ACCEPTABILITY OF BUILT ENVIRONMENT INTERVENTIONS AIMED AT PROMOTING A HEALTHY DIET AND PHYSICAL ACTIVITY IN URBAN NEIGHBOURHOODS OF SASKATCHEWAN, CANADA

A Thesis Submitted to the College of

Graduate and Postdoctoral Studies

in Partial Fulfillment of the Requirements

for the Degree of Master of Science

in the Department of Community Health and Epidemiology,

College of Medicine, University of Saskatchewan,

Saskatoon, Canada

By
SAHANA RAMAMOORTHY

PERMISSION TO USE

In presenting this thesis in partial fulfillment of the requirements for a Postgraduate degree from the University of Saskatchewan, I agree that the Libraries of this University may make it freely available for inspection. I further agree that permission for copying of this thesis in any manner, in whole or in part, for scholarly purposes may be granted by the professor or professors who supervised my thesis work or, in their absence, by the Head of the Department or the Dean of the College of Graduate and Postdoctoral Studies in which this thesis work was done. It is understood that any copying or publication or use of this thesis or parts thereof for financial gain shall not be allowed without written permission from the author. It is also understood that due recognition shall be given to the author and to the University of Saskatchewan in any scholarly use which may be made of any material in this thesis.

Requests for permission to copy or to make other use of material in this thesis in whole or part should be addressed to:

Head of the Department of Community Health and Epidemiology
Room 3247 - E wing - Health Sciences 104 Clinic Place Saskatoon
University of Saskatchewan
Saskatchewan
S7N-5E5
Canada

Dean
College of Graduate and Postdoctoral Studies
University of Saskatchewan
116 Thorvaldson Building, 110 Science Place
Saskatoon, Saskatchewan S7N 5C9
Canada

ABSTRACT

Background: Physical activity and diet play a critical role in the primary and secondary prevention of several chronic diseases. In Saskatchewan, 35% of adults are reported to be obese, which is partly attributable to physical inactivity and an unhealthy diet. In addition, individuals living in urban areas are faced with an increased risk of an unhealthy lifestyle due to the structure of the built environment (BE). Regardless, attempts to transform BE have met with mixed results. An essential contributor to the heterogeneity found in the success of the BE interventions is 'public acceptability'. However, current knowledge about the acceptability of diverse BE interventions is limited. Additionally, information on how individual and neighbourhood-level factors influence acceptability is lacking.

Purpose: The purpose of this study was to estimate the current level of public acceptability of diverse built environment interventions varying in intrusiveness that support healthy eating and physical activity in Saskatoon and Regina and to identify individual and neighbourhood-level factors associated with the level of acceptability of diverse interventions.

Method: This study used a subset of data from "THEPA" - Targeting Healthy Eating & Physical Activity: Citizens' perspectives, with linkage to respondents' neighbourhood-level factors using data from the Canadian Urban Environmental Health Research Consortium (CANUE). A sample of 2133 respondents was analysed using multi-level logistic regression. Missing observations were treated by multiple imputation procedure. Outcome variables were 'agreement' to implement 12 and 26 BE interventions related to food and physical activity. Independent variables were individual and neighbourhood-level factors. Interventions were ordered according to the level of intrusiveness as per Nuffield's intervention ladder.

Results: Overall, individuals were more agreeable to implementing the least intrusive interventions in both the food and physical activity domain; even so, the public support differed by the type of intervention. In addition, the likelihood of support across different levels of the intervention varied by gender, immigration status, Indigenous status, employment, education, and neighbourhood ethnic concentration. Notably, women showed a higher likelihood of support for all levels of interventions. However, no strong relationship between neighbourhood-level attributes and acceptability was detected.

Conclusion: Individual factors strongly influence public acceptability, and the degree of support varies for different levels of intrusion. This study provides previously lacking evidence on the acceptability of diverse BE interventions, the influence of intervention intrusion, and individual and neighbourhood attributes on acceptability. Further investigation, including the individuals' lived experiences, is needed for better understanding of the variations observed.

Keywords: Built environment; Physical activity; Healthy diet; Interventions; Policies; Acceptability

ACKNOWLEDGEMENT

Dedication

To the Almighty God

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

NCD   Non-Communicable Diseases

BMI   Body Mass Index

THEPA   Targeting Healthy Eating & Physical Activity

CANUE   Canadian Urban Environmental Health Research Consortium

CIHR   Canadian Institutes of Health Research

BE   Built Environment

CMA   Census Metropolitan Area

FSA   Forward Sortation Area

DA   Dissemination Area

CI   Confidence Interval

AOR   Adjusted Odds Ratio

CHAPTER 1
INTRODUCTION

1.1 Background

Non-communicable diseases (NCDs) are the leading cause of death globally and one of the major health challenges in recent decades(1). In 2016, they were responsible for 71% of deaths worldwide(2). Cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes were among the leading NCDs accountable for these deaths(3). In Canada, NCDs account for 88% of all deaths(3), and there is a 10.7% probability of dying from these four leading NCDs(4). The leading risk factors for NCDs(5) and global mortality(6) include high blood pressure, tobacco & alcohol use, raised blood glucose, physical inactivity, unhealthy diet, and overweight and obesity.

Diet and physical activity are integral to daily living and have a strong influence one's health(7). Overwhelming evidence supports the importance of physical activity and a healthy diet in the primary and secondary prevention of several chronic diseases (8–17). Regular physical activity has been proved to be an effective preventative strategy, reducing 20–30% risk of at least 25 chronic medical conditions in adults who attain at least 150 minutes of moderate-intensity physical activity per week(11,18). Physical activity is also associated with improved mental health through reduced stress, anxiety, and depression(19–23). However, physical inactivity is seen as a significant health crisis globally. Almost 3.2 million global deaths each yearly are attributable to insufficient physical activity(24). According to a recent report, 30% of Canadian adults are physically inactive(3), accounting for an estimated $6.7 billion direct and indirect healthcare costs, 7.4% of the overall healthcare costs(25).

Further, physical activity and diet are key modifiable risk factors that drive the obesity pandemic(26–28). Obesity, in turn, is a significant risk factor for several chronic conditions, including hypertension, diabetes mellitus, cardiovascular disease, hypertriglyceridemia, and high cholesterol(29–31). In the 2018 national survey, 26.8% of Canadian adults (7.3 million) were classified as obese, while 36.3% were classified as overweight (32). Obesity will affect more than one in three Canadian adults by 2031(33). Further, the 2018 report indicates that nearly 35% of Saskatchewan adults are obese(32) – one of the highest rates in Canada. Thus, to address these ballooning health consequences, policymakers and researchers have shifted their focus on population interventions that increase energy expenditure (34–38) and reduce energy intake (39–46).

The built environment has a facilitative role in promoting a healthy lifestyle, especially being physically active and adopting a healthy diet(47–52). Therefore, policies and interventions that modify the built environment have been considered crucial to changing the population's diet and physical activity pattern. Schulz and Northridge(53) define the *built environment* as that part of the physical environment that "*encompass all of the buildings, spaces, and products that are created or significantly modified by people...*". Accordingly, neighbourhood built environment can promote opportunities for physical activity through good access to recreation facilities(47,54,55); improved mode of transport(47); accessible pathways for nonmotorized transport(56,57); safety lighting(58); incentives to promote physical activity(59); improved aesthetic qualities of the area(60); and improved perceived neighbourhood safety(60), and encourage healthy food habits through increased access to affordable and nutritious food(61)(56); and access to food outlets(62) and, supermarkets(63). In Canada, about 80% of the population lives in an urban or suburban area(64). Residents of urban and suburban neighbourhoods are generally more likely to lead a

sedentary lifestyle, have easy access to unhealthy food, and engage in less physical activity(65). Urban sprawl(66) has consistently been linked to low physical activity and an unhealthy diet(66–71). The 2017 Public Health Agency report(65) indicates the importance of building healthy communities through redesigning cities for improved health outcomes among Canadians.

Consequently, several attempts have been made to transform the built environment to increase opportunities for and reduce barriers to physical activity and a healthy diet. However, these interventions have shown mixed success. For instance, improving the quality of parks and playgrounds has been shown to generate positive impacts on physical activity (72,73); on the contrary, studies have also shown a decline in park use and physical activity after built environment transformation(74).

A recent systemic review(73) indicates that of the five studies that assessed physical activity impacts due to new park amenities and new paths/trails, two found a positive change in physical activity level in users. Two other studies assessed changes in total physical activity after active transportation intervention, and one found a positive result. Another study evaluated whether or not state health policies changed parents' activity levels and found that fathers showed an increase in physical activity but not mothers. Further, the review found that improvements to the food environment through local or school policies were shown to be more successful than interventions posting nutritional information.

An essential contributor to the heterogeneity found in the success of built environment interventions and their likelihood of implementation may be the 'public acceptability'. As proposed by Sekhon and colleagues (75), *acceptability* is a "*multi-faceted construct that reflects the extent to which people delivering or receiving a healthcare intervention consider it to be*

appropriate, based on anticipated or experienced cognitive and emotional responses to the intervention."

Further, the multidimensional framework(76) suggested by Kitson and colleagues illustrated that a successful intervention is a function of the relation between the nature of the evidence, the context or environment into which the research is to be placed, and the method or way in which the process is facilitated. Similarly, Proctor and colleagues(77) denoted that the success of any intervention can be conceptualised as a function of three important determinants - effectiveness, acceptability, and sustainability of the intervention. If an intervention is considered acceptable, people are more likely to adhere to it and benefit from it. Conversely, behavior change is unlikely to occur if interventions unaccepted by the target population are implemented(78,79).

To date, few studies have investigated the acceptability of the intervention to deliverers alone (e.g., municipal officers, councillors, etc.)(80–82). However, knowledge of the prospective (anticipated) acceptability of the public (intervention receivers) is vital to avoid unnecessary resource depletion and aid in designing effective built environment interventions to guarantee the best outcomes achievable with available resources(75). In addition, several studies(83) so far have investigated how neighbourhood-built environment characteristics may affect health outcomes. For instance, Riva, Gauvin, and Barnett conducted a systemic review(84) that examined multi-level investigations of small area effects on health published since 1998. The authors concluded that part of the variation in health was significantly associated with area context independently of individual characteristics. However, evidence on how neighbourhood characteristics may influence individuals' perceptions on the implementation of built environment interventions is lacking.

Many interventions and policies to transform the built environment favorable for active and healthy living are still being developed and implemented. However, the available evidence is insufficient to identify which specific built environment intervention would have the most impact on physical activity and diet for which group of individuals or area of residence. Thus, providing evidence on what works, for whom, and under what contextual circumstance will prove valuable for policymakers and other researchers(85).

The purpose of this study, therefore, is to estimate the level of public acceptability of diverse built environment interventions varying in intrusiveness that support healthy eating and physical activity in urban neighbourhoods of Saskatoon and Regina and to identify individual and neighbourhood level factors associated with the level of acceptability of diverse interventions.

1.2 Rationale of the study

The present study used a subset of pan-Canadian data and focussed on two cities in the province of Saskatchewan, Saskatoon and Regina. A higher prevalence of obesity rates in the province of Saskatchewan demands action. As urban populations face an increased risk of unhealthy lifestyle due to the structure of the built environment that reduces mobility and increases the opportunity for unhealthy food habits, built environment interventions that may improve the population's diet and physical activity in the two cities are pertinent. Because intervention strategies are more likely to instigate behavior change when they are considered acceptable by the target population, the findings of this study may hold critical practical implications for policymakers and intervention planners. In addition, focusing on these two cities where there is much local knowledge of built environment changes will allow a deeper understanding of how the current state may have affected people's decision-making process and, thereby, the study findings.

1.3 Specific objectives of the study

1. Estimate the current level of acceptability of built environment interventions[1] varying in intrusiveness (i.e., as per intervention ladder) that support healthy eating and physical activity in urban neighbourhoods of Saskatoon and Regina.

2. Identify individual and neighbourhood-level characteristics that are associated with the acceptability of built environment interventions varying in intrusiveness that support healthy eating and physical activity

    a. Identify individual and neighbourhood-level characteristics that are associated with overall acceptability of built environment interventions that support healthy eating and physical activity

    b. Examine how the association varies for different levels of intervention intrusiveness

1.4 Research hypotheses

- Built environment interventions that are more intrusive will be viewed as less acceptable than less intrusive interventions

- Individuals living in areas that are more supportive of healthy eating and physical activity will view built environment interventions as more acceptable than individuals living in areas that are less supportive of healthy eating and physical activity

---

[1] The built environment interventions included in the study range from direct transformations to the physical environment (e.g., separate bike lanes) to policies that influence the physical environment, services, and products (e.g., tax on sugar beverages).

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

The current state of unhealthy living can be attributed, in part, to the shift in the food environment(86). Food environments provide easy access to low nutrient high energy-dense fast foods, processed foods, saturated fats, and sugar-sweetened beverages(87–89), and rapid urbanization and land use policies in urban areas which has resulted in increased dependence on motor vehicles(68) and decreased physical mobility(69). All these changes are shaped by the spatial structure of the built environment(71,90), which has led to equally marked shifts in energy imbalance(90). In an article published in 1998(91), Hill and Peters reported on the environmental influence on food intake and physical activity. Further, in their classical work(92), Egger and Swinburn demonstrated the ecological approach to the obesity pandemic where biological, behavioral, and environmental factors influence the equilibrium levels of body fat through the mediators – food intake and physical activity. To date, several studies have documented the diverse ways in which the built environment affects individuals' energy intake and expenditure. However, approaches to transform the built environment in favor of increased physical activity and healthy food habits have met with limited success(73). This is primarily due to the lack of agreement among the public, who are the key stakeholders of these interventions(75,93). So far, numerous studies have evaluated public support for various behavioral interventions, including smoking and alcohol use, and few studies have done so for built environment transformations to promote physical activity and a healthy diet. But, no studies have investigated both individual and neighbourhood-level predictors of acceptability of diverse built environment transformations.

