cost of item), date and timestamp (see Appendix A for an example). In order for this data set to be analyzed, a process was implemented to convert the original format (point of sale data export) to a file type that could be read into statistical analysis software. This process involved taking transaction level data and separating it into item-level data, while repeating necessary transaction level variables for each item (e.g., transaction number, date

and timestamp). This created a data set that contained one row for each item purchased so that each item could be individually coded into a category.

An initial review of the dataset revealed that a limited quantity (n=41 units) of ultra-processed beverages were sold after the intervention. The pharmacist remarked that when he removed the ultra-processed beverages from the store he made the decision to continue selling the in stock chocolate milk with expiry dates soon after the intervention date until the remaining products were sold out. He made a public comment that he “couldn’t watch milk spoil and sleep at night” (personal communication, G. MacKenzie, 2017). All 41 of these products were sold within two weeks after the intervention date. These items were considered exceptional and were excluded from the analysis.

5.5. Data Coding

5.5.1. NOVA Classification System

The NOVA classification system for food and beverages categorizes products based on the amount and purpose of processing rather than the nutrient content (Monterio et al., 2016). This system is accepted by the Food and Agriculture Organization of the United Nations and the Pan American Health Organization as a valid instrument for public health research and policy implications (Monterio et al, 2016). Food and beverages are categorized into one of four groups: minimally processed food and beverages, processed culinary ingredients, processed food and beverages, and ultra-processed food and beverage products.

Minimally processed food and beverages include all unprocessed, naturally occurring foods from plants (e.g., seeds, fruits, leaves, stems, or roots) or animals (e.g., meat, eggs, milk), as well as fungi, algae and water (Monterio et al., 2016). These food and beverages may be minimally altered (e.g., removal of

inedible or unwanted parts, drying, crushing, roasting), but processing does not add any substances like salt, sugar or oil to the original food. These products may also be minimally processed to extend the shelf life through processes like freezing or pasteurizing. See table 2 for examples of minimally processed food and beverages.

At the time of the intervention, the pharmacy sold very few minimally processed food and beverages aside from water and unsweetened milk. During the time since the intervention, the pharmacy has been expanding the variety of more “nutritious” food. If the classification for any product was unclear based on the product description, the labels of these products were reviewed either online or by contacting the pharmacist to ensure they were properly classified.

Processed culinary ingredients are products derived directly from minimally processed food through processes such as pressing, refining, grinding and milling, or which exist naturally (Monterio et al., 2016). These products are used to enhance flavour and palatability during meal preparation and are not often consumed on their own. Examples of processed culinary ingredients include salt, sugar, honey, vegetable oils, butter and starches. While some of these products are sold in the pharmacy, they were not examined as part of this study because they are not ready to consume products.

Processed food and beverages include products made by adding sugar, oil or salt to minimally processed food. These food and beverages have been altered to further extend the shelf life of minimally processed food and beverages (e.g., through canning, salting, smoking, or other forms of curing), or to enhance their taste, texture or look (Monterio et al., 2016). These products typically only contain two or three ingredients. See table 2 for examples of processed food. Processed beverages are typically made through

fermentation (e.g., alcoholic drinks like beer, cider, and wine). These products are not sold in the pharmacy and, as such, were not included in the analysis.

Ultra-processed food and beverages are products that typically contain five or more ingredients (Monterio et al., 2016). These products often contain very little whole food (e.g., whole grains, fruits, vegetables), but are processed to include sugar, oils, fats, stabilizers, and preservatives. These products are typically ready to eat, highly appetizing, and attractively packaged. See table 2 for examples of ultra-processed food and beverages.

Given the food and beverage products available in the pharmacy, and the focus of the intervention, the current study examines data for each of the following categories: minimally processed beverages, minimally processed snack food, ultra-processed beverages, and ultra-processed snack food. Snack food was defined as ready to consume products that are generally eaten between meals. See table 2 for examples of minimally processed snack food, processed snack food, and ultra-processed snack food. Food products that are used to prepare meals (i.e., non-snack foods) were not examined as a part of this study. See table 2 for examples of food and beverages that were not examined.

Table 2 also identifies the broader sales classification (i.e., pharmaceuticals or front-of-store merchandise) for the product categories included in the analysis. This is an important distinction for reporting overall pharmacy sales (Shoppers Drug Mart, 2012).

Table 2: Classification of products sold at the pharmacy

Sales Classification	Category	Specific product examples
Front-of-store	Minimally processed beverages	Water, unsweetened milk, unsweetened coconut water
Front-of-store	Minimally processed snack food	Nuts (unsalted, unflavoured), unsweetened dried fruit, fresh fruit, hard boiled eggs
Front-of-store	Processed snack food	Salted nuts, salted seeds, dried seaweed snacks
Front-of-store	Ultra-processed beverages	Carbonated soft drinks (diet and regular), sports drinks, fruit juice*, fruit drinks, energy drinks, vitamin-enhanced water, iced tea
Front-of-store	Ultra-processed snack food	Chocolate, candy, chips, gum, fruit snacks, cookies, brownies, pudding
Front-of-store	Other beverages	Tea bags, coffee, coconut milk, coffee creamer, drink mix, etc. (not ready to consume products)
Front-of-store	Other food	Bread, cereal, canned meat, canned vegetables, condiments, jello/pudding mix, etc. (not ready to consume products)
Pharmaceuticals	Prescriptions	Prescription medications

*While 100% fruit juice is listed as an example in the “fruits and vegetables” category of Canada’s *Food Guide to Healthy Eating*, Health Canada issued a statement in early 2015 indicating that more than one serving of fruit juice (125 ml) could contribute too much sugar to a person’s daily consumption (Government of Canada, 2015). Given that all single serving bottles of fruit juice contain more than one serving and thus contain high levels of sugar, these items will be classified as ultra-processed beverages (and were also removed as part of the pharmacy intervention).

5.5.2. Data Classification

Once the data set was organized by item, each item was categorized into a researcher-defined general sales category (e.g., health and beauty, medication, lottery, candy, chocolate, water, milk, etc.), based on the product description. All items were also classified as either “food” (which included both food products and beverage products) or “non-food” items. For example, products listed as “baked coconut chips”, “black beans”, and “brown jasmine rice” were classified as “food”, while products listed as “bubble bath”, “dish liquid” and “fashion scarf” were classified as another sales category (health and beauty, home and office, and clothing, respectively). Items that could not be classified using the classification algorithms were manually coded. If a product could not be coded based on the product description, the pharmacist was asked to provide more detailed information about the product (e.g., ingredients from nutrition label). In consultation with the pharmacist, a line of food and beverage products called Ideal Protein was excluded from the food category. While some of these products could be considered ready to eat snack foods, these products are marketed as a clinical weight-loss supplement and, as such, more closely align with the nutritional supplement category. The pharmacist also noted that sales of this product line varied greatly over the study period.

Additionally, based on the product description and SKU from the sales data, food and beverage products were also categorized according to the NOVA classification as minimally processed beverages, minimally processed foods, processed food, ultra-processed beverages or ultra-processed foods (see table 2). The NOVA classification system groups foods and beverages into categories based on the extent of processing they undergo (Monterio et al., 2016).