2.2.1 Role of the built environment on diet

The built environment includes many factors that influence dietary habits, such as government and industry policies; accessibility to and type and location of supermarkets and restaurants; available food options, price, promotion, placement, nutrition information; and media and advertising(94). Several systemic reviews(52,95,96) have cited support for a significant association between these aspects of the built environment and individuals' diet.

Having healthy food available and affordable in food retail and foodservice settings allows people to make healthier food choices. A recent study(61) reported that the residents of neighbourhoods with limited access to affordable and nutritious food are more likely to be overweight. Similarly, a previous review(47) supported that communities with easy access to healthy foods tend to have a healthier diet. Furthermore, in a study conducted on the urban population, aspects of the neighbourhood food environment influenced fruit and vegetable intake(97). In that line, Zenk and colleagues found that the presence of a large grocery store within 0.5 mile was positively related to fruit and vegetable consumption(97).

Similarly, Rose and colleagues found that those with easy access to supermarkets had 84 grams of increased consumption of fruits(98). In addition, Moore and colleagues found that participants with no supermarkets near their homes were 25-46% less likely to have a healthy diet than those with the most stores(48). This association between proximity to supermarket/food stores and diet patterns has consistently been supported by many other studies(63,84,99,100), including a recent scoping review of reviews(101). Besides, Papas and colleagues found that the number of residents per fast-food restaurant and the number of square miles per fast-food restaurant were significantly associated with the prevalence of obesity. Further, lower area prices for fruits and vegetables and the presence of supermarkets were associated with a decrease in BMI (Body mass

index). In contrast, the presence of convenience stores was associated with a higher prevalence of obesity (62).

Furthermore, in their review(73), Mayne and colleagues showed that some policies and built environment interventions, such as banning or restricting unhealthy foods and altering purchase/payment rules for low-income food vouchers, can improve diet. In contrast, in their review(102), Faith and colleagues found strong evidence suggesting subsidization/ taxing influences food purchase but not necessarily food consumption. However, the review confirmed that easy access to food influences food purchases as well as food intake. In another systemic review conducted by Hasanthi and colleagues to assess the impact of new food store intervention on selected health outcomes, it was revealed that BMI and self-rated health did not show any significant improvement but perceptions of food access, neighbourhood satisfaction and psychological health improved. However, the authors concluded that longer follow-up is needed to provide stronger evidence.

In another systemic review(103), the authors of the study revealed that policies and practices that successfully reduce the size, availability, and appeal of larger-sized portions, packages, individual units, and tableware could control overeating. One study(104), for instance, found that customers at restaurants with menu labeling purchased food with 151 fewer kilocalories and decreased fat and sodium compared to customers at restaurants without labeling.

According to the latest scoping review of reviews conducted by Dixon and colleagues, investigating the association between the built environment and dietary intake, physical activity, and obesity, a significant association was found between greater access to supermarkets and higher diet quality and access to fast-food outlets and poor diet quality(105).

2.2.2 Role of the built environment on physical activity

A substantial number of studies has demonstrated the link between the characteristics of built environment and individual's physical activity level(47,54,57,58,60,74,85,90,101,106,107). Certain community designs have strong potential to contribute to increased physical activity. For instance, numerous systemic reviews(58–60,62,90,108–110) have shown strong evidence for an increased level of physical activity with enhanced access to places for physical activity; zoning; creation of walking and bicycle trails, play space, and sidewalk; increased neighbourhood walkability; availability of green space such as parks; enhanced aesthetic qualities of the area; provision of incentives to promote physical activity; and creation of physical activity and recreational facilities. In a recent scoping review of reviews conducted by Dixon and colleagues, a positive association was found between physical activity and walkability in 83% of the reviews, followed by access to recreational facilities in 70% of the reviews, nearby shops and services in 67% of the reviews, and parks and trails in 63% of reviews. The review also indicated that eight meta-analyses reported a significant association between built environment factors and physical activity(105).

Ball and colleagues, in their study(111), found that those who reported proximity to a park, beach, a cycle path, shops, or a more aesthetically pleasing environment were more likely to report walking – a finding endorsed by systemic reviews conducted by Sallis and Glanz(47), and Riva and colleagues(84). In addition, a recent systemic review conducted by Smith and colleagues(72) highlighted that providing adequate active transport infrastructure positively impacts physical activity in children and adults. Besides, in a study that investigated the dependence on cars in urban neighbourhoods of Canada(68), it was found that the odds of a person driving on at least one of

their trips during the day was 2.5 times higher for residents of low-density neighbourhoods than for residents of high-density neighbourhoods.

Handy and colleagues(106), in their overview of how the built environment affects physical activity, revealed that mixed-use development, street connectivity, and good design can reduce barriers and enhance walking and cycling. Similarly, a systemic review of reviews and meta-analysis conducted by Vet and colleagues showed that neighbourhood appearance, availability of exercise facilities, and general accessibility were positively related to physical activity. In contrast, the characteristics of neighbourhood residents, traffic safety, and personal safety were unrelated to physical activity(54). A natural experiment conducted by Veitch and colleagues proved that the intervention park that had improved features showed an increase in park users and the number of people observed walking and being vigorously active. In contrast, the control park showed a decreased usage(112).

Though studies on the built environment have produced inconsistent results, taken together, all reviews conclude that the built environment can significantly impact individual's health by promoting healthy lifestyle behaviours such as physical activity and a healthy diet.

2.3 Varied success and effectiveness of built environment interventions

Even though considerable evidence has shown that the built environment influences physical activity and diet, attempts to transform the built environment favorable to these behaviors have yielded mixed results. An intervention that was effective in one context has been ineffective in another. For example, one study that evaluated the impact of park renovation found an increase in park use and physical activity(113), while another study found a decline in park use after park improvements(74).

A systematic review of naturally occurring experiments that evaluated the impact of policy and built environment changes confirmed that certain types of interventions had more success than others in improving diet and physical activity outcomes. Furthermore, the researchers found that most studies that evaluated improvements to the food environment, either through local or school policies involving policy bans on certain types of food, showed significant improvements in purchasing or self-reported diet. In contrast, studies that simply required posting of nutritional information found little effect. In addition, physical activity-related studies found more substantial impacts when the intervention improved infrastructure(73). For example, one study indicated that the building of a multi-use trail did not demonstrate increased physical activity among adults living near the trail(114). At the same time, another similar intervention showed an increase in the level of physical activity post-implementation (115). Further, in their systemic review, Smith and colleagues demonstrated that infrastructure improvements may predominantly benefit socioeconomically advantaged groups (72). One American study(116) that investigated the impact of calorie labels in New York City chain restaurants on food purchasing found no change in the type of food purchased. In contrast, another study(117) conducted in northern New England and New York saw an increase in purchasing of foods and beverages of high nutritional quality after nutrition labelling intervention. Similar findings have been reported by Capacci and colleagues in their study that evaluated the effectiveness of policies to promote healthy eating in European countries. Nevertheless, the authors found heterogeneous effects and success across different regions(118).

2.4 Public acceptability

These study-to-study variations observed in the implementation and outcome of interventions can be partially accounted for by differences in "context"(119,120). Public acceptability is a key component of the context in which behaviour change may be attempted(121). It is also essential for the successful implementation of interventions and policies(79,124).

Acceptability of interventions has long been a focus for researchers. For instance, in 1984, Witt, Eliot, and Martens studied the teachers' acceptability of behavioural interventions used in classrooms. The authors believed that interventions found unacceptable by teachers would be used less frequently and thus not practical for use in the classroom even if the particular intervention is shown to be effective(123).

In a theoretical framework(75) proposed by Sekhon and colleagues to conceptualise acceptability from the perspectives of intervention deliverers and recipients, prospectively and retrospectively, *acceptabili*ty was defined as a "*multi-faceted construct that reflects the extent to which people delivering or receiving a healthcare intervention consider it to be appropriate, based on anticipated or experienced cognitive and emotional responses to the intervention*." Further, the proposed framework consisted of seven component constructs: affective attitude, burden, perceived effectiveness, ethicality, intervention coherence, opportunity costs, and self-efficacy. In addition, the authors indicated that 55% of studies included in their review measured acceptability objectively; using indicators such as dropout rates, all-cause discontinuation, the reason for discontinuation, and withdrawal rates, whereas 26% of the reviews assessed acceptability using self-report measures; which included responses to hypothetical scenarios, satisfaction measures, attitudinal measures, reports of individuals on their perceptions of, and experiences with, the

intervention, and opened-ended interview questions, and 19% using both objective and self-reported measures.

Most interventions are developed and implemented on the assumption that individuals act according to their rational self-interest. However, information about how individuals perceive various interventions as acceptable is important for policymakers to identify barriers to the successful and effective implementation of interventions. Acceptability of an intervention or policy can be assessed either prospectively or retrospectively and at different time points: pre-intervention delivery, during intervention delivery, and post-intervention delivery(75).

Most previous studies of acceptability have been confined to interventions and policies related to smoking and alcohol. According to a systemic review conducted by Diepeveen and colleagues regarding public attitudes towards policy interventions aimed at changing tobacco and alcohol use, diet, and physical activity, out of 200 studies included, only 39 looked at the acceptability of interventions aimed at physical activity and/or diet with no Canadian studies contributing to this domain(122). Further, part of the studies investigating the acceptability of built environment interventions focused solely on other stakeholders except for the public. For instance, one Canadian study examined the stakeholder perspectives on the development of walkable neighbourhoods in Edmonton. The study findings indicated that economic constraints and existing social norms, attitudes, and behaviours are common barriers to the development and embracement of healthier built environments. However, the study only included municipal employees, city councillors, and the private sector as stakeholders and did not investigate the public perspective(80).

Sekhon and colleagues(75) argue that acceptability is an important measure that should be assessed before developing and implementing any interventions. Only a few studies have done so.

An Australian study used concept mapping to evaluate community members, researchers, government, and non-government stakeholders' perceptions concerning the role of built environments in shaping heart health. The study indicated that stakeholders identified "Public Open Spaces," "Quality of Pedestrian Environments," and the "Public Transit and Traffic" as being among the most important and changeable determinants of Cardiometabolic risk. However, community members perceived "Street Connectivity" and the "Quality of Pedestrian Environments" as less important than other stakeholder groups. The authors concluded that this difference in perspective reflected potential stakeholder disparities in their respective beliefs(82).

One Canadian qualitative study found a notable distinction between high- and low-SES students in their perceptions of environmental factors of physical activity. The study reported that high-SES students preferred physical activity programs to be within the community, although having an accessible facility in close proximity did not appear to be a critical factor for their involvement. In contrast, students from the low-SES schools emphasized that the program must be close to where they live for them to be able to attend. Further, low SES students reported that if the cost were too high, they would not be able to participate in any physical activity programs. In addition, low SES youth considered high-quality equipment and well-maintained parks and facilities as fundamental for their participation(124).

Other studies that evaluated the acceptability of built environment intervention have focused on absolute acceptability. For example, a recent Canadian study(81) investigated the non-profit organisations, policymakers, government practitioners and professionals, private businesses, and the public perspective on the factors that influence the success and failure of the Biketoria cycling network in Victoria, Public Bike Share System in Vancouver, Rapid Bus Transit in Saskatoon and built environment interventions in Montreal using concept mapping. The study

showed that the importance of stakeholder engagement was a common theme that emerged in all four cities. At the same time, concerns for citizen safety were prominent in Victoria, Vancouver, and Saskatoon, and reliability of service and ease of use emerged in Saskatoon and Vancouver.

Furthermore, several studies have investigated the relationship between an individual's party preference and the acceptability of interventions and policy. For example, a study that tested whether US citizens and practising policymakers exhibit partisan bias found that citizens and policymakers may reject or accept behavioural policy interventions merely because they dislike or like the policies with which these strategies happen to be associated(125).

2.5 Intrusiveness of intervention and public acceptability

Population-based interventions and policy can be classified as a function of the intervention ladder proposed by the Nuffield Council on Bioethics(126). The proposed intervention ladder conceptualises interventions along an 8-rung continuum from least intrusive to more intrusive strategies, namely, 1) doing nothing or simply monitoring the situation, 2) providing information to inform and educate public, 3) enabling choice to change their behaviour, 4) guiding choices through changing the default policy, 5) guiding choices through incentives by providing fiscal and other incentives, 6) guiding choices through disincentives by imposing fiscal and other disincentives to influence people not to pursue certain activities, 7) restricting choice through regulations that limit choices available, and 8) entirely eliminating choice through regulations(Figure 2.1). Further, it was highlighted that stronger justifications should be made when the policymakers intervene at the higher rung of the ladder (most intrusive) for the intervention to be publicly acceptable and produce the desired effect.
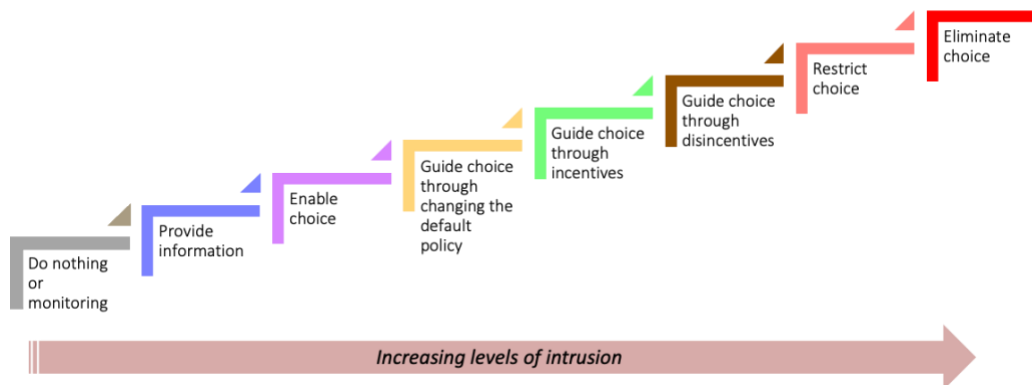
Figure 2.1 Ladder of intervention *(Nuffield Council on Bioethics, 2007)*[2]

Interventions and policies that target behavioral modification generally range from providing information to more stringent regulations to limit/restrict behaviors(127). Evidence suggests that individuals are more likely to oppose interventions and policies if they feel their behavior is being steered or their freedom of choice is being restricted(128). However, traditional approaches to change behaviors, such as providing information and mass media campaign, have shown little or no effect(129). Consequently, policymakers have made efforts to introduce more stringent interventions.

Research concerning built environment interventions has generally found that public support tends to be highest for the least intrusive strategies, such as health promotion campaigns, and lowest for intrusive, restrictive policies, such as bans on advertising or selling unhealthy products or taxation of unhealthy products(78,122,130). For instance, a German study(130) showed that almost 90% of the public supported obesity prevention focusing on behavioural

---

[2] In the subsequent sections, the level of intervention is numbered starting from the item 'providing information', as there were no items included in the study under the first level 'doing nothing'. For convenience, 'doing nothing' is excluded from the ladder in the data representations in the subsequent sections.

change in children, 82% supported providing information in adults, and only 42% supported regulations. Similarly, in their systemic review, Diepeveen and colleagues found that public acceptability was generally higher for interventions perceived as less intrusive (e.g., nutrition labels, education campaigns) as opposed to policies introducing disincentives and tax. Conversely, respondents also supported more intrusive measures if they were aimed at commercial businesses than at individuals themselves(122). Similar findings have been reported by Branson and colleagues(131).

Notably, Stok and colleagues assessed adolescents' acceptability of eating-related interventions. The authors explored which individual and behavioral characteristics were associated with acceptability. The participants for the study were recruited from four European countries, and the interventions included varied in type, level of intrusiveness, setting, and change agent. The study found that acceptability was higher for interventions that promote healthy eating than those discouraging unhealthy eating. Further, acceptability was higher among younger adolescents, girls, overweight or obese adolescents, immigrant adolescents, and those with healthier average daily food intake. The findings also highlighted that the level of intrusiveness of intervention affected acceptability. However, it was emphasised that the type of strategy was more influential for acceptability when two strategies of the same intrusiveness were examined(132).

Further, several attempts to induce behavioral change have also been made using the 'nudging' approach in recent times. Thaler and Sustein(133) define nudging as "subtle alteration to people's behavior without forbidding any options or significantly changing their economic incentives". Reisch and Sustein, in their study to investigate public attitude towards nudging in six European countries, found that Europeans are more likely to support nudges that fit with their interests and values, regardless of their intuition about the intrusiveness of the intervention.

Further, they also found that acceptability varied between the countries and individual's party affiliation (134). Later, the authors conducted another similar study in a broad sample of eight countries, including Australia, Brazil, Canada, China, Japan, Russia, South Africa, and South Korea, and found that overall approval of the presented nudges was high in survey countries. Further, the authors identified industrialized western democratic countries, including Canada, as "principled pro-nudge nations" where the majority are more likely to approve of nudges if they have legitimate ends and are consistent with their interests and values. According to the study findings, in Canada, majority support was observed for less intrusive interventions such as governmental information campaigns (93%) and mandatory information imposed by the government (90% for calorie labels; 88% for high levels of salt) compared to more intrusive interventions such as mandatory default rules imposed by the government (79% for healthy food placement) and mandatory choice architecture (62% for sweet free cashier zone; 51% for meat-free day). It is worth noting that variability in acceptability existed within the same level of intervention depending on the type of intervention(135). In a similar study that tested the attitudes of two distinct minority groups in Israel, it was found that minorities showed less support towards nudging that did not align with their norms(136).

Besides, Adams and colleagues highlighted that "nudge" intervention such as reducing the salt content of bread manufactured by the food industry or changing the placement of healthier options in a buffet that require little or no individual resources or motivation to benefit is more effective than intervention such as the provision of information leaflet that requires individual's decision and motivation to gain benefit (137).

2.6 Summary

In summary, the existing literature shows that:

- The built environment affects individuals' food habits and physical activity in diverse ways.

- Built environment interventions and policies can result in an improved diet and physical activity among the public.

- However, variability in the success of interventions exists and can be partly attributable to the 'public acceptability'.

- Previous studies on acceptability have mostly been confined to other behavioural interventions and policies related to behaviours other than healthy eating and physical activity (e.g., smoking and alcohol), intervention deliverers, and acceptability of intervention following implementation.

- The public tends to support interventions that are less intrusive of their freedom of choice. However, this view is not generalizable to all interventions of a similar level of intrusion.

- Although a few studies examined the association of sociodemographic factors (e.g., age, sex) with acceptability, more evidence is needed about individual characteristics and their association to the acceptability of active living and food-related built environment interventions.

- The existing literature does not provide evidence on how the neighbourhood attributes are associated with individuals' perceptions, in addition to their individual attributes.

Based on the existing evidence reviewed, there is considerable scope for research concerning the public acceptability of built environment interventions, as it can provide valuable

insights into the very possibility or likely success of the interventions. Further, it has become apparent that attitudes towards different interventions may differ significantly between distinct sociodemographic groups. Additionally, attitudes towards the same intervention may also vary considerably between distinct societal groups within and between different residential neighbourhoods. However, this potential heterogeneity in public acceptability has been largely overlooked(134). Therefore, the current study aimed to determine the level of public acceptability of a range of built environment interventions varying in intrusiveness that support a healthy diet and physical activity and identify individual and neighbourhood level factors associated with the level of acceptability.

2.7 Conceptual Model

Figure 2.2 shows a conceptual model proposed by Gifford and colleagues illustrating the transactions between individuals and their built and natural environments (138). According to this model, residents' personal factors and physical aspects of the area of residence, such as the structure of the built environment, influence each other. These factors, in turn, influence individuals' cognitive function that determines their behavior. These behaviors may be pro - social, anti - social, or neither and include everyday behaviors in urban communities such as parks and stores. These individual behaviors are considered as the urban-planners design neighbourhoods and propose new amenities. The design process influences the physical space – the built environment and the cycle continues. Thus, the model suggests that the aspects of the physical environment drive individuals' thinking and behaviors. Therefore, in addition to their individual factors, the public's support for built environment interventions may be influenced by the existing structure or nature of their neighbourhood-built environment.
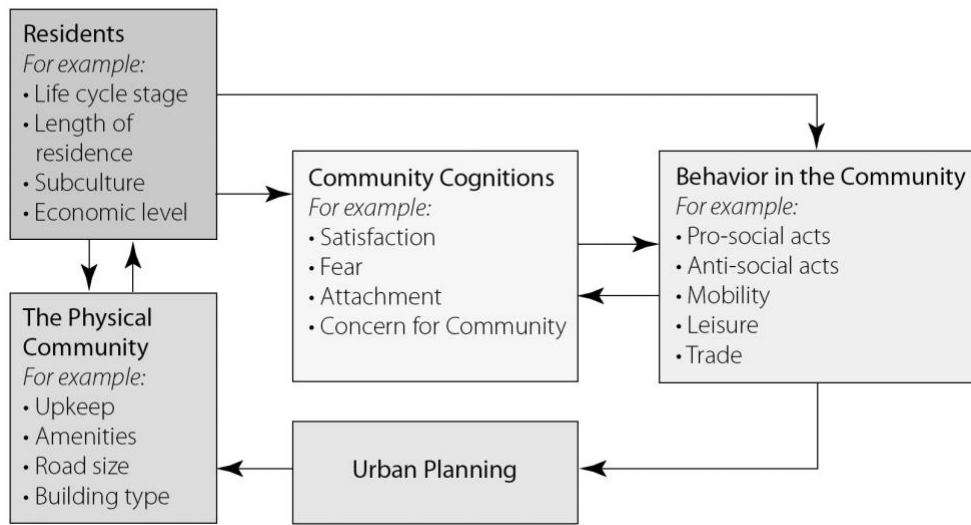
Figure 2.2 A conceptual model showing the person-environment relationship (*adapted from Gifford et al., 2011*)

CHAPTER 3
METHODOLOGY

3.1 Research setting

The present study is a secondary data analysis of a larger survey data set funded by the CIHR (The Canadian Institutes of Health Research) titled: "THEPA" - Targeting Healthy Eating & Physical Activity: Citizens' perspectives (Principal investigators: Dr. Lise Gauvin and Dr. Nazeem Muhajarine, CIHR Grant # PJT-148919). The THEPA study aimed to provide knowledge on populations' perspectives concerning built environment (BE) transformations while providing a platform for knowledge advancement and implementation considerations. In the present study, a subset of the pan-Canadian data from THEPA was linked to respondents' respective neighborhood-level characteristics using data from the Canadian Urban Environmental Health Research Consortium (CANUE)(139).

3.2 Study design and recruitment

THEPA is a large-scale cross-sectional survey that collected data on the acceptability of BE interventions aimed to improve physical activity and healthy diet in 17 Canadian census metropolitan (CMA) areas. Data were collected from 27,162 urban-dwelling adults (aged 18 years and above) who lived in one of Canadas's 17 largest census metropolitan areas (CMA). The present study utilized a subset of the data from two large CMAs in the province of Saskatchewan: Regina (n=1068) and Saskatoon (1065), with a total sample of N=2133 respondents. The data collection for this study was conducted between October 6, 2020, and December 23, 2020. The survey participants were recruited primarily online, but a smaller proportion was recruited via telephone

survey. For the online survey, the data were collected from a random sample of respondents who had previously accepted to participate in online surveys through national and international survey firms. Additionally, two random samples of telephone numbers were deployed for the telephone survey: one for landline telephones based on information available from Canada telephone interchange data and another for cellular telephone numbers based on valid numbers listed according to area code. Once a respondent was reached, they were given the option to respond verbally or online. Informed consent was obtained from respondents either verbally or online. Ethics approval for the main study (THEPA) was obtained from the *Comité d'éthique à la recherche du Centre Hospitalier de l'Université de Montréal* (CÉR #19.258) and secondary analysis was approved by the University of Saskatchewan Behavioural Ethics Board (ID #122).

3.3 Survey instrument

Data were collected using a structured survey questionnaire developed by the THEPA research team. Initially, the THEPA team identified 140 BE interventions from the existing literature and classified them according to Nuffield's intervention ladder. Then, using a cross-national Delphi procedure, BE interventions that were of particular interest to policymakers and researchers and that reflected the entire continuum of intrusiveness were selected. Finally, a total of 45 BE items dealing with the food environment (n=12), active living (n=26), and Covid (n=7) were included in the survey questionnaire. The present study focused on BE interventions aimed at promoting a healthy diet and physical activity among the public.

The survey questionnaire contained sections on i) residential information, ii) acceptability of food environment transformations, iii) current walking, cycling, gardening, and park visitation behaviours, iv) acceptability of active living environment and COVID accommodations

transformations, v) occupational physical activity, leisure-time physical activity, frequency of eating outside the home, smoking history, and sleep habits, vi) neighbourhood social cohesion, trust, and belongingness, vii) open-ended question about neighbourhood improvement, and viii) sociodemographic and health questions. The residential information section obtained data on 6-digit or 3-digit residential postal codes. (See Appendix A)

3.4.1 Outcome variables

The outcomes assessed in this study were agreement to implement BE interventions aimed at promoting 1) healthy diet and 2) physical activity. Outcome variables were measured using 12 and 26 items, respectively. Tables 3.1 and 3.2 describe BE items related to food environment and physical activity included in the survey questionnaire.

The survey questionnaire presented these BE items (as survey questions) in random order of intrusiveness. The respondents were asked to indicate the extent to which they would agree with the implementation of a host of built environment interventions if they were implemented in the area where they lived. Respondents were asked: "*In the next set of questions, we ask about services, regulations, and policies that are available in your residential neighbourhood. For these questions, your residential neighbourhood is the area which is within 15-minute walking distance of where you live. This is often 8 to 10 city blocks*". Then, for each item, they were asked: "*To what extent would you agree with the implementation of each of the following measures in the area where you live?*". Responses were recorded on a 4-point scale: completely agree, somewhat agree, somewhat disagree, and completely disagree. For all questions, respondents were also given the option to select "I don't know/I prefer not to respond".