For many of the products sold at the pharmacy, the classification was straightforward (e.g., chocolate bars, chips, candy – all classified as ultra-processed snack food products). For products where the level of processing was unclear based on the product description, the ingredient list was used to determine the appropriate NOVA classification. For example, plain seaweed snacks were classified as a processed food because the ingredient list only included roasted seaweed, olive oil, and sea salt, whereas if they were flavoured, they were categorized as ultra-processed foods. Similarly, 100% coconut water was categorized as a minimally processed beverage because the ingredient list only contained coconut water. However, if flavours or sweeteners were present in the ingredient list, the drinks were categorized as ultra-processed.

A random subsample of the items was checked by Dr. Minaker to ensure items were classified correctly. These manually coded records were combined with the initially coded records to create a fully coded data set. The data set contained nearly 800,000 items purchased between September 1, 2013 and September 30, 2015.

Weeks were categorized as two dichotomous time periods: 1) to account for seasonal variability in sales; and 2) to distinguish between pre- and post-intervention weeks. For the seasonal time period, the months June, July and August were categorized as “summer peak”, whereas the rest of the months during the year were categorized as “normal”. For the pre- and post-intervention time period, the 53 weeks prior to the intervention (between January 1, 2013 and September 10, 2014) were categorized as “pre-intervention” and the 54 weeks after the intervention (between September 11, 2014 and December 31, 2015) were categorized as “post-intervention”.

Once the individual items were coded, the items were then merged back to the transaction level in a separate data set. There are many external factors that may result in changes in retail performance (e.g., overall improving economy during the two years of study, overall decline in sugar-sweetened beverage sales), and thus impact the results of this study. Subsequent data analysis was conducted at the transaction level. By analyzing changes in the expenditure per transaction over the course of the study as a proportion of sales, the influence of changes in the overall economy will be mitigated. Since overall store sales vary from year to year due to a variety of external factors mentioned above, it was anticipated that analyzing the data as a proportion of transactions would allow for a more reliable measure of change given that it is not reliant on the number of total transactions.

A flag variable was assigned for each item sold as part of the transaction for all of the sub-categories of interest. The flag variable, a binary classification, allows the analysis software to check for conditions (e.g., does this transaction contain any ultra-processed beverages?) before processing other functions (e.g., calculate the mean expenditure per transaction for ultra-processed beverages) at the transaction level rather than just at the individual item level. All necessary variables (e.g., transaction date, transaction total, and sub-totals for each category) were maintained. This data set included nearly 220,000 transactions.

Data were categorized into two broad classifications (i.e., pharmaceuticals or front-of-store merchandise). This distinction between pharmacy and front of store merchandise is a common method of reporting pharmacy sales (e.g., Shoppers Drug Mart, 2012; Malson, 2008). This is also an important distinction because, while historically pharmaceutical sales generated the largest proportion of revenue, more recently front-of-store sales account for approximately half of pharmacy revenue (Warnica, 2013).

6. Statistical analysis

The primary outcome measure was mean expenditure per transaction for each level of the dependent variable (i.e., minimally processed beverages, minimally processed snack foods, ultra-processed beverages, and ultra-processed snack foods). Sales data were analyzed to better understand food and beverage sales as a percentage of all products sold overall at the pharmacy, as well as what percentage of overall store revenue food and beverage sales account for. To provide context for the analysis, preliminary analyses were conducted at the item level (as opposed to the transaction level). Descriptive statistics were used to examine the number of products sold, store revenue from specific product categories, the proportion of mean expenditures per transaction for each of the dependent variables, and the mean for the pre-intervention period was compared to the mean after the intervention. Reporting the mean expenditure per transaction rather than direct sales of the pharmacy protects sensitive proprietary information (Holmes, Estabrooks, Davis, & Serrano, 2012).

Chi-square tests are typically used to determine whether the distribution of categorical variables differ from one another. The Chi-square test was used in this study to determine if there was a statistically significant relationship between transactions containing at least one item of the category of interest (e.g., minimally processed beverages) and the intervention period (pre- and post-intervention). A null hypothesis assumes that there is no association between the two variables. The alternative hypothesis assumes that there is an association between the two variables. A level of statistical significance of <0.01 was used as the cut-off because there was a large number of transaction observations and multiple tests were conducted for the various categories of interest.

A t-test is used to compare two means in two independent samples. A t-test with pooled variances was used for this study to determine if there were statistically significant difference in the mean amount spent

per transaction pre- and post-intervention. Additionally, t-tests were used to assess statistically significant differences in the mean amount spent per transaction for each category of interest. A p-value of <0.01 was used as the cut-off.

All analyses were conducted using SAS® V.9.3 statistical software.

7. Results

7.1. Overall store sales

Table 3 below shows the number of food and beverage products (combined), front-of-store non-food products, and prescriptions sold as a percentage of overall products sold, the percentage of store revenue that each of these product categories accounted for, and the change of revenue within the product category between September 1, 2013 and September 30, 2015. All food and beverage products combined accounted for only 3.18% of total store revenue pre-intervention and 3.41% post-intervention. As noted in table 3, before the intervention, beverages accounted for 1.06% of store revenue (n=20,546 items), while food products accounted for 2.12% of store revenue (n=41,245 items). After the intervention, beverages accounted for 0.82% of store revenue (n=13,539 items) and food products accounted for 2.59% of store revenue (n=43,046 items). After the intervention, the number of beverages sold decreased by 34%, while the number of food products sold increased by 4%.

Front-of-store non-food products (e.g., health and beauty products, home and office products, clothing, etc.) made up 27.89% of overall store revenue pre-intervention and 28.61% post-intervention.

Prescriptions made up 68.93% of overall store revenue pre-intervention and 67.98% post intervention.

While front-of-store non-food products make up about two-thirds of overall products sold at the pharmacy, prescriptions make up about two-thirds of overall store revenue both pre- and post-intervention. After the intervention, the number of non-food products sold decreased by 2% and the number of prescriptions sold increased by 9%.

Table 3: Beverages, food products, non-food products and prescription sales and revenue as a percentage of overall store sales and revenue

	Pre-intervention		Post-intervention		Change in Sales		Chi square value	Value
	Products sold n (%)	Store revenue (%)	Products sold n (%)	Store revenue (%)	Products sold n (%)	Revenue change within category (%)*		
Beverages	20,546 (7.00)	1.06	13,539 (5.00)	0.82	-7,007 (-34.00)	-20.00	10283.96	<.0001
Food	41,245 (14.00)	2.12	43,046 (15.00)	2.59	1,801 (4.00)	17.00	90.71	<.0001
Non-food products	198,140 (65.43)	27.89	193,230 (65.18)	28.61	-4,910 (-2.00)	2.00	4.14	0.0419
Prescriptions	42,909 (14.17)	68.93	46,640 (15.73)	67.98	3,731 (9.00)	-2.00	288.71	<.0001

*Actual revenue amounts have been suppressed to protect proprietary information.

Sales data were also analyzed by month (see table 9) and by week (see table 10) to examine any changes in the number of items sold and the overall percentage of store revenue pre- and post-intervention. Any pre-intervention week that did not have a matching post-intervention week, and weeks that did not include all seven days of sales data were excluded from the tables so that a direct comparison could be made by time of year. For example, the post-intervention weeks of September 7-28, 2015 did not have a corresponding pre-intervention week and the week of September 28, 2015 only included three days worth of sales because the end of the intervention period fell in the middle of the week.

Store revenue was lower during “normal season” as compared to “peak season” in both study years.

While overall store revenue was around 1% lower after the intervention, sales followed the same general trends across weeks and months pre- and post-intervention.

7.2. Beverage sales

Table 4 below presents item-level beverage sales pre- and post-intervention. Overall, store revenue from beverages decrease by 20%. The overall number of beverage products sold was lower after the intervention (n=13,580) than before the intervention (n=20,546). Prior to the intervention, ultra-processed beverages represented approximately half (50.32%) of all beverage sales and 0% of sales post-intervention because all products in this category were removed. Minimally processed beverages comprised 38.31% of all beverage sales pre-intervention and made up two-thirds (63.49%) of all beverage sales post-intervention. Store revenue from minimally processed beverages increased by 3% after the intervention, however, revenue from ultra-processed beverages decreased by 100% because of the intervention.

7.3. Food sales

Table 4 presents food product sales at the item level of analysis pre- and post-intervention. Overall, store revenue from food products increased by 17% after the intervention. The overall number of food products sold was also higher after the intervention (n=43,046 vs. 41,245 pre-intervention). Specific sub-categories are of particular interest to assess whether or not the intervention also had an impact on snack food purchasing behaviour. Prior to the intervention, ultra-processed snack food accounted for the majority of snack food sales (78.94%), whereas minimally processed and processed snack food only accounted for 1.33% and 0.63% respectively.

Table 4: Number of beverage products and food products sold as percentage of overall beverage products and overall food products, pre- and post-intervention

		Pre-intervention	Post-intervention	Change in sales		Chi square value	Prob.
		Products sold n (%)	Products sold n (%)	Products sold n (%)	Revenue change within category (%)		
Beverages	Minimally processed beverages	7,871 (38.31)	8,622 (63.68)	751 (10.00)	3.00	153.87	<.0001
	Ultra-processed beverages	10,338 (50.32)	0 (0.00)	-10,338 (-100.00)	-100.00	10372.71	<.0001
	Other beverages	2,337 (11.37)	4,917 (36.32)	2,580 (110.00)	99.00	1236.66	<.0001
	Total beverages	20,546 (100)	13,539 (100)	-7,007 (-34.00)	-20.00	10283.96	<.0001
Food	Minimally processed snack food	549 (1.33)	897 (2.08)	348 (63.00)	98.00	118.846	<.0001
	Processed snack food	260 (0.63)	370 (0.86)	110 (42.00)	43.00	30.326	<.0001
	Ultra-processed snack food	32,558 (78.94)	33,400 (77.59)	842 (3.00)	8.00	480.706	<.0001
	Other food (non snack food)	7,878 (19.10)	8,379 (19.47)	501 (6.00)	37.00	105.66	<.0001
	Total food	41,245 (100)	43,046 (100)	1,801 (4.00)	17.00	90.71	<.0001

After the intervention, ultra-processed snack food represented approximately the same percentage of sales (77.59%), whereas both minimally processed and processed snack food sales increased slightly (2.08% and 0.86% respectively). Revenue from all food sub-categories increased after the intervention. The ultra-processed snack food category saw the smallest increase (8%), however, while the other food categories saw larger percentage increases, the number of items sold is still very low compared to ultra-processed snack food.

7.4. Transaction level analysis

Tables 5 and 6 below describe the number and percentage of transactions that contain the sales of at least one item per category, before and after the intervention. These tables also note any statistically significant change for each category. As noted in table 5, the percentage of transactions with non-food products (e.g., household items, clothing, etc.) and the percentage of transactions with both a food product and prescription purchased were not statistically different pre- and post-intervention. There were statistically significant differences in the percentage of transactions with food and beverage products and prescriptions before and after the intervention.

Table 5: Number and percentage of transactions containing the sale of at least one item per category, pre- and post-intervention

	Pre-intervention	Post-intervention	Difference (%)	Chi-square value	Prob.
	Number and percentage of transactions n (%)	Number and percentage of transactions n (%)			
Overall food & beverage	32,095 (28.41)	27,328 (25.58)	-2.83	226.46	<.0001
Non-food	104,566 (82.56)	98,664 (92.28)	-0.28	6.33	0.0118
Prescription	24,381 (21.58)	25,437 (23.79)	2.21	152.89	<.0001
Food & prescription	3,270 (2.89)	3,024 (2.83)	-0.06	0.89	0.3443

Note: columns do not add to 100% because the categories are not mutually exclusive

As observed in table 6 below, the number of transactions containing at least one minimally processed beverage increased from 6,282 transactions pre-intervention to 6,781 transactions post-intervention. Prior to the intervention there were 7,618 transactions that contained at least one ultra-processed beverage. There were no transactions that contained ultra-processed beverages after the intervention. The percentage of transactions containing each of the beverage categories showed statistically significant differences pre- and post-intervention.

As also noted in table 6, there were 19,130 transactions that contained at least one ultra-processed snack food pre-intervention and 18,001 transactions post-intervention. The percentage of transactions containing ultra-processed snack food were not statistically different pre- and post-intervention. The number of transactions that contained at least one minimally processed snack food increased from 468 transactions

pre-intervention to 714 transactions post-intervention. Similarly, the number of transactions that contained at least one processed snack food increased from 226 transactions pre-intervention to 307 transactions post-intervention. The percentage of transactions containing minimally processed snack food, processed snack food and other food all showed statistically significant changes pre- and post-intervention.

Table 6: Percentage of transactions containing the sale of at least one beverage, one food product, pre- and post-intervention

		Pre-intervention	Post-intervention	Difference (%)	Chi-square value	Prob.
		Number and percentage of transactions n (%)	Number and percentage of transactions n (%)			
Beverages	Minimally processed beverages	6,282 (5.56)	6,781 (6.34)	0.78	60.00	<.0001
	Ultra-processed beverages	7,618 (6.74)	0 (0.00)	-6.74	7,468.90	<.0001
	Other beverages	1,316 (1.16)	1,981 (1.85)	0.69	175.98	<.0001
Food	Minimally processed snack food	468 (0.41)	714 (0.67)	0.26	66.03	<.0001
	Processed snack food	226 (0.20)	307 (0.29)	0.09	17.22	<.0001
	Ultra-processed snack food	19,130 (16.93)	18,001 (16.83)	-0.10	0.38	0.5397
	Other food (non snack food)	4,376 (3.87)	4,867 (4.55)	0.68	62.77	<.0001

For each transaction where at least one product in a category of interest was sold, the mean expenditure per transaction for the specific category was calculated. Tables 7 and 8 below describe the number of transactions and the mean amount spent per transaction for each of the product categories, before and after the intervention. These tables also indicate where there were statistically significant differences between pre- and post-intervention expenditures.

As documented in table 7, there was no statistically significant difference in the mean expenditure per transaction overall (all products combined), however, there was a statistically significant increase in the mean expenditure per transaction on food and beverages (combined) before and after the intervention.

Table 7: Mean amount spent per transaction pre- and post-intervention of transactions overall (all products combined) and mean amount spent on food or beverage products

	Pre-intervention		Post-intervention		Difference (\$)	T-test value	Prob.
	Transactions (n)	Mean expenditure (\$)	Transactions (n)	Mean expenditure (\$)			
Overall (all products combined)	112,967	27.14	106,919	27.97	0.83	-0.93	0.3524
At least one food or beverage product	32,095	2.24	27,328	2.54	0.30	-17.56	<.0001

Note: Row one above reports the mean expenditure for all products purchased in the transaction. Row two reports the mean expenditure for only the food and beverage products purchased within transactions.