Table 3.1 The 12 BE items related to food environment as included in the survey[3]

---

1. Hold newspaper, radio, social media campaigns to promote healthy eating

2. Modify zoning laws to allow creation of new stores selling healthy foods

3. Offer more urban spaces for community garden and urban agriculture

4. Change the usual side dish in restaurants for a healthier option like salad instead of fries

5. Create public markets or farmers markets

6. Support local and sustainable food production by creating gardens on the roofs of buildings

7. Impose municipal regulations to limit fast food outlets around schools

8. Eliminate the offer of chips, candy and other unhealthy foods in restaurants, cafeterias, and vending machines in municipal buildings like arenas and recreation centres

9. Provide money to purchase healthy foods like fruits and vegetables

10 Impose a tax on sugar-sweetened beverages

11 Organize activities demonstrating how to start a vegetable garden.

12 Limit the size of sugar-sweetened beverages sold in municipal buildings like arenas and recreation centres.

---

[3] The items presented in table 3.1 and 3.2 were sourced from a literature review of BE interventions and then reduced through a Delphi process of consultations (2-rounds) of stakeholders and experts by the THEPA team.

Table 3.2 The 26 BE items related to active living as included in the survey

1. Educate motor vehicle drivers on proper road sharing behaviours

2. Broadcast public information messages on active transportation

3. Improve access to public transportation

4. Improve greenness by planting trees and flowers

5. Develop safer street intersections by increasing the number of curb extensions

6. Build protected bicycle infrastructure like separated bike lanes

7. Reduce automobile speed limits to maximum 30 km/hr. in the vicinity of schools

8. Implement a speed limit of 40 km/hr. throughout the city

9. Improve public transit infrastructure

10 Increase the number of reserved bus lanes

11 Develop new parks

12 Add road tolls to enter the downtown area

13 Increase police surveillance and enforcement to have motor vehicle drivers obey traffic laws

14 Increase the cost of fines for infractions to traffic laws by motor vehicle drivers

15 Increase police surveillance and enforcement to have bicyclists obey traffic laws

16 Increase the cost of fines for infractions to traffic laws by bicyclists

17 Implement traffic calming measures like making streets narrower and adding speed bumps

18 Close off entire street segments to motor vehicles

19 Improve play infrastructures and rest areas in parks

20 Increase the number of priority traffic lights for buses

21 Ban motor vehicles from circulating in front of schools when students are entering or leaving the school

22 Ban heavy vehicles from urban centers overnight

23 Redistribute road space to make more room for pedestrians and cyclists (shared streets)

24 Improve accessibility to parks and green space by reducing cost of parking

25 Improve accessibility to parks and green space by reducing cost of public transport to these destinations

26 Develop safer street intersections by increasing crossing time

3.4.2 Independent variables

The independent variables in this study were grouped into two levels: individual and neighbourhood-level factors. The variables were identified and selected from literature and based on common knowledge.

    Individual-level factors: The individual-level factors were obtained from the THEPA data and included the following: Respondent's age (18-34 years, 35-64 years and above 65 years), self-identified sex (man, woman and diverse[4]), country of birth (born in Canada vs. born outside Canada), Indigenous status (Indigenous vs. non-Indigenous), current employment status (employed, unemployed, student, retired, and other[5]), level of education (high school or less, trade school/college, and university), annual household income (less than $20k, $20k-$39k, $40k-$59k, $60-$79k, and $80k or more), perceived health (excellent, very good, good, fair, and poor), home tenure (less than 1 year, 1-5 years, 6-10 years, and more than 10 years) and home type (house, duplex, townhouse/apartment/condo, student housing, and senior housing).

    Neighbourhood-level factors: The variables pertaining to respondents' neighbourhoods were obtained from the CANUE data and represented respondents' corresponding neighbourhood attributes for 2006, 2016, and 2019. These data which are available at the dissemination area (DA) level were linked using the Forward Sortation Area (FSA) of respondents (i.e., the first 3-digits of the postal code). DAs are small geographic units defined by Statistics Canada, with a population of between 400 to 700 persons(140). This is (DA) the smallest geographic unit for which complete census data is released across Canada. On average, each DA consists of about 15 3-digit postal codes. The FSA of the respondent from the survey was linked to their residential dissemination

---

[4] Includes those who did not self-identify as either man or woman
[5] Includes those who reported caring for kids/others, housework, mat-pat leave, long-term illness, and volunteers

area data and in turn to their corresponding DA-level attributes. Therefore, the variables studied correspond to the respondent's respective DA. Consequently, a group of FSAs makes up a DA, and the aggregation of DAs represents a "neighbourhood" (hereafter referred to as neighbourhoods).

The neighbourhood factors considered were: 1) favourability of active living environment (ALE) which is a categorical variable characterizing the favourability of the ALE on a scale from 1 (very low) to 5 (very high) based on four indicators such as intersection density, dwelling density, points of interest and transit stops. This variable is part of the Canadian Active Living Environments (Can-ALE) database (141). 2) Green roads count – is a categorical variable (zero points, 1-5 points, and more than 6 points) indicating the number of points (each representing a 30m LandSat8 pixel) with NDVI > 0.3 within a buffer of 1000m of link postal codes(142). 3) Urban sprawl – is a categorical variable (more sprawl, less sprawl, and least sprawl) based on indicators of urban form such as density (population density, gross employment density); centering; land use mix; and street accessibility(143). All these above variables were obtained from the 2016 CANUE database. Variables such as quintiles of 4) residential instability, 5) dependency, 6) ethnic concentration, and 7) material deprivation were classified from 1 = least to 5 = most unstable/dependent/ethnically concentrated/deprived areas. These four variables indicate four dimensions of the Canadian Marginalization Index (CAN-Marg)(144). The above variables were obtained from 2006 data. Variables such as the presence of at least one 8) grocery store, 9) park, 10) transit stop (yes vs. no) indicates whether at least one grocery store/park/transit stop exists within walking distance of 1 km(145). 11) Amenity density - indicates whether a dissemination block is an amenity dense neighbourhood, a high amenity density neighbourhood, or a non-amenity dense neighbourhood. The Data on these variables were obtained from 2019 data base.

3.5 Data Analysis

Data management and all statistical analyses were performed using Stata statistical software package version 17.0 (StataCorp LP, College Station, TX, USA). An appropriate weight using the 2016 Canadian Census data adjusted for age, sex, and level of education for each CMA was applied to ensure the findings are generalizable to the target population, which is the urban population in Saskatchewan. For the descriptive analysis, first, the sample distribution of sociodemographic characteristics was examined using frequencies and proportions for the two CMAs - Regina and Saskatoon, and Pearson's chi-square test was used to determine whether respondents from Regina differed from those from Saskatoon. Further, the distribution of the study sample was compared to the study population using data from 2016 Canadian census data(146). The statistical significance for all analyses was set at P-value <0.05.

3.5.1 Estimate the current level of acceptability of BE interventions varying in intrusiveness that support a healthy diet and physical activity in Saskatoon and Regina.

First, the current level of acceptability for 12 items related to the food environment and 26 items related to physical activity was estimated using the categorical outcome variables (measured on 4-point scale). The results were reported with percentages and 95% confidence intervals (CI).

Then, using the categorical outcome variables, a separate summary index for the food and physical activity domain and each intervention level was created. The responses were scored (0 to 3), and an index was created using the total possible lowest and highest scores for each level of intervention and each domain. Then, using the cut-off set at the lower 2/3rd tercile, the outcome

was categorized as 'no-low agreement' and the upper $1/3^{rd}$ tercile as 'moderate-high agreement'. Then overall prevalence of acceptability for food and physical activity domain and acceptability by the level of intervention was computed. As the sample was drawn from two CMAs, Saskatoon and Regina, any differences in the prevalence of acceptability across the two CMAs were tested using Pearson's chi-square test. As there were no significant differences in acceptability in the two regions, the Regina and Saskatoon samples were combined for subsequent analyses.

3.5.2 Identify individual and neighbourhood-level factors associated with the overall acceptability of BE interventions that support a healthy diet and physical activity.

The Pearson's chi-square test was used to test the degree of crude association for individual and neighbourhood-level factors and compare the proportions of respondents in each group. The dichotomous summary variable created for interventions related to food environment and physical activity indicating agreement was used as the outcome, and percentages with 95% CI were reported.

Then, the model-building technique was used to measure individual and neighbourhood-level factors' association with acceptability. The observations in data are not independent of each other as responses from individuals from the same neighbourhood are more likely to be related. Due to this nature of the data, where respondents are nested within neighbourhoods, multi-level regression analysis was conducted. For this, level 1 was identified as individuals and level 2 was the neighbourhoods represented by FSA[6]. Observations in the study were found to be distributed within 27 FSAs in Saskatoon and Regina.

---

[6] Details of FSA in data for Saskatoon and Regina are given in Appendix B

Further, the data contained missing observations (36% of the total data) for respondents' neighbourhood factors as their postal code information was unavailable. Data were assumed to be missing at random (MAR) and were imputed using multiple imputation by chained equations method. Ten imputed data sets were generated for analysis and were then analyzed using multilevel logistic regression to produce combined estimate regression parameters.

Three models were fitted for the binary outcome variable for food and physical activity separately. Variables with P-value <0.20 from bivariable multi-level logistic regression analyses were selected to fit the individual, neighbourhood, and final model with both individual and neighbourhood-level variables. Adjusted odds ratios and 95% CI were reported.

3.5.3 Examine how the association between individual and neighbourhood characteristics and acceptability of BE transformations vary as a function of different levels of intervention intrusiveness

The effect of individual and neighbourhood-level factors on acceptability across different levels of intervention (as per Nuffield's intervention ladder) was evaluated by fitting the ultimate model (final model with both induvial and neighbourhood-level variables) with the summary variable for each level of intervention as the outcome. Adjusted odds ratios and 95%CI for multi-level logistic regression models were reported.

CHAPTER 4
RESULTS

4.1 Characteristics of the study sample

Table 4.1 shows the distribution of sociodemographic characteristics between study participants from Saskatoon and Regina, contrasting the distribution of the study population of the two cities. The two cities did not show any significant difference (Chi-square P<0.05) in the distribution of the key sociodemographic factors. About one-half of the study population self-identified as female, belonged to the age group 35-64 years, and were employed. Less than that population (45%) had a high school education or less, and about one-fourth had a university education. Eighty one percent of study participants were born in Canada, and 89% self-declared as non-indigenous. About one-third of the respondents reported an annual household income of $80,000 or more.

Comparison to the 2016 census population distribution shows that the sample was well represented in terms of age, sex, and level of education. However, immigrants and the Indigenous population were slightly over and underrepresented, respectively. In terms of individuals' annual household income, middle-income groups (40-79k) were represented well, but the sample was less representative of the low and high-income groups.

Table 4.1 Sociodemographic characteristics of the study sample (weighted proportions): Distribution by region and comparison with population distribution using 2016 Canadian census data

Variable	Frequency (%)					
	Saskatoon			**Regina**		
	Sample distribution	*Missing*	Population distribution	Sample distribution	*Missing*	Population distribution
Gender		4 (0.34)			9 (0.85)	
Men	574 (**48.54**)		90620 (**48.29**)	460 (**48.43**)		79345 (**48.60**)
Women	601 (**50.89**)		97030 (**51.70**)	480 (**50.54**)		83905 (**51.39**)
Other	3 (**0.23**)		-	2 (**0.18**)		-
Age		17 (1.52)			32 (3)	
18-34 years	403 (**34.12**)		61435 (**32.73**)	299 (**31.53**)		50390 (**30.86**)
35-64 years	568 (**48.11**)		92865 (**49.48**)	462 (**48.64**)		83120 (**50.9**)
Above 65 years	192 (**16.25**)		33355 (**17.77**)	160 (**16.83**)		29750 (**18.22**)
Country of birth		66 (4.84)			76 (7.18)	
Canada	966 (**82.38**)		168330 (**89.70**)	750 (**79.57**)		146280 (**89.59**)
Outside Canada	150 (**12.78**)		19325 (**10.29**)	125 (**13.25**)		16980 (**10.40**)
Indigenous status		18 (1.6)			19 (2.49)	
No	1068 (**90.1**)		214105 (**88.68**)	842 (**88.34**)		190855 (**90.11**)
Yes	98 (**8.29**)		27315 (**11.31**)	88 (**9.16**)		20925 (**9.88**)
Current employment status		14 (1.65)	-		16 (1.97)	-
Employed	598 (**50.38**)			487 (**51.01**)		
Unemployed	83 (**7.02**)			66 (**6.89**)		
Student	109 (**9.17**)			58 (**6.01**)		
Retired	228 (**19.22**)			184 (**19.31**)		

Other	149 (**12.56**)		141 (**14.72**)	
Educational attainment		9 (0.85)		12 (1.12)
High school or less	517 (**43.76**)	85870 (**43.53**)	440 (**46.32**)	81065 (**47.07**)
Trade school/college	351 (**29.68**)	56725 (**28.76**)	267 (**28.11**)	47520 (**27.59**)
University	304 (**25.71**)	54630 (**27.69**)	232 (**24.45**)	43610 (**25.32**)
Annual household income		165(14.09)		137(12.81)
Less than 20k	123 (**10.44**)	48785 (**25.72**)	77 (**8.13**)	38750 (**23.39**)
20k to 39k	177 (**15.1**)	46645 (**24.59**)	140 (**14.86**)	38810 (**23.43**)
40k to 59k	217 (**18.46**)	37545 (**19.79**)	163 (**17.21**)	34225 (**20.66**)
60k to 79k	127 (**10.84**)	22690 (**11.64**)	110 (**11.69**)	21690 (**13.09**)
80k or more	364 (**31.05**)	33980 (**17.91**)	333 (**35.31**)	32130 (**19.40**)