Table 8 shows that there were statistically significant decreases in the mean expenditures per transaction for minimally processed beverages and other beverages pre- and post-intervention.

As observed in table 8, the mean expenditure per transaction for minimally processed snack food, ultra-processed snack food and other food were statistically different pre- and post-intervention. The mean expenditure per transaction on processed snack food was not statistically different before and after the intervention.

Table 8: Number of transactions and mean amount spent per transaction, where at least one product per category was purchased, pre- and post-intervention

		Pre-intervention		Post-intervention		Difference (\$)	T-test value	Prob.
		Transactions	Mean	Transactions	Mean			
		(n)	expenditure (\$)	(n)	expenditure (\$)			
Beverages	Minimally processed beverages	6,282	1.96	6,781	1.79	-0.17	8.02	<.0001
	Ultra-processed beverages	7,618	1.46	0	0	-1.46	---	---
	Other beverages	1,316	4.29	1,981	3.53	-0.75	5.08	<.0001

		Pre-intervention		Post-intervention		Difference (\$)	T-test value	Prob.
		Transactions (n)	Mean expenditure (\$)	Transactions (n)	Mean expenditure (\$)			
		Food	Minimally processed snack food	468	3.56	714	4.33	0.77
Processed snack food	226		3.18	307	3.23	0.05	-0.45	0.6526
Ultra-processed snack food	19,130		2.21	18,001	2.34	0.13	-7.17	<.0001
Other food (non snack food)	4,376		3.36	4,867	4.09	0.73	-11.31	<.0001

Note: t-test was not performed for ultra-processed beverage because there were no post-intervention transactions that contained at least one ultra-processed beverage.

8. Discussion

The present study examined weekly sales data before and after the removal of ultra-processed beverages from one location of a national chain pharmacy in Baddeck, NS, Canada. This study addressed the change in mean expenditure per transaction on four product categories (minimally processed beverages, minimally processed snack food, ultra-processed beverages, and ultra-processed snack food).

8.1. Findings

Overall this study highlights three findings. 1) The number of beverages sold decreased substantially after the intervention. Store revenue from beverages also decreased significantly. However, there was no sizeable change in the percentage of total store revenue that food and beverage products accounted for before and after the intervention. 2) After the intervention, overall, a larger proportion of transactions contained at least one minimally processed beverage and minimally processed snack food and processed snack food. 3) The mean expenditure per transaction did not change significantly after the intervention.

These findings are described in more detail below.

8.1.1. Food and beverage products as a percentage of total store revenue

The first finding from this study is that, as indicated in table 3, after September 11, 2014 the number of beverages sold decrease by 34%. A decrease in the number of beverages sold after the intervention was expected, given that the intervention removed an entire sub-category of beverages. It was not known whether sales in other beverage sub-categories would increase enough to compensate for the loss of revenue from ultra-processed beverages. While there was a 100% decrease in the number of ultra-processed beverages sold, there was an increase of 10% in the number of minimally processed beverages sold after the intervention. While the overall *number* of beverage products sold after the intervention

decreased by 34% of the pre-intervention number (20,546 beverages sold during the pre-intervention period compared to 13,580 beverages sold after the intervention), the *revenue* from these beverage products decreased by 20% after the intervention. A loss of 20% in revenue in one product category would appear to be a significant loss, however, in terms of overall store revenue, it is less than one thousandth of a percent. At the same time, the number of food products sold after the intervention increased by 4% (from 41,245 food products pre-intervention to 43,046 food products sold after the intervention) and revenue from food products increased by 17%.

Overall, food and beverage products accounted for approximately 3% of total store sales. This percentage was not considerably different before (3.2%) and after (3.4%) the intervention. Beverages alone accounted for 1.1% of total store sales. As noted in table 4, prior to the intervention, ultra-processed beverages comprised approximately half (50.3%) of all beverage sales. However, given that all beverages combined make up a very small percentage of total store sales, this only constitutes 0.5% of total store sales and results in a relatively minor loss of revenue for the pharmacy.

For small business owners, concerns related to potential revenue loss may be a considerable obstacle when considering the implementation of a restrictive food environment intervention. As noted by De Marco and colleagues (2017), it is essential for researchers to develop strong partnerships with business owners and to explain the potential benefits of an in-depth examination of their sales data. Within the retail sector, small businesses owners are likely aware of their overall store revenue, but may have an incomplete understanding of the revenue generated from specific product categories. As Minaker and colleagues described (2017), small stores often have a limited capacity to use sales data to make evidence-based purchasing decisions. The results from this study indicate that beverage sales make up a very small percentage of overall products sold in the pharmacy in Baddeck. This presents an opportunity

for public health practitioners to use sales data to inform business owners of potential food or beverage product categories that can be targeted for intervention without creating significant detriments to retail performance.

Assessing sales data to better understand revenue generated from specific categories allows small business owners to inform their business practices and to consider changing the products sold for the long-term health benefit of their customers. It is likely that many business owners do not have a thorough understanding of dietary guidelines so it may be challenging at first to know which food and beverage products to introduce into their store with the intent of improving health. A simple suggestion for public health practitioners or researchers working with business owners would be to encourage business owners to start increasing minimally processed products and decrease ultra-processed products. These recommendations are similar to those used in Brazil's dietary guidelines, which incorporate the NOVA classification system (Brazilian Ministry of Health, 2014) and are relatively easy to understand without understanding nutrient content.

8.1.2. Proportion of transactions containing food and beverage products

8.1.2.1. Minimally processed beverages

The second finding from this study indicates that after the intervention there was an increase in the percentage of transactions that contained minimally processed beverages.

The number of transactions containing at least one minimally processed beverage was higher after the intervention (n=6,781, 77% of all transactions that contained a beverage) as compared to before the intervention (n=6,282, 41% of all transactions that contained a beverage). As reflected in table 8, overall,

there were fewer transactions that contained at least one beverage after the intervention. This may be a result of customers going elsewhere to purchase their ultra-processed beverages, or because customers did not continue to purchase minimally processed beverages on impulse to the same extent that they did with ultra-processed beverages. As Minaker et al. (2016) found, customers were not purchasing more carbonated soft drinks at other retailers in Baddeck, suggesting that most beverages purchased at the pharmacy were purchased on impulse rather than a pre-planned purchase that customers would go elsewhere for. While the findings from this study indicate that there was a statistically significantly greater proportion of transactions containing minimally processed beverages after the intervention (5.6% of all transactions pre-intervention as compared to 6.3% of all transactions post-intervention), the effect size was very small and any pre- and post-intervention is likely inconsequential.

This increase in transactions containing minimally processed beverages was expected since these were the only ready to consume beverages available in the pharmacy after the intervention, further supporting the idea that most beverages were purchased on impulse and customers were still purchasing whatever was available in the store. However, minimally processed beverage sales do not compensate entirely for the loss of revenue from impulse purchases of ultra-processed beverages. While the number of transactions that contained at least one minimally processed beverage saw a small increase (from 6,282 pre-intervention to 6,781 post-intervention), transactions with any type of beverage sales were much lower as a result of losing the transactions that contained ultra-processed beverages prior to the intervention.

This study specifically examined if there was any change in mean expenditure per transaction on beverages before and after the intervention. The findings in table 8 show that, while the number of transactions that contained at least one minimally process beverage increased, the mean expenditure on minimally processed beverages decreased by \$0.17 after the intervention. The reason for this decrease is

not known from the analysis, but could be a result of the business owner lowering the prices on minimally processed beverages, or as a result of stocking lower priced minimally processed beverages.

Minimally processed beverages were the only beverages available in the pharmacy after the intervention. As noted in the literature (Center for Science in the Public Interest, 2015), many consumers purchase single serving beverages on impulse at the checkout. The checkout area is a place that every customer must pass through and can have a strong influence on the purchasing patterns of shoppers (Center for Science in the Public Interest, 2015). The findings from this study suggest that while consumers may have continued to make impulse beverage purchases, they were purchasing minimally processed beverages by default, but to a lesser extent than they previously did with ultra-processed beverages.

8.1.2.2. Minimally processed and processed snack food

Overall, the proportion of transactions containing at least one food product after the intervention remained the same over the course of the study period (22,747 transactions [20%] pre-intervention as compared to 21,860 [20%] transactions post-intervention). While the intervention only directly impacted ultra-processed beverages, there were significantly more transactions that contained at least one minimally processed snack food (0.4% of transactions pre-intervention vs. 0.7% of transactions post-intervention) or processed snack food (0.2% of transactions pre-intervention vs. 0.3% of transactions post-intervention) after the intervention. Again, while these changes are statistically significant, the increases seen post-intervention are likely quite negligible from a revenue perspective, especially considering how small of a percentage these products account for in terms of overall store revenue. With that being said, seeing increases in transactions containing processed and minimally processed snack foods may be beneficial for encouraging the business owner and consumers to further invest in these products.

As Gittelsohn et al. (2014) suggested, in order for small stores to increase access to healthy food, it is important to start slow and build over time. For many small business owners, implementing an intervention that changes the availability of products can be cause for concern (Gittelsohn, Laska, Karpyn, Klingler, Ayala, 2014). One common concern among business owners is that healthier food products will not sell as well. Small stores like the pharmacy in Baddeck have a limited amount of space available. For this particular study, the pharmacist expanded the availability of the minimally processed and processed snack food products over the course of the study period, but the selection was limited to non-perishable products. Seeing an increase in the proportion of transactions containing these products is encouraging and provides another opportunity for practitioners to encourage small business owners to consider permissive interventions aimed at improving access to minimally processed and processed foods.

Small business owners are often hesitant to sell perishable food and beverages because of the significant investment needed to properly do so (e.g., investing in refrigerators, safe food handling, procuring from suppliers) (Minaker, Lynch, Cook, & Mah, 2017). Presenting small business owners with their sales data and visualizations of their sales is one way to increase owners' willingness to include new products (Minaker, Lynch, Cook, & Mah, 2017). More specifically, exploring sales data within specific product categories provides small business owners with the opportunity to weigh the potential risks and benefits of implementing interventions within the retail food environment (Minaker, Lynch, Cook, & Mah, 2017).

This study also examined whether there was any change in mean expenditure on minimally processed snack food and processed snack food per transaction before and after the intervention. The findings in table 8 show that the mean expenditure per transaction on minimally processed snack food increased by \$0.77 after the intervention. The percentage of transactions that contained at least one minimally processed food also increased by 0.3% after the intervention.

These findings may be important for the pharmacist looking for opportunities to improve availability of these products. As the literature referenced earlier, a study by Farley et al. (2009) noted that pharmacies allocate very little shelf space, in some cases as little as 5%, to minimally processed foods like fresh fruits and vegetables. Small, rural, and independent stores may stock even fewer fresh fruits, vegetables and nutritious beverages (Centers for Disease Control and Prevention [CDC], 2014). The checkout aisle and other prominent locations within retail stores are opportunities to promote minimally processed food and beverage products rather than ultra-processed food and beverage products. There are only a few examples of other retailers taking action to implement interventions that support health; one example being the removal of all candy from the checkout aisle in several major United Kingdom retailers (Center for Science in the Public Interest, 2015). Another example is corner store programs asking businesses to display highly processed snack foods and sugar-sweetened beverages less prominently and replace front of store displays with attractive displays of produce (Ogilvie, 2013).

Other strategies for promoting minimally processed food and beverages include advertising healthier products, lowering the price of healthier options, and placing these items at eye level (CDC, 2014). While the pharmacy currently sells only a select variety of minimally processed foods, the findings from this study may encourage the pharmacist to broaden the selection of these minimally processed food and beverage products or consider other ways to promote their sale, given the increased expenditure in this category. While not specific to pharmacies, the study by Surkan and colleagues (2017) examined sales data to evaluate the impact of promoting healthier alternatives to commonly purchased foods in supermarkets. Their findings suggest that in-store interventions that aim to promote healthy foods do yield an increase in sales of the promoted foods (Surkan, Tabrizi, Lee, Palmer, & Frick, 2017). Similar approaches may be beneficial for business owners looking to introduce new minimally processed foods.

8.1.3. Expenditure per transaction

The third finding from this study, as noted in table 7, indicates that the overall mean expenditure per transaction was not statistically different before (\$27.14) and after (\$27.97) the intervention. Additionally, while overall store revenue did decline during the post-intervention period, the mean expenditure on food and beverage products actually increased significantly from \$2.24 to \$2.54, suggesting that the decline in revenue may have been related to external factors. These findings demonstrate that removing an entire product category (i.e., sugar-sweetened beverages) did not have a substantial impact on overall expenditures at the pharmacy. This is an important finding because one of the major arguments from pharmacists against halting the sale of tobacco was a projected loss of revenue (Taylor, M., n.d.). Prior to the ban of tobacco product sales in pharmacies in Ontario in 1994, Shoppers Drug Mart predicted that the ban would result in the elimination of 2000 jobs and the closure of stores (Taylor, M., n.d.). A similar concern of job loss as a result of lost revenue could be anticipated by chain pharmacies and independent pharmacy owners if pharmacists were asked to stop selling SSBs. Pharmacy retail settings are a major market for the soft drink and snack food industries to promote and sell ultra-processed food and beverage products. If policy changes were suggested that would restrict the sale of ultra-processed food and beverage products, significant push-back could be expected from these industries. Having evidence that demonstrates that removing an entire product category does not have a substantial impact on overall expenditures in pharmacies would provide support to public health advocates and business owners.

8.2. Limitations

This study has two primary limitations. First, this study is a case study design with only one retailer. While much can be learned from this particular example, case study designs are limited in terms of the generalizability of the findings. This particular study can only examine the findings in one particular

context, and may not be applicable to other settings. For example, this study was implemented in a small, rural pharmacy by an engaged storeowner. The findings presented above may not be observed if the intervention was implemented in a larger pharmacy, where beverage sales account for more than 1% of overall store sales, or in a pharmacy where the storeowner was not committed to the intervention.

While it would be advantageous to include additional retailers, the pharmacy in Baddeck is the only retailer implementing this type of restrictive food environment intervention, to my knowledge, and there is no indication at this time that other stores will consider implementing the same intervention. Research using natural experiments is one way of understanding the health impact of policies and interventions at a local level before expanding the reach or scaling the intervention to other jurisdictions. One of the major arguments from pharmacists against halting the sale of tobacco was a projected loss of revenue (Taylor, n.d., Katz, 2013). In the 1990s, when Ontario was debating legislation to stop the sale of tobacco in pharmacies, no studies existed to determine the financial impact of such legislation. Once the implications of the ban were understood in Ontario, and evidence showed that there was no adverse economic impact for pharmacies when the ban was introduced (Physicians for a smoke-free Canada, 2014), other provinces enacted similar bans. One of the contributions of this study, therefore, will be to provide preliminary evidence on the financial effect of a ban on sugar-sweetened beverages in a rural pharmacy.