Sample distribution estimates are weighted in terms of age, sex, and education level (using 2016 Canadian census data)

4.2.1 Prevalence of different levels of acceptability of 12 BE interventions aimed at promoting a healthy diet

Table 4.2 presents the percentage of respondents who completely agreed, completely disagreed, somewhat agreed, or somewhat disagreed on implementing each BE intervention to improve a healthy diet in their area of residence. The highest support (53.26%, 95%CI: 50.44-56.05) was shown for intervention focused on creating a public farmer market, while the lowest was for intervention that impose a tax on sugar-sweetened beverages (18.74%, 95%CI: 16.63-21.05) and eliminate junk foods in restaurants, cafes, and vending machines, and so on. (18.73%, 95%CI: 16.56-21.12). Figure 4.1 illustrates the BE items related to the food environment classified as per the intervention ladder in their ascending order of intrusiveness.
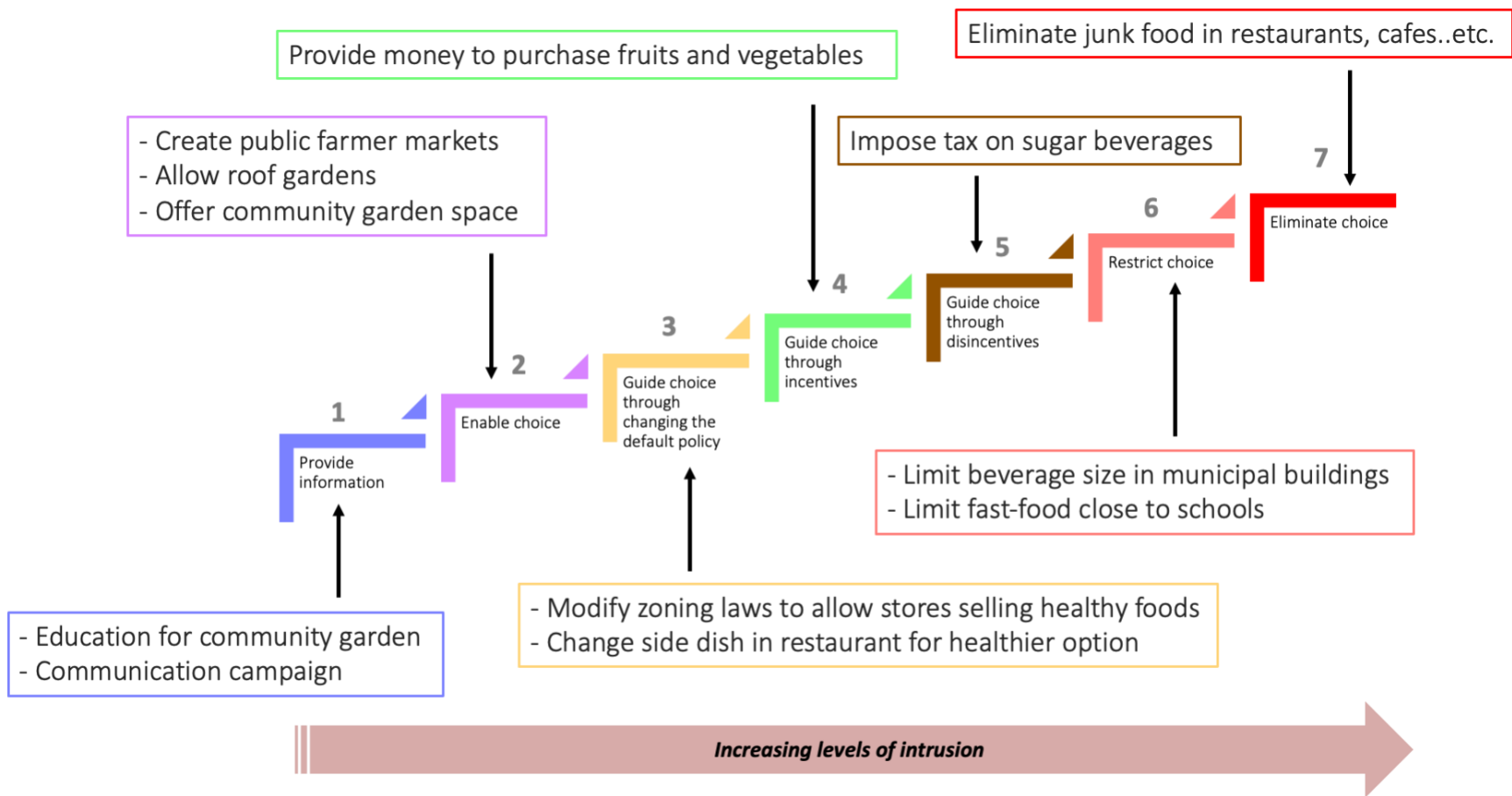
Figure 4.1 The 12 BE items related to food arranged according to increasing order of intrusiveness as per Nuffield's intervention ladder[7]

---

[7] The level of intervention is numbered starting from 'providing information', as there were no items included in the survey under the first level, 'doing nothing'. For convenience, 'doing nothing' is excluded from the ladder in the data representations in the subsequent sections.

Table 4.2 Overview of the proportions of the population expressing different levels of acceptability of the 12 BE interventions related to the food environment

		Percentage [95% CI]			
	BE Interventions	Completely disagree	Somewhat disagree	Somewhat agree	**Completely agree**
1	Communication campaign	5.18 [3.99-6.70]	14.64 [12.64-16.89]	47.86 [45.02-50.72]	**32.31 [29.69-35.06]**
2	Education for community garden	3.91 [3.00-5.10]	10.75 [9.02-12.76]	44.37 [41.57-47.21]	**40.96 [38.2-43.79]**
3	Offer community garden space	3.68 [2.78-4.86]	9.23 [7.59-11.18]	40.27 [37.57-43.03]	**46.82 [44.02-49.64]**
4	Create public farmer markets	3.67 [2.69-4.99]	6.56 [5.21-8.23]	36.51 [33.86-39.25]	**53.26 [50.44-56.05]**
5	Create roof gardens	6.63 [5.40-8.11]	11.73 [9.97-13.75]	39.79 [37.06-42.59]	**41.84 [39.04-44.69]**
6	Change side dish in restaurant for healthier option	12.07 [10.21-14.21]	22.98 [20.62-25.53]	38.74 [36.05-41.5]	**26.21 [23.76-28.81]**

7	Create zoning laws to allow stores selling healthy foods	6.61 [5.26-8.28]	16.32 [14.3-18.56]	46.7 [43.81-49.61]	**30.37** **[27.74-33.13]**
8	Provide money to purchase fruits and vegetables	10.7 [9.07-12.58]	13.3 [11.56-15.26]	37.02 [34.29-39.84]	**38.97** **[36.17-41.85]**
9	Impose tax on sugar beverages	31.19 [28.48-34.04]	23.48 [21.27-25.84]	26.59 [24.18-29.14]	**18.74** **[16.63-21.05]**
10	Limit fast-food close to schools	15.08 [13.02-17.39]	23.57 [21.25-26.05]	37.47 [34.78-40.25]	**23.88** **[21.51-26.44]**
11	Limit beverage size in municipal buildings	15.66 [13.59-17.99]	20.91 [18.75-23.26]	36.1 [33.46-38.83]	**27.32** **[24.84-29.96]**
12	Eliminate junk food in restaurants, cafes, vending machines etc.	22.34 [19.9-24.99]	29.74 [27.28-32.34]	29.18 [26.74-31.75]	**18.73** **[16.56-21.12]**

Weighted results
BE items are arranged according to their increasing order (ascendant) of intrusiveness

4.2.2 Prevalence of different levels of acceptability of 26 BE interventions aimed at promoting physical activity

Table 4.3 presents the percentage of respondents who completely agreed, completely disagreed, somewhat agreed, or somewhat disagreed on implementing each BE interventions aimed to promote physical activity in their area of residence. Respondents showed the highest support (55.18%, 95%CI: 52.35-57.96) for intervention that aimed to improve greenness by planting more trees and flowers, while the lowest support was seen for adding road tolls to enter the downtown area (8.31%, 95%CI: 6.62-10.38). Figure 4.2 illustrates the BE items related to physical activity classified as per the intervention ladder in their ascending order of intrusiveness.

- Improve access to public transport
- Improve greenness by trees and flowers
- Create safer street intersection by increasing curb extensions
- Improve public transit infrastructure
- Increase reserved bus lanes
- New parks

- Close entire streets to motor vehicles
- Ban motor vehicles in front of schools when kids are entering or exiting
- Ban heavy vehicles from urban area overnight

Redistribute road areas towards pedestrians and cyclists (shared streets)

- Improve play infrastructures and rest areas in parks
- Increase priority traffic lights for buses
- Increase Park accessibility by reducing parking cost
- Increase Park accessibility by reducing public transit cost

7

Eliminate choice

6

Restrict choice

5

Guide choice through disincentives

4

Guide choice through incentives

3

Guide choice through changing the default policy

2

Enable choice

1

Provide information

- Add road tolls to enter downtown
- Police surveillance of drivers and enforcement of traffic code
- Increased fines for motor vehicle drivers
- Police surveillance of cyclists and enforcement of traffic code
- Increased fines for cyclists
- Traffic calming like narrow streets and speedbumps

- Build separated bike lanes
- Limit speed at 30km/hr around schools
- Limit speed at 40km/hr in the entire city
- Reconfigure intersections by increasing crossing time

- Education for road sharing behaviours
- Broadcast public information messages on active transportation

Increasing levels of intrusion

Figure 4.2 The 26 BE items related to physical activity arranged according to increasing order of intrusiveness as per Nuffield's intervention ladder[8].

[8] The level of intervention is numbered starting from 'providing information', as there were no items included in the survey under the first level, 'doing nothing'. For convenience, 'doing nothing' is excluded from the ladder in the data representations in the subsequent sections.

Table 4.3 Overview of the proportions of the population expressing different levels of acceptability of the 12 BE interventions related to physical activity

	BE transformation	Percentage [95% CI]			
		Completely disagree	Somewhat disagree	Somewhat agree	**Completely agree**
1	Education for road-sharing behaviours	2.62 [1.91-3.58]	9.03 [7.48-10.87]	40.34 [37.57-43.18]	**47.99 [45.17-50.84]**
2	Promote active transport by info messages	7.17 [5.58-9.16]	15.57 [13.5-17.89]	44.94 [42.05-47.87]	**32.32 [29.55-35.21]**
3	Improve access to public transport	4.22 [3.23-5.51]	11.89 [10.11-13.93]	42.86 [40.05-45.71]	**41.03 [38.17-43.95]**
4	Improve greenness by trees and flowers	2.27 [1.42-3.62]	6.66 [5.25-8.43]	35.88 [33.27-38.58]	**55.18 [52.35-57.96]**
5	Create safer street intersection by increasing curb extensions	12.49 [10.54-14.75]	20.7 [18.41-23.21]	41.59 [38.69-44.56]	**25.21 [22.57-28.04]**
6	Improve public transit infrastructure	5.08 [3.86-6.65]	12.85 [11.05-14.88]	43.35 [40.51-46.23]	**38.71 [35.86-41.66]**
7	Increase reserved bus lanes	15.9 [13.95-18.08]	29.39 [26.86-32.05]	37.24 [34.37-40.21]	**17.47 [15.09-20.14]**
8	New parks	4.63 [3.65, 5.87]	12.01 [10.25-14.01]	43.65 [40.84-46.49]	**39.71 [36.94-42.55]**

9	Separated bike lanes	18.34 [16.32-20.55]	18.59 [16.48-20.9]	34.92 [32.29-37.64]	**28.15** **[25.48-30.99]**
10	Limit speed at 30km/hr around schools	11.79 [9.93-13.93]	13.63 [11.75-15.74]	29.8 [27.32-32.41]	**44.79** **[41.98-47.63]**
11	Limit speed at 40km/hr in the entire city	44.77 [41.97-47.6]	26.8 [24.35-29.41]	16.18 [14.17-18.41]	**12.25** **[10.45-14.31]**
12	Reconfigure intersections by increasing crossing time	6.39 [5.11-7.96]	21.22 [18.9-23.73]	40.77 [38.01-43.6]	**31.61** **[29-34.35]**
13	Improve play infrastructures and rest areas in parks	3.34 [2.41-4.62]	10.92 [9.21-12.9]	45.68 [42.88-48.51]	**40.05** **[37.29-42.88]**
14	Increase priority traffic lights for buses	14.96 [12.78-17.44]	27.63 [25.07-30.33]	36.97 [34.16-39.87]	**20.44** **[17.97-23.16]**
15	Increase Park accessibility by reducing parking cost	5.40 [4.23-6.86]	11.06 [9.34-13.04]	36.6 [33.89-39.41]	**46.94** **[44.05-49.84]**
16	Increase Park accessibility by reducing public transit cost	8.43 [7.07-10.03]	17.32 [15.27-19.59]	40.61 [37.8-43.47]	**33.63** **[30.8-36.58]**
17	Add road tolls to enter downtown	59.46 [56.52-62.33]	20.06 [17.78-22.57]	12.16 [10.32-14.28]	**8.31** **[6.628-10.38]**
18	Police surveillance of drivers and enforcement of traffic code	10.38 [8.51-12.6]	17.38 [15.32-19.66]	39.53 [36.79-42.33]	**32.71** **[30.1-35.44]**
19	Increased fines for motor vehicle drivers	16.61 [14.4-19.09]	23.64 [21.31-26.14]	33.02 [30.42-35.7]	**26.73** **[24.25-29.36]**
20	Police surveillance of cyclists and enforcement of traffic code	11.21 [9.28-13.47]	17.35 [15.23-19.7]	35.99 [33.31-38.75]	**35.46** **[32.81-38.2]**