Second, the pre-post-intervention design has limitations in that the design assumes that conditions are similar before and after the intervention, and that findings are assumed to be due to the intervention and may not account for external factors (e.g., change in economic climate between one year and another). Longer pre- and post-intervention periods increase the likelihood that other conditions will affect the results. This is one reason why this study was limited to approximately one year before and after the intervention, even though the pharmacist provided sales data beyond this period. De Marco et al. (2017)

recommend obtaining 12 months of sales data in order to observe changes in sales over time and during different seasons, and to see if changes are sustained after the intervention period.

While the sugar-sweetened beverage industry has reported an overall decline of carbonated soft drink sales (Kell, 2016), sales of other sugar-sweetened beverages, especially those perceived as healthier alternatives (e.g., juice, iced tea, flavoured water, organic soda) are seeing rapid increases in sales (Sanger-Katz, 2015). As reported by Schwartz et al. (2016), even with the implementation of a multifaceted campaign targeting sugar-sweetened beverages, sales of sports drinks and diet soda did not decrease significantly post-intervention. Beverage companies also made adjustments to their products to persuade their customers back to carbonated soft drinks (e.g., smaller containers, products without artificial sweeteners) (Sanger-Katz, 2015). At the same time, sales of bottled water have also been increasing (International Bottled Water Association, 2016). The Baddeck study did not have a “control pharmacy” to account for external factors. Examining the mean expenditure per transaction before and after the intervention as a proportion of overall store sales, as well as for a variety of product categories, allowed for a better understanding of the impact removing all ultra-processed beverages had on pharmacy sales.

8.3. Implications and Future Research

The findings from this study have implications in practice for the local pharmacy in Baddeck, the broader retail pharmacy community, and for future population health research.

At a local level, the findings from this study may encourage the pharmacist to continue expanding the selection of minimally processed and processed food and beverage offerings, and to consider other

strategies (e.g., product placement, pricing) to increase sales. Supplementing total store sales with minimally processed products may also support the pharmacist in further restricting other ultra-processed food products such as chocolate bars, candy or chips. Given that food and beverages combined accounted for about 3% of total store sales, by further restricting ultra-processed food products one would expect to see similar reductions in total store sales as seen by removing ultra-processed beverages.

While the financial risk of further restricting ultra-processed food selection could be mitigated by increasing sales of minimally processed food and beverages, there are a variety of factors that make introducing minimally processed foods a complex decision for retail pharmacy business owners. Business owner buy-in is essential for successful in-store interventions. This can be achieved by assuring business owners that promoting healthy foods will be beneficial to their store (Krisberg, 2016). As noted by Gravlee and colleagues (2014), many business owners perceive ultra-processed foods and beverages as “healthy” and may believe that they are already selling products that support customer health. Applying the NOVA classification system, which uses clear definitions for the level of food processing rather than relying on an understanding of nutrient content of food and beverage products (Monteiro, Cannon, Mobarac, Levy, Louzada, & Jaime, 2017), to purchase store inventory may be an opportunity for public health practitioners to work with business owners to consider new products to introduce. Business owners may not have the decision-making control to make changes to the products they sell if they believe their inventory is managed by a larger corporation (Gravlee, Boston, Mitchell, Schultz, & Betterley, 2014).

Further, introducing minimally processed foods like fruits and vegetables requires business owners to make a significant investment in store infrastructure, such as refrigeration units, and staff must be properly trained in food handling (Minaker, Lynch, Cook, & Mah, 2017). Many customers also believe that minimally processed foods like fruits and vegetables are very costly; this belief may lower the

demand for such products (Gravlee, Boston, Mitchell, Schultz, & Betterley, 2014). This in turn makes it difficult for stores to sell perishable products in a timely manner, resulting in a greater financial risk for small business owners. An important lesson learned by Gittelsohn and colleagues (2014) was for small stores to introduce new products slowly, and increase the selection over time. This allows time for business owners to learn about customer needs and product demand and to start with shelf-stable minimally processed foods (e.g., unsweetened, dried fruit, unsalted nuts) and lower risk perishable foods (e.g., bananas, apples, etc.) that do not require major infrastructure investment, building up to higher risk products over time (e.g., pre-packaged cut vegetables). Store owners may also consider opportunities to promote minimally processed foods as they become available through signage promoting health benefits, taste testing or price promotions.

An upcoming process evaluation will explore the intervention in more detail and will include interviews with the pharmacist and other key stakeholders. At a broad level, while the findings of this study will be limited by the context of this natural experiment, they may be useful to inform the decision-making of other small pharmacies wanting to make a change to their business. Understanding the process used to develop and implement this type of restrictive retail food environment intervention may also support other retailers in overcoming barriers to implementing health-promoting food environment interventions.

Using sales data as a population health metric is a novel method for assessing the impact of retail interventions and has only been used in a limited number of studies focused on changing the retail food environment (e.g., Fuller, Engler-Stringer, & Muhajarine, 2015; Gittelsohn, Rowan, & Gadhoke, 2012; Minaker, Lynch, Cook, & Mah, 2017). Examining sales data allows researchers and business owners to better understand the proportion of sales that specific sales categories account for, and the opportunity to use evidence to tailor interventions and support changes to business practices (Minaker, Lynch, Cook, &

Mah, 2017). As suggested by De Marco and colleagues (2017), the findings from changes in sales data are easily communicated to a variety of stakeholders and, as reported by Schwartz et al. (2017), have the potential to impact policy change in communities. The findings from the Baddeck study support the use of retail sales data in future research for assessing food and beverage purchasing patterns for population health research. Additional studies could further assess the impact of retail interventions on individuals by accessing data from loyalty card programs. While not all businesses, especially small businesses, have loyalty card programs, this type of assessment provides the chance to examine individual purchasing behaviours and the ability to link purchases over time (De Marco, Chauvenet, Chapman, & Noriega-Goodwin, 2017).

As noted earlier, a key limitation of this study was the case study design with only one small, rural retailer. In order to improve the generalizability of this type of study, future research should engage additional stores in other contexts (e.g., intervention led by someone other than the retail owner) and jurisdictions (e.g., larger, urban retailers). In terms of context, the current study focused on a retailer-led intervention. The pharmacist designed and implemented the intervention himself and, as such, was a champion for its success. If the same intervention was implemented in pharmacies where the business owners were less motivated to carry out a similar intervention (e.g., did not believe that selling ultra-processed beverages sends inconsistent health messages), the outcomes may differ from what was noted in the Baddeck pharmacy. In terms of jurisdiction, the current study took place in a small, rural pharmacy. Larger, more urban retailers may not have the same composition of products (e.g., beverage sales may account for more than 1% of total store sales). Again, the outcome of a similar intervention may differ from those seen in Baddeck, or business owners in larger stores may not see the intervention as acceptable or feasible if their beverage sales account for a larger percentage of total store sales.

Another limitation of this study is not having another pharmacy to act as a control for external confounding variables. External factors may relate to the built environment around the store (e.g., new retail outlets opening near by), political conditions (e.g., implementation of national campaigns focused on the items of interest during the intervention, introduction of new taxes) and economic conditions (e.g., an increase in fuel costs which impact shipping costs) (De Marco, Chauvenet, Chapman, Noriega-Goodwin, 2017). Including a control pharmacy would help reduce bias and analyses could account for potential confounding in a future study. The current study examined the impact of the intervention on the mean expenditure per transaction, however, there may be additional economic factors or other confounding variables that are influencing the results. Having a control pharmacy with similar characteristics (e.g., store size, geographic location, shopper demographics) to the intervention store would help to properly attribute any changes in expenditure to the intervention.

Ultimately, the aim of this type of intervention was to have an impact on individual dietary intake of sugar-sweetened beverages. Future research should explore the extent to which this type of food environment retail-level intervention reduces consumption of sugar-sweetened beverages at the individual level. This could include using other methods, such as loyalty card program sales data, in order to be able to link individual purchasing patterns over time (as a proxy for consumption patterns), or through dietary assessment methods, such as food frequency questionnaires or 24-hour dietary recall.

9. Conclusions

With the expanding selection of food and beverages available in pharmacies, pharmacies play an important role in creating healthy food environments and supporting shoppers in making healthy purchases. To my knowledge, this study was the first to examine the impact of a restrictive retail food environment intervention on pharmacy sales. For this type of health intervention to be feasible and desirable for other pharmacies to consider as a business model, it must not have a negative impact on retail performance.

There are three main findings from this study. First, there were significantly fewer beverages sold after the intervention. Store revenue from beverages also decreased significantly. However, the number of food products and revenue from food products increased significantly after the intervention. Overall, there was no sizeable change in the percentage of total store revenue that food and beverage products accounted for before and after the intervention. Given that beverage products accounted for such a small percentage of total store revenue, decreases in revenue from these products resulted in a relatively minor loss of revenue for the pharmacy overall. Second, there were significant increases in the percentage of transactions that contained at least one minimally processed beverage after the intervention. Third, the mean expenditure per transaction did not change significantly after the intervention. While the ultimate goal of the intervention in Baddeck was focused on health promotion, the success of the intervention is dependent on the satisfaction of both the business owner and the customers. The business owner must be satisfied with the changes in revenue composition, with opportunities to offset reduction in revenue from specific food and beverage categories, and with the prospect of implementing changes for the purpose of health promotion. Customers must continue to be satisfied with the product selection available in the store. A customer demand for healthier food and beverage products is necessary for a successful balance between health promotion and customer interest, resulting in store earnings.

While the findings from this natural experiment in one small, rural pharmacy may be limited in terms of generalizability, they suggest that this type of restrictive intervention can be implemented with a very minor loss to overall store revenue after the removal of all sugar-sweetened beverages. These findings also suggest opportunities for further research using sales data in different contexts and jurisdictions.

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Appendices

Appendix A: Example of raw sales data

Figure 3: Point of sale data as received from pharmacist

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Stone's Pharmasave
PO Box 249
Baddeck, NS,
BOE 1B0
Phone: (902)295-2404
=====
Date Range: Jan01/13 - Dec31/13
Branches: All
Tue Mar 10 14:08:20 2015

POS JOURNAL DETAIL

FOLIO # DATE      ITEM # NAME          C CODE QTY  AMOUNT TAX 1  TAX 2  TOTAL
ACCT #  DESCRIPTION, SERIAL #  CODE   AMOUNT SELLING
                                           TAX 1  TAX 2  AMOUNT
                                           AMOUNT
=====
Jan02/13
=====
S-1274467 Jan02/13 08:43 , SALE          NNN SALE 1    17.93  0.00  0.00  17.93
000001 PRESCRIPTION, 7567760 NNN ITEM 1    17.93  17.93
000000 *****9239,      MN084147 NNN MCRD
S-1274468 Jan02/13 08:43 , SALE          BLB SALE 1    26.69  2.91  0.00  29.60
315591 ADVIL/EXT/STRE/LIQ/G, BLB ITEM 1    19.39  19.39
000001 PRESCRIPTION, 7567901 BLB ITEM 1    7.30  7.30
000000 *****          , MN004021 BLB DBIT
S-1274469 Jan02/13 09:10 , SALE          BLB SALE 2    15.98  0.00  0.00  15.98
909663 FOLGERS COFFEE CLASS, BLB ITEM 2    7.99  15.98
000000 , BLB CASH
S-1274470 Jan02/13 09:10 , SALE          JEI SALE 1    12.43  0.00  0.00  12.43
000001 PRESCRIPTION, 7567838 JEI ITEM 1    12.43  12.43
000000 , JEI CASH
S-1274471 Jan02/13 09:10 , VOID          BLB VOID -2   -15.98  0.00  0.00 -15.98
909663 FOLGERS COFFEE CLASS, BLB ITEM -2    7.99  -15.98
000000 , BLB CASH
COMM'T VOIDED #: S-1274469VOID BY BLB AUTH
S-1274472 Jan02/13 09:10 , SALE          BLB SALE 2    15.98  0.00  0.00  15.98
909663 FOLGERS COFFEE CLASS, BLB ITEM 2    7.99  15.98
000000 *****          , MN944047 BLB DBIT
S-1274473 Jan02/13 09:15 , SALE          BLB SALE 1    65.64  9.85  0.00  75.49
303833 CROWN-CASHEWS, BLB ITEM 1    5.99  5.99
1049900 FISHERMANS FRN CITRU, BLB ITEM 1    1.99  1.99
320209 WRIST SUPPORT MD/L, BLB ITEM 1    29.99  29.99
987123 B/D-ALMONDS-LT-SLT, BLB ITEM 1    2.99  2.99
680176 FARMERS TWIST 1% CHO, BLB ITEM 1    1.59  1.59
1080699 TIC TAC, BLB ITEM 1    1.59  1.59
1080699 TIC TAC, BLB ITEM 1    1.59  1.59
966437 EXCEL MINT PEPPERMIN, BLB ITEM 1    2.29  2.29
909594 JAM B100, BLB ITEM 1    17.62  17.62
000000 *****          , MN005704 BLB DBIT
S-1274474 Jan02/13 09:18 , SALE          BLB SALE 1    4.49  0.67  0.00  5.16
170511 ENEMOL, BLB ITEM 1    4.49  4.49
000000 *****2007, MN042708 BLB VISA
S-1274475 Jan02/13 09:19 , SALE          BLB SALE 1    11.65  0.00  0.00  11.65
000001 PRESCRIPTION, 7567914 BLB ITEM 1    11.65  11.65
000000 , BLB CASH
S-1274476 Jan02/13 09:20 , SALE          BLB SALE 1    2.51  0.38  0.00  2.89
574074 CAPE BRETON POST, BLB ITEM 1    1.12  1.12
000031 CHRONICLE HERALD, BLB ITEM 1    1.39  1.39
000000 , BLB CASH
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Appendix B: Monthly and weekly sales pre- and post-intervention

Table 9: Number of items sold pre- and post-intervention (monthly)