21	Increased fines for cyclists	12.74 [10.6-15.25]	19.79 [17.54-22.26]	34.54 [31.89-37.28]	**32.93** **[30.32-35.66]**
22	Traffic calming like narrow streets and speedbumps	30 [27.44-32.68]	27.97 [25.48-30.61]	27.72 [25.29-30.3]	**14.31** **[12.28-16.61]**
23	Redistribute road areas towards pedestrians and cyclists (shared streets)	16.09 [14.15-18.23]	22.81 [20.43-25.37]	37.9 [35.19-40.69]	**23.21** **[20.76-25.85]**
24	Close entire streets to motor vehicles	31.85 [29.2-34.62]	31.55 [28.89-34.33]	25.03 [22.57-27.67]	**11.57** **[9.787-13.62]**
25	Ban motor vehicles in front of schools when kids are entering or exiting	18.49 [16.23-20.99]	26.62 [24.17-29.23]	31.46 [28.81-34.24]	**23.43** **[21.12-25.91]**
26	Ban heavy vehicles from urban area overnight	15.71 [13.48-18.24]	25.33 [22.78-28.07]	30.88 [28.27-33.61]	**28.07** **[25.52-30.78]**

Weighted results
BE items are arranged according to their increasing order of intrusiveness

4.3.1 Prevalence of higher levels of acceptability of BE interventions aimed at promoting a heathy diet by level of intervention intrusiveness

Overall, 41% of the individuals showed 'moderate-high' agreement regarding the implementation of BE interventions aimed at promoting a healthy diet. Figure 4.3 (a) illustrates the proportion of higher agreement (modetate-high) across different levels of intervention intrusion. The highest level of support (56.3%, 95%CI: 53.5-59.05) was shown for the 2nd level intervention – enabling choice, followed by 1st level - providing information (43.1%, 95%CI: 40.36-45.9) and 4th level – guiding choice through incentives (39%, 95%CI: 36.17-41.85). The lowest support (18.7%, 95%CI: 16.63-21.05) was shown for the 5th level of intervention that guides choice through disincentives.
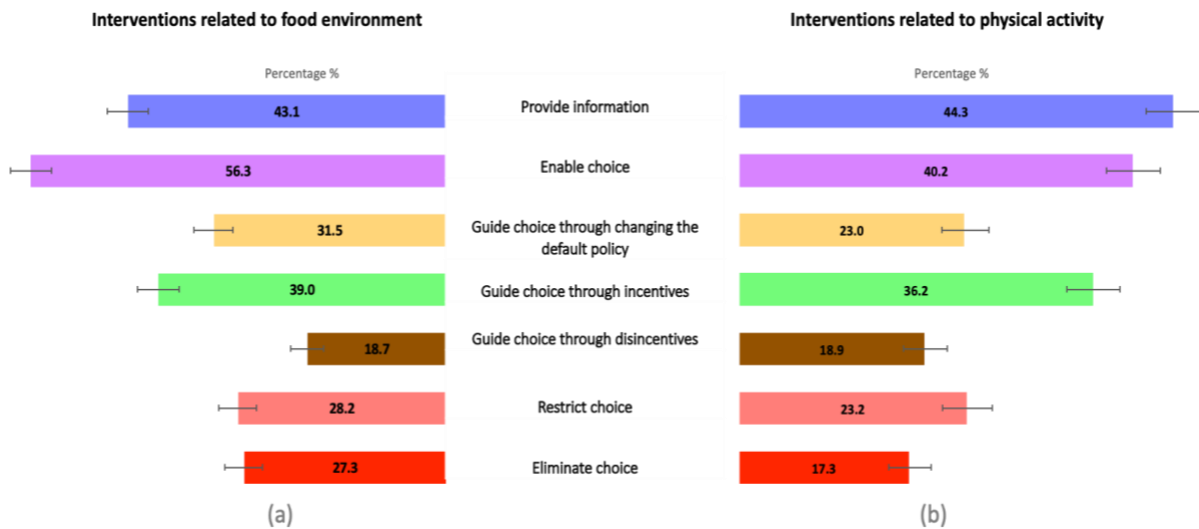
Figure 4.3 Percentage of respondents indicating 'moderate-high' agreement to BE interventions of varied levels of intrusiveness aimed at promoting (a) a healthy diet and (b) physical activity[9]

---

[9] Detailed results are presented in Appendix C

4.3.2 Prevalence of higher levels of acceptability of BE interventions aimed at promoting physical activity[10] by level of intervention intrusiveness

Overall, 27% of the respondents indicated moderate-high agreement regarding the implementation of BE interventions aimed at promoting physical activity. As indicated in figure 4.3 (b), respondents showed the highest support for 1st level intervention, i.e., deemed the least intrusive – providing information (44.3%, 95%CI: 41.53-47.13), followed by 2nd level – enabling choice (40.2%, 95%CI: 37.49-43.01) and 4th level – guiding choice through incentives (36.2%, 95%CI: 33.48-8.91). Conversely, the lowest support (17.32%, 95%CI: 15.27, 19.59) was shown for the 7th level of intervention, i.e., deemed most intrusive - eliminating choice, followed by guiding choice through disincentives (18.91%, 95%CI: 16.77-21.26).

---

[10]As mentioned in Chapter 3, section 3.6.1, Pearson's chi-square test for difference in acceptability between regions can be found in appendix C. There were no significant differences across regions for levels of interventions related to diet and physical activity (except one - marginally significant). Therefore, the presentation of results for both regions combined.

4.4.1 Individual and neighbourhood-level factors that are associated with the level of overall acceptability of BE interventions aimed at promoting a healthy diet

Table 4.4 shows the crude association between individual and neighbourhood-level factors and the overall acceptability of BE interventions that promote a healthy diet. A significantly higher proportion of women (46.5%, 95%CI: 43.13-49.91) compared to men (35.42%, 95%CI: 31.21-39.87) showed moderate-high agreement regarding the implementation of intervention related to the food environment. Further, younger (18-34 years) and older adults (above 65 years) indicated a significantly higher proportion (44.83%, 95%CI: 38.98-50.83 and 45.85%, 95%CI: 40.98-50.8) of moderate-high agreement than those who were middle-aged (37.49%). A larger proportion of immigrants (50.74%, 95%CI: 42.97-58.48) compared to those born in Canada (38.1%, 95%CI: 35.12-41.17) indicated moderate-high support. Furthermore, higher support was shown by unemployed individuals (47.08%, 95%CI: 34.78-59.74) and those who had university-level education (47.08%, 95%CI: 43.07-51.12) compared to those who were employed (36.87%, 95%CI: 33.17-40.74), went to trade school/college (36.83%, 95%CI: 32.72-41.15) or high school (41%, 95%CI: 36.14-46.05). Respondents who perceived their health as either excellent or poor showed significantly higher (55.77%, 95%CI: 47.63-63.6 and 51.04%, 95%CI: 37.41-64.51) moderate-high support compared to those who rated in-between.

Individual factors such as Indigenous status, annual household income, home tenure, and home type were not significantly associated with the acceptability of interventions related to food environment at $P<0.05$. Further, all the neighbourhood-level factors except for neighbourhood ethnic concentration were not significantly associated with the acceptability of interventions related to the food environment. Individuals living in the least ethnically concentrated neighbourhoods showed a significantly higher (52.62%, 95%CI: 44.03-61.06) proportion of

moderate-high agreement than those living in most ethnically concentrated neighbourhoods (25.32%, 95%CI: 15.7-38.16).

4.4.2 Individual and neighbourhood-level factors that are associated with the level of overall acceptability of BE interventions aimed at promoting physical activity

As shown in table 4.4, a higher proportion of individuals who were immigrants (40.33%, 95%CI: 33.04-48.07) and self-identified as Indigenous (37.42%, 95%CI: 27.02-49.12) reported moderate-high agreement regarding implementation of interventions aimed at promoting physical activity compared to those who were born in Canada (23.66%, 95%CI: 21.05-26.49) and were non-Indigenous (26.05, 95%CI: 23.58-28.69). A relatively higher agreement was shown by respondents who had a university education (32.85%, 95%CI: 29.1-36.82), belonged to the lower-income group (32.45%, 95%CI: 23.11-43.42 and 34.26%, 95%CI: 27.55-41.66), been residing in the current residence for less than one year (36.19%, 95%CI: 26.71-46.88) and lived in townhouse/apartment/condo (33.91%, 95%CI: 28.59-39.67). Individuals who perceived their health as either excellent or poor showed a higher proportion (40.38%, 95%CI: 32.46-48.83 and 30.88%, 95%CI: 20.04-44.33) of agreement than those who rated their health in-between.

Factors such as gender, age, and current employment did not significantly affect the acceptability of interventions related to physical activity. Further, individuals who resided in an area with moderate favourability of active living environment and had most residential instability[11] indicated higher support than those who lived in neighbourhoods with least favourability of active

---

[11] Residential instability is characterised by proportion of population living alone, proportion of population who are not youth, proportion of dwellings that are not owned, and proportion of population moved during past 5 years etc.

living and was least unstable. No other neighbourhood-level factors showed significant association

with the acceptability of interventions related to physical activity.

Table 4.4 Crude association between individual and neighbourhood-level factors and overall acceptability of BE interventions aimed at promoting a healthy diet and physical activity

	BE interventions related to food environment			BE interventions related to physical activity		
Variable	**Weighted % [95% CI]**			**Weighted % [95% CI]**		
	P-value	**No-low agreement**	**Moderate-high agreement**	**P-value**	**No-low agreement**	**Moderate-high agreement**
Individual-level factors						
Sex	**P<0.001**			P=0.68		
Men		64.58 [60.13-68.79]	35.42 [31.21-39.87]		72.39 [68.09-76.32]	27.61 [23.68-31.91]
Women		53.5 [50.09-56.87]	46.5 [43.13-49.91]		73.55 [70.48-76.4]	26.45 [23.6-29.52]
Other		74.36 [22.09-96.74]	25.64 [3.261-77.91]		87.1 [40.67-98.52]	12.9 [1.481-59.33]
Age	**P<0.05**			P=0.10		
18-34 years		55.17 [49.17-61.02]	44.83 [38.98-50.83]		69.53 [63.68-74.8]	30.47 [25.2-36.32]
35-64 years		62.51 [58.93-65.95]	37.49 [34.05-41.07]		75.46 [72.22-78.45]	24.54 [21.55-27.78]
above 65 years		54.15 [49.2-59.02]	45.85 [40.98-50.8]		72.8 [68.27-76.9]	27.2 [23.1-31.73]
Born in Canada	**P<0.01**			**P<0.001**		
No		49.26 [41.52-57.03]	50.74 [42.97-58.48]		59.67 [51.93-66.96]	40.33 [33.04-48.07]
Yes		61.9 [58.83-64.88]	38.1 [35.12-41.17]		76.34 [73.51-78.95]	23.66 [21.05-26.49]
Indigenous status	P=0.44			**P<0.05**		
No		59.33 [56.48-62.12]	40.67 [37.88-43.52]		73.95 [71.31-76.42]	26.05 [23.58-28.69]
Yes		54.82 [43.34-65.81]	45.18 [34.19-56.66]		62.58 [50.88-72.98]	37.42 [27.02-49.12]

				P=0.70		
Current employment	**P<0.05**					
Employed		63.13 [59.26-66.83]	36.87 [33.17-40.74]		73.92 [70.24-77.3]	26.08 [22.7-29.76]
Unemployed		52.92 [40.26-65.22]	47.08 [34.78-59.74]		74.21 [63.21-82.82]	25.79 [17.18-36.79]
Retired		54.27 [49.7-58.76]	45.73 [41.24-50.3]		74.13 [69.96-77.9]	25.87 [22.1-30.04]
Student and other		56.18 [49.3-62.82]	43.82 [37.18-50.7]		70.43 [63.69-76.38]	29.57 [23.62-36.31]
Educational attainment	**P<0.01**			**P<0.01**		
High school or less		59 [53.95-63.86]	41 [36.14-46.05]		73.37 [68.57-77.67]	26.63 [22.33-31.43]
Trade school/college		63.17 [58.85-67.28]	36.83 [32.72-41.15]		77.21 [73.38-80.65]	22.79 [19.35-26.62]
University		52.92 [48.88-56.93]	47.08 [43.07-51.12]		67.15 [63.18-70.9]	32.85 [29.1-36.82]
Annual HH income	P=0.816			**P<0.05**		
					67.55 [56.58-76.89]	32.45 [23.11-43.42]
Less than 20k		58.84 [48-68.89]	41.16 [31.11-52]		65.74 [58.34-72.45]	34.26 [27.55-41.66]
20k-39k		57.23 [49.82-64.33]	42.77 [35.67-50.18]		67.02 [60.01-73.35]	32.98 [26.65-39.99]
40k-59k		58.02 [50.89-64.84]	41.98 [35.16-49.11]		75.03 [67.5-81.29]	24.97 [18.71-32.5]
60k-79k		54.59 [46.44-62.5]	45.41 [37.5-53.56]		76.48 [72.44-80.09]	23.52 [19.91-27.56]
Above 80k		60.44 [56.09-64.64]	39.56 [35.36-43.91]			
Perceived Health	**P<0.001**			**P<0.001**		
Excellent		44.23 [36.4-52.37]	55.77 [47.63-63.6]		59.62 [51.17-67.54]	40.38 [32.46-48.83]
Very good		59 [54.07-63.75]	41 [36.25-45.93]		76.1 [71.77-79.95]	23.9 [20.05-28.23]
Good		64.23 [59.77-68.46]	35.77 [31.54-40.23]		75.56 [71.5-79.21]	24.44 [20.79-28.5]
Fair		60.29 [53.15-67.02]	39.71 [32.98-46.85]		73.7 [66.57-79.78]	26.3 [20.22-33.43]
Poor		48.96 [35.49-62.59]	51.04 [37.41-64.51]		69.12 [55.67-79.96]	30.88 [20.04-44.33]