Pre-intervention		Post-intervention			
Month	Number and percentage of items sold n (%)	Month	Number and percentage of items sold n (%)	Difference (n)	Difference (%)
Oct. 2013	26567 (4.43)	Oct. 2014	24738 (4.13)	-1829	-0.3
Nov. 2013	20186 (3.37)	Nov. 2014	20969 (3.50)	783	0.13
Dec. 2013	27560 (4.60)	Dec. 2014	26960 (4.50)	-600	-0.1
Jan. 2014	19855 (3.31)	Jan. 2015	20415 (3.41)	560	0.1
Feb. 2014	20353 (3.40)	Feb. 2015	20384 (3.40)	31	0
Mar. 2014	19588 (3.27)	Mar. 2015	19918 (3.32)	330	0.05
Apr. 2014	22370 (3.73)	Apr. 2015	22286 (3.72)	-84	-0.01
May 2014	23730 (3.96)	May 2015	22283 (3.72)	-1447	-0.24
Jun. 2014	25380 (4.23)	Jun. 2015	23471 (3.92)	-1909	-0.31
Jul. 2014	30669 (5.12)	Jul. 2015	25357 (4.68)	-5312	-0.44
Aug. 2014	32428 (5.41)	Aug. 2015	27879 (4.65)	-4549	-0.76
Total	268686 (44.83)	Total	254660 (42.95)	-14026	-1.88

Table 10: Number of items sold pre- and post-intervention (weekly)

Pre-intervention		Post-intervention		Difference (n)	Difference (%)
Week	Number and percentage of items sold n (%)	Week	Number and percentage of items sold n (%)		
Sep. 16, 2013	5980 (1.00)	Sep. 15, 2014	5736 (0.96)	-244	-0.04
Sep. 23, 2013	6544 (1.09)	Sep. 22, 2014	5733 (0.96)	-811	-0.13
Sep. 30, 2013	6328 (1.06)	Sep. 29, 2014	5867 (0.98)	-461	-0.08
Oct. 7, 2013	6379 (1.06)	Oct. 6, 2014	5872 (0.98)	-507	-0.08
Oct. 14, 2013	5442 (0.91)	Oct. 13, 2014	5349 (0.89)	-93	-0.02
Oct. 21, 2013	5359 (0.89)	Oct. 20, 2014	5145 (0.86)	-214	-0.03
Oct. 28, 2013	5397 (0.90)	Oct. 27, 2014	5112 (0.85)	-285	-0.05
Nov. 4, 2013	4486 (0.75)	Nov. 3, 2014	4761 (0.79)	275	0.04
Nov. 11, 2013	4195 (0.70)	Nov. 10, 2014	4421 (0.74)	226	0.04
Nov. 18, 2013	4854 (0.81)	Nov. 17, 2014	4821 (0.80)	-33	-0.01
Nov. 25, 2013	5487 (0.92)	Nov. 24, 2014	6119 (1.02)	632	0.1
Dec. 2, 2013	5494 (0.92)	Dec. 1, 2014	5533 (0.92)	39	0
Dec. 9, 2013	6697 (1.12)	Dec. 8, 2014	5963 (0.99)	-734	-0.13
Dec. 16, 2013	7675 (1.28)	Dec. 15, 2014	7336 (1.22)	-339	-0.06
Dec. 23, 2013	5770 (0.96)	Dec. 22, 2014	5393 (0.90)	-377	-0.06
Dec. 30, 2013	3734 (0.62)	Dec. 29, 2014	4428 (0.74)	694	0.12
Jan. 6, 2014	5037 (0.84)	Jan. 5, 2015	5332 (0.89)	295	0.05
Jan. 13, 2014	4415 (0.74)	Jan. 12, 2015	4355 (0.73)	-682	-0.01
Jan. 20, 2014	4282 (0.71)	Jan. 19, 2015	4458 (0.74)	43	0.03
Jan. 27, 2014	4882 (0.81)	Jan. 26, 2015	4979 (0.83)	697	0.02
Feb. 3, 2014	5040 (0.84)	Feb. 2, 2015	5013 (0.84)	131	0

Pre-intervention		Post-intervention		Difference (n)	Difference (%)
Week	Number and percentage of items sold n (%)	Week	Number and percentage of items sold n (%)		
Feb. 10, 2014	5366 (0.90)	Feb. 9, 2015	5542 (0.92)	502	0.02
Feb. 17, 2014	4718 (0.79)	Feb. 16, 2015	4518 (0.75)	-848	-0.04
Feb. 24, 2014	5197 (0.87)	Feb. 23, 2015	5199 (0.87)	481	0
Mar. 3, 2014	4458 (0.74)	Mar. 2, 2015	4372 (0.73)	-825	-0.01
Mar. 10, 2014	4378 (0.73)	Mar. 9, 2015	4696 (0.78)	238	0.05
Mar. 17, 2014	4511 (0.75)	Mar. 16, 2015	3870 (0.65)	-508	-0.1
Mar. 24, 2014	4756 (0.79)	Mar. 23, 2015	5207 (0.87)	696	0.08
Mar. 31, 2014	4846 (0.81)	Mar. 30, 2015	5358 (0.89)	602	0.08
Apr. 7, 2014	5201 (0.87)	Apr. 6, 2015	4822 (0.80)	-24	-0.07
Apr. 14, 2014	5691 (0.95)	Apr. 13, 2015	4937 (0.82)	-264	-0.13
Apr. 21, 2014	4664 (0.78)	Apr. 20, 2015	5006 (0.84)	-685	0.06
Apr. 28, 2014	5169 (0.86)	Apr. 27, 2015	5472 (0.91)	808	0.05
May 5, 2014	5311 (0.89)	May 4, 2015	5315 (0.89)	146	0
May 12, 2014	5436 (0.91)	May 11, 2015	4945 (0.83)	-366	-0.08
May 19, 2014	5171 (0.86)	May 18, 2015	4494 (0.75)	-942	-0.11
May 26, 2014	5601 (0.93)	May 25, 2015	5703 (0.95)	532	0.02
Jun. 2, 2014	5686 (0.95)	Jun. 1, 2015	5561 (0.93)	-40	-0.02
Jun. 9, 2014	5401 (0.90)	Jun. 8, 2015	5163 (0.86)	-523	-0.04
Jun. 16, 2014	5611 (0.94)	Jun. 15, 2015	5351 (0.89)	-50	-0.05
Jun. 23, 2014	6885 (1.15)	Jun. 22, 2015	5453 (0.91)	-158	-0.24
Jun. 30, 2014	6377 (1.06)	Jun. 29, 2015	5731 (0.96)	-1154	-0.1
Jul. 7, 2014	6798 (1.13)	Jul. 6, 2015	5604 (0.94)	-773	-0.19

Pre-intervention		Post-intervention		Difference (n)	Difference (%)
Week	Number and percentage of items sold n (%)	Week	Number and percentage of items sold n (%)		
Jul. 14, 2014	6768 (1.13)	Jul. 13, 2015	6785 (1.13)	-13	0
Jul. 21, 2014	7252 (1.21)	Jul. 20, 2015	6256 (1.04)	-512	-0.17
Jul. 28, 2014	7354 (1.23)	Jul. 27, 2015	6917 (1.15)	-335	-0.08
Aug. 4, 2014	7674 (1.28)	Aug. 3, 2015	7154 (1.19)	-200	-0.09
Aug. 11, 2014	8034 (1.34)	Aug. 10, 2015	6542 (1.09)	-1132	-0.25
Aug. 18, 2014	6741 (1.12)	Aug. 17, 2015	6013 (1.00)	-2021	-0.12
Aug. 25, 2014	7546 (1.26)	Aug. 24, 2015	5790 (0.97)	-951	-0.29
Sep. 1, 2014	5772 (0.96)	Aug. 31, 2015	6054 (1.01)	-1492	0.05
Total	287850 (48.02)	Total	275556 (45.95)	-11559	-2.07