				P<0.001		
Home tenure	P=0.07					
Less than 1 year		57.11 [46.18-67.39]	42.89 [32.61-53.82]		63.81 [53.12-73.29]	36.19 [26.71-46.88]
1-5 years		52.88 [47.03-58.66]	47.12 [41.34-52.97]		67.02 [61.14-72.41]	32.98 [27.59-38.86]
6-10 years		64.01 [57.07-70.4]	35.99 [29.6-42.93]		81.31 [75.72-85.85]	18.69 [14.15-24.28]
More than 10 years		60.86 [57.21-64.39]	39.14 [35.61-42.79]		75.12 [71.71-78.23]	24.88 [21.77-28.29]
Home type	P=0.33			**P<0.001**		
House/ Duplex		60.17 [56.95-63.31]	39.83 [36.69-43.05]		75.11 [72.18-77.82]	24.89 [22.18-27.82]
Townhouse-apt-condo		55.28 [49.57-60.87]	44.72 [39.13-50.43]		66.09 [60.33-71.41]	33.91 [28.59-39.67]
Student/ senior housing		62.28 [40.77-79.84]	37.72 [20.16-59.23]		87.01 [73.37-94.22]	12.99 [5.784-26.63]

Neighbourhood-level factors

Favourability of active living environment	P=0.63			**P<0.05**		
Very low		60.4 [52.13-68.12]	39.6 [31.88-47.87]		73.9 [66.56-80.11]	26.1 [19.89-33.44]
Low		58.24 [53.48-62.85]	41.76 [37.15-46.52]		76.03 [71.83-79.79]	23.97 [20.21-28.17]
Moderate		56.56 [49.59-63.27]	43.44 [36.73-50.41]		66.3 [59.09-72.83]	33.7 [27.17-40.91]
High		71.97 [49.96-86.85]	28.03 [13.15-50.04]		72.91 [51.24-87.33]	27.09 [12.67-48.76]
Quintiles of instability	P=0.44			**P<0.05**		
1 (least unstable)		66.93 [57.35-75.28]	33.07 [24.72-42.65]		83.03 [74.76-88.99]	16.97 [11.01-25.24]
2		55.89 [46.05-65.29]	44.11 [34.71-53.95]		76.77 [67.14-84.25]	23.23 [15.75-32.86]
3		55.95 [45.49-65.9]	44.05 [34.1-54.51]		74.11 [64.67-81.74]	25.89 [18.26-35.33]
4		57.36 [49.66-64.71]	42.64 [35.29-50.34]		70.73 [63.1-77.34]	29.27 [22.66-36.9]
5(most unstable)		57.55 [50.97-63.87]	42.45 [36.13-49.03]		67.37 [60.87-73.26]	32.63 [26.74-39.13]

Quintiles of Deprivation	P=0.47			P=0.65		
1 (least deprived)		60.72 [54.68-66.45]	39.28 [33.55-45.32]		75.07 [69.49-79.92]	24.93 [20.08-30.51]
2		61.94 [54.13-69.18]	38.06 [30.82-45.87]		74.27 [66.6-80.69]	25.73 [19.31-33.4]
3		56.53 [44.98-67.42]	43.47 [32.58-55.02]		68.34 [56.45-78.23]	31.66 [[21.77-43.55]
4		53.35 [42.8-63.62]	46.65 [36.38-57.2]		71.56 [61.36-79.95]	28.44 [20.05-38.64]
5 (most deprived)		52.9 [43.21-62.37]	47.1 [37.63-56.79]		69 [59.44-77.17]	31 [22.83-40.56]
Quintiles of Dependency	P=0.41			P=0.35		
1 (least dependent)		61.86 [55.05-68.22]	38.14 [31.78-44.95]		76.69 [70.32-82.04]	23.31 [17.96-29.68]
2		54.51 [46.12-62.65]	45.49 [37.35-53.88]		68.31 [59.73-75.81]	31.69 [24.19-40.27]
3		52.79 [43.78-61.62]	47.21 [38.38-56.22]		72.41 [63.51-79.83]	27.59 [20.17-36.49]
4		58.38 [49.5-66.74]	41.62 [33.26-50.5]		74.87 [67.06-81.35]	25.13 [18.65-32.94]
5 (most dependent)		62.91 [52.82-71.99]	37.09 [28.01-47.18]		67.67 [57.17-76.64]	32.33 [23.36-42.83]
Quintiles of Ethnic Concentration	**P<0.01**			P=0.54		
1 (least ethnically concentrated)		47.38 [38.94-55.97]	52.62 [44.03-61.06]		67.21 [58.21-75.1]	32.79 [24.9-41.79]
2		62.05 [53.62-69.8]	37.95 [30.2-46.38]		76.24 [68.81-82.35]	23.76 [17.65-31.19]
3		61.61 [53.88-68.8]	38.39 [31.2-46.12]		74.87 [67.48-81.06]	25.13 [18.94-32.52]
4		53.74 [46.73-60.61]	46.26 [39.39-53.27]		71.94 [65.29-77.76]	28.06 [22.24-34.71]
5 (most ethnically concentrated)		74.68 [61.84-84.3]	25.32 [15.7-38.16]		70.17 [55.66-81.51]	29.83 [18.49-44.34]
Green Roads count within 1000m	P=0.91			P=0.81		
zero points		56.86 [49.48-63.95]	43.14 [36.05-50.52]		71.97 [65.1-77.94]	28.03 [22.06-34.9]
1-5 points		58.61 [53.93-63.15]	41.39 [36.85-46.07]		74.03 [69.67-77.96]	25.97 [22.04-30.33]
6 or more points		58.66 [50.9-66.01]	41.34 [33.99-49.1]		72.09 [64.63-78.51]	27.91 [21.49-35.37]

|						
Presence of at least one grocery store within the dissemination block	P=0.56			P=0.84		
No		58 [54.41-61.51]	42 [38.49-45.59]		73.14 [69.85-76.18]	26.86 [23.82-30.15]
Yes		62.22 [47.93-74.66]	37.78 [25.34-52.07]		71.73 [56.58-83.17]	28.27 [16.83-43.42]
Presence of at least one park within the dissemination block.	P=0.58			P=0.20		
No		57.76 [53.74-61.68]	42.24 [38.32-46.26]		74.12 [70.46-77.46]	25.88 [22.54-29.54]
Yes		59.99 [52.97-66.62]	40.01 [33.38-47.03]		69.48 [62.6-75.59]	30.52 [24.41-37.4]
Presence of at least one transit stop within the dissemination block	P=0.31			P=0.50		
No		56.5 [51.57-61.31]	43.5 [38.69-48.43]		71.98 [67.32-76.22]	28.02 [23.78-32.68]
Yes		60.04 [55.15-64.74]	39.96 [35.26-44.85]		74.09 [69.59-78.14]	25.91 [21.86-30.41]
Amenity dense neighbourhood	P=0.64			P=0.56		
Non-amenity dense neighbourhood		57.7 [53.91-61.4]	42.3 [38.6-46.09]		73.67 [70.16-76.89]	26.33 [23.11-29.84]
Amenity dense neighbourhood		61.15 [52.33-69.3]	38.85 [30.7-47.67]		70.17 [61.7-77.45]	29.83 [22.55-38.3]
High amenity density neighbourhood		51.27 [19.92-81.65]	48.73 [18.35-80.08]		73.43 [41.15-91.61]	26.57 [8.391-58.85]
Urban sprawl	P=0.90			P=0.64		
No sprawl		58.55 [54.65-62.34]	41.45 [37.66-45.35]		73.69 [70.09-77]	26.31 [23-29.91]
Less sprawl		62.3 [42.21-78.9]	37.7 [21.1-57.79]		65.97 [45.83-81.62]	34.03 [18.38-54.17]
More sprawl		57.43 [48.82-65.62]	42.57 [34.38-51.18]		71.53 [63.33-78.52]	28.47 [21.48-36.67]

Weighted results

4.5.1 Association of individual and neighbourhood-level factors on overall acceptability of BE interventions aimed at promoting a healthy diet

Factors such as sex, country of birth, educational attainment, perceived health, and ethnic concentration of neighbourhood of residence were found to be independently associated with the odds of moderate-high agreement regarding implementing interventions aimed at improving a healthy diet. (Figure 4.4).

Women (AOR = 2.18, 95%CI: 1.56-3.05) and immigrants (AOR= 1.65, 95%CI: 1.02-2.67) were almost two times more likely to show moderate-high agreement as compared to men and individuals born in Canada. Further, the odds of acceptability were 60% higher among individuals with university-level education (AOR=1.60, 95%CI: 1.05-2.43) compared to those with educational attainment of high school or less. Individuals who rated their health as either very good or fair were 51-61% (AOR= 0.49, 95%CI: 0.29-0.82 and AOR= 0.39, 95%CI: 0.21-0.71) less likely to agree with the implementation of interventions related to food environment relative to those who rated their health as excellent, while individuals who rated their health in-between (as 'good') were 69% (AOR=0.31, 95%CI: .18-.53) less likely to agree.

After controlling for individual-level factors, only ethnic concentration of the neighbourhood of residence was independently associated with the odds of acceptability of interventions related to the food environment. Those who came from least ethnically concentrated neighbourhoods were almost four times (AOR= 3.86, 96%CI: 1.53-9.75) more likely to support these interventions than those who came from most ethnically concentrated neighbourhoods.

Figure 4.4 Adjusted odds ratio associated with 'moderate-high' agreement regarding implementation of BE interventions aimed at promoting a healthy diet: Results from the final multivariable multi-level logistic regression model[12]

---
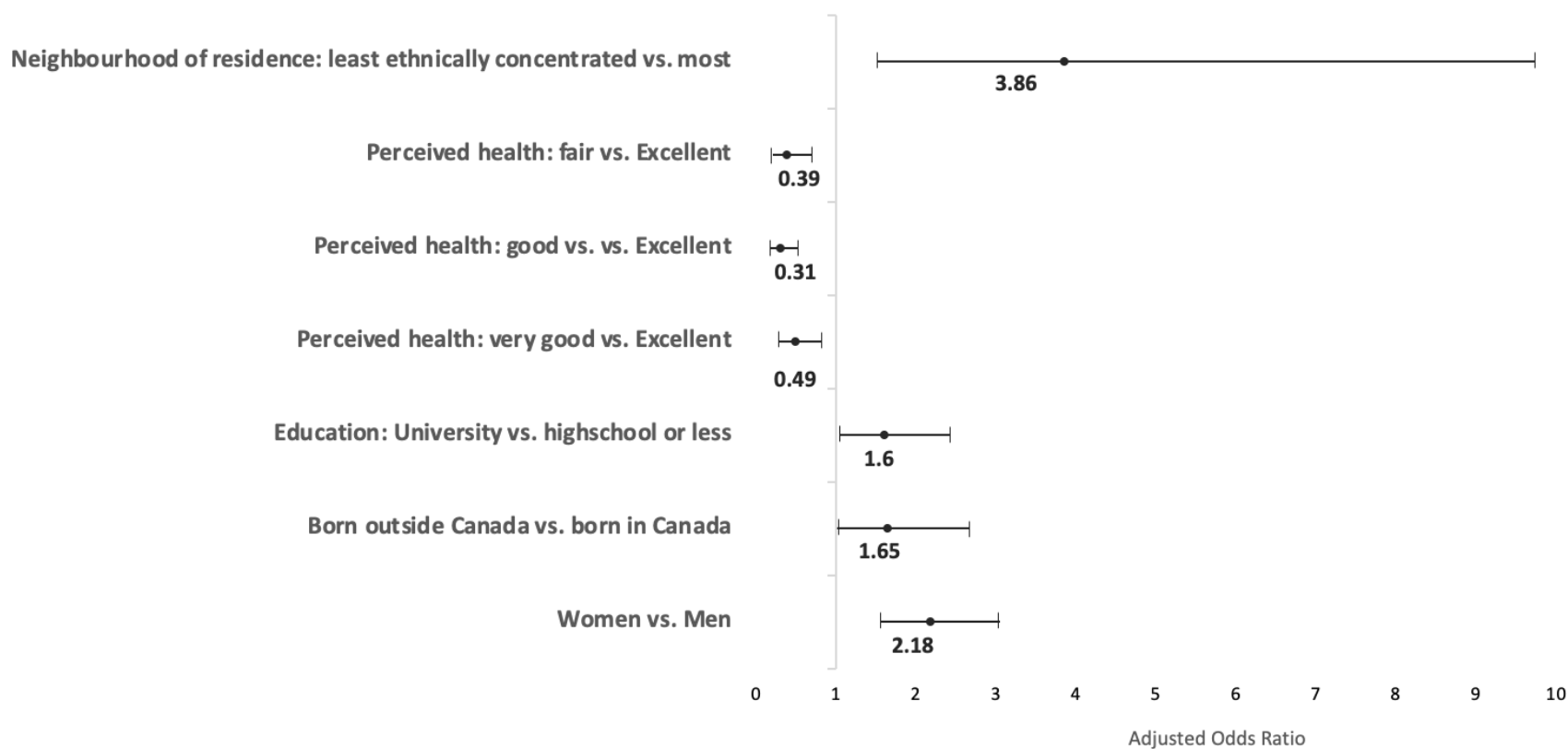
[12] Figure presents only significant results from the final model. Full model results are presented in table 4.5
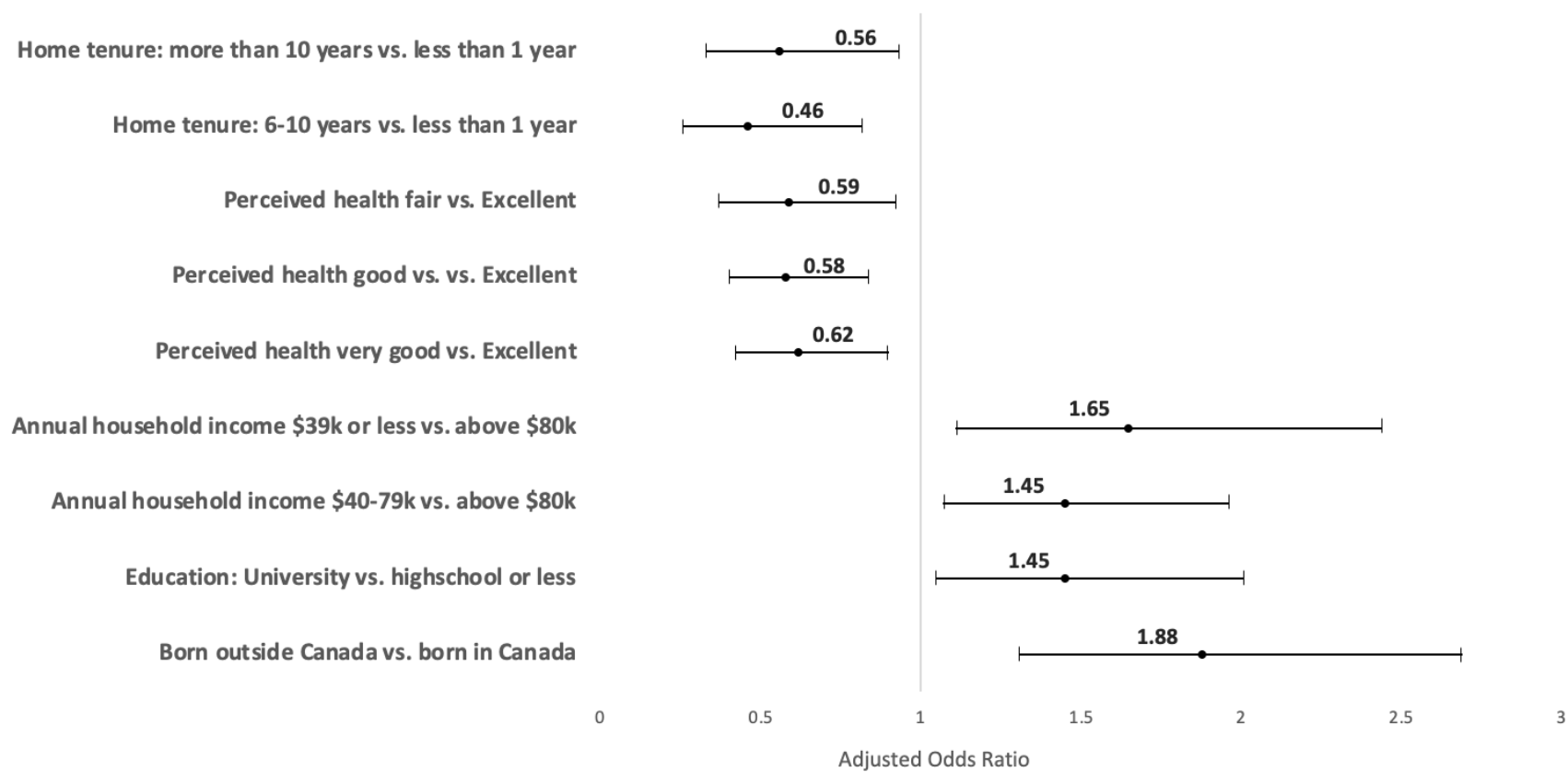
4.5.2 Association of individual and neighbourhood-level factors on overall acceptability of BE interventions aimed at promoting physical activity

Factors such as country of birth, educational attainment, annual household income, perceived health, and home tenure were found to be independently associated with the odds of moderate-high agreement regarding implementing interventions aimed at improving physical activity. (Figure 4.5).

The likelihood of acceptability of interventions aimed to improve physical activity was 88% (AOR=1.88, 95%CI: 1.31- 2.69) higher for immigrants, 45% (AOR=1.45, 95%CI: 1.05-2.01) higher for those who had a university education and 45-65% (AOR=1.45, 95%CI: 1.07- 1.96; AOR=1.65, 95%CI: 1.11-2.44) higher for those who had less than $80,000 of annual household income, relative to those who were born in Canada, had high school education or less and reported an annual household income of $80,000 or more. Further, those who lived in their current residence for 6-10 years and more than ten years were 54% (AOR=0.46, 95%CI: 0.26-0.82) and 44% (AOR=0.56, 95%CI: 0.33-0.93) less likely to support interventions compared to those who lived for less than a year.

Further, when significant individual-level variables were already present in the model, no neighbourhood-level factors were found to be independently associated with the odds of moderate-high agreement regarding implementing interventions aimed at improving physical activity.

Figure 4.5 Adjusted odds ratio associated with 'moderate-high' agreement regarding implementation of BE interventions aimed at promoting physical activity: Results from the final multivariable multi-level logistic regression model[13]

[13] Figure presents only significant results from the final model. Full model results are presented in table 4.5

Table 4.5 Association of individual and neighbourhood-level factors on overall acceptability of BE interventions aimed at promoting a healthy diet and physical activity: Results from multivariable multi-level logistic regression models

Individual and neighbourhood-level factors	Interventions related to food environment			Interventions related to physical activity		
	Model 1 Individual-level variables	Model 2 Neighbourhood-level variables	Model 3 Individual and Neighbourhood-level variables	Model 1 Individual-level variables	Model 2 Neighbourhood-level variables	Model 3 Individual and Neighbourhood-level variables
	AOR [95% CI]	AOR [95% CI]	AOR [95% CI]	AOR [95% CI]	AOR [95% CI]	AOR [95% CI]
Gender						
Men (Reference)	1		1	-		-
Women	1.77*** [1.43-2.19]		2.18*** [1.56-3.05]			
Age						
Above 65 years (reference)	1		1	1		1
18-34 years	0.97 [0.65-1.46]		1.16 [.62-2.16]	0.75 [.47- 1.20]		0.76 [.47 - 1.21]
35-64 years	0.84 [0.62-1.14]		0.97 [.59-1.59]	0.73 [.51 - 1.05]		0.74 [.52 - 1.07]
Born in Canada						
Yes (reference)	1		1	1		1
No	1.59*** [1.16-2.17]		1.65* [1.02-2.67]	1.85*** [1.30 - 2.64]		1.88*** [1.31- 2.69]
Indigenous status	-		-			
No (reference)				1		1
Yes				1.63 [.97- 2.72]		1.58 [.93 - 2.68]
Current employment						
Employed (reference)	1		1	1		1

60

Unemployed	1.51 [.90-2.54]	1.48 [.72-3.05]	1.03 [.57 - 1.86]	1.03 [.57 - 1.86]
Retired	1.45** [1.06-1.99]	1.54 [.92-2.58]	0.89 [.62 - 1.28]	0.93 [.64 - 1.35]
Student and other	1.12 [.81-1.55]	1.33 [.85-2.10]	1.00 [.69 - 1.46]	1.03 [.70 - 1.50]
Educational attainment				
High school or less	1	1	1	1
Trade school/college	0.94 [.71-1.24]	0.99 [.66-1.48]	0.93 [.67 - 1.29]	0.94 [.67 - 1.30]
University	1.34* [1.02-1.76]	**1.60*** [1.05-2.43]	1.45* [1.05 - 1.99]	1.45* [1.05 - 2.01]
Annual HH income				
Above 80k (reference)	1	1	1	1
$40-79k	1.07 [0.83-1.38]	1.25 [.85-1.84]	1.73** [1.20 - 2.49]	**1.45*** [1.07 - 1.96]
$39k or less	1.03 [0.75-1.42]	1.11 [.69-1.78]	1.48** [1.11 - 1.98]	**1.65*** [1.11 - 2.44]
Perceived Health				
Excellent (reference)	1	1	1	1
Very good	0.60** [.43-.83]	**0.49*** [.29-.82]	0.61** [.42 - .87]	**0.62*** [.42 - .90]
Good	0.47*** [.34, .66]	**0.31*** [.18-.53]	0.58** [.40 - .84]	**0.58*** [.40 - .84]
Fair	.59** [.40-.89]	**0.39*** [.21-.71]	0.59* [.38 - .93]	**0.59*** [.37 - .92]
Poor	0.80 [.41-1.55]	0.49 [.20-1.18]	0.91 [.44 - 1.87]	0.88 [.42 - 1.83]
Home tenure				
Less than 1 year (reference)	1	1	1	1
1-5 years	1.11 [0.69-1.79]	1.00 [.52-1.91]	0.66 [.40 - 1.11]	0.66 [.39 - 1.11]
6-10 years	0.74 [0.44-1.25]	0.75 [.37-1.53]	0.46** [.26 - .81]	**0.46*** [.26 - .82]
More than 10 years	0.86 [0.54-1.38]	0.79 [.41-1.51]	0.55* [.33 - .91]	**0.56*** [.33 - .93]

	-	-	-	

Favourability of Active living environment

	Col1	Col2	Col3	Col4
Very low (reference)	1	1		
Low	1.15 [.74-1.81]	1.25 [.79-1.97]		
Moderate	1.27 [.75-2.16]	1.33 [.78-2.28]		
High	0.77 [.20-2.94]	1.09 [.28-4.19]		

Quintiles of instability

	Col1	Col2	Col3	Col4
1 (least unstable) (reference)	1	1	1	1
2	1.24 [.68-2.26]	1.24 [.68-2.27]	1.07 [.61 - 1.88]	1.02 [.58 - 1.77]
3	1.14 [.57-2.27]	1.04 [.52-2.07]	1.14 [.56 - 2.31]	1.00 [.50 - 2.01]
4	1.40 [.78-2.51]	1.33 [.71-2.46]	1.31 [.77 - 2.21]	1.10 [.64 - 1.87]
5(most unstable)	1.59 [.88-2.88]	1.44 [.77-2.67]	1.59 [.95 - 2.65]	1.25 [.74 - 2.10]
	-	-		

Quintiles of Dependency

	Col1	Col2	Col3	Col4
1 (least dependent) (reference)			1	1
2			1.15 [.74 - 1.79]	1.15 [.75 - 1.75]
3			0.96 [.53 - 1.73]	0.98 [.54 - 1.76]
4			1.01 [.60 - 1.69]	1.05 [.62 - 1.75]
5 (most dependent)			1.11 [.61 - 2.03]	1.19 [.64 - 2.22]

Quintiles of Ethnic Concentration

	Col1	Col2	Col3	Col4
5 (most ethnically concentrated) (reference)	1	1	1	1
4	1.91** [.87-4.21]	2.14** [0.94-4.84]	1.07 [0.52 - 2.21]	1.18 [0.57 - 2.46]
3	1.95* [.90-4.23]	2.25* [1.02-4.99]	1.09 [0.50 - 2.37]	1.23 [0.57 - 2.62]

	Model 1	Model 2		
	1.51* [.67-3.42]	1.71* [0.74-3.98]	0.90 [0.37 - 2.19]	1.01 [0.42 - 2.39]
2	3.56** [1.45-8.73]	3.86** [1.53-9.75]	1.19 [0.51 - 2.78]	1.34 [0.58 - 3.09]
1 (least ethnically concentrated	-	-		
Amenity Dense Neighborhood				
Non-amenity dense neighbourhood (reference)	1	1	1	1
Amenity dense neighbourhood			1.09 [.71 - 1.68]	1.12 [.73 - 1.72]
High amenity density neighbourhood			0.75 [.14 - 4.03]	0.69 [.13 - 3.45]

Estimates significant at *P < 0.05; ** P < 0.01; *** P < 0.001; 'AOR' Adjusted Odds Ratio, 'CI' Confidence Interval
Model 1 was built using individual-level variables that were selected from the bivariate multi-level logistic regression analyses (P<0.20); Model 2 was built using neighbourhood-level variables that were selected from the bivariate multi-level logistic regression analyses (P<0.20); Finally, the ultimate model was built by adding both individual and neighbourhood-level variables from model 1 & 2.

4.6.1 Varying effects of individual and neighbourhood-level factors on overall acceptability of BE interventions aimed at promoting a healthy diet across different levels of intervention intrusion[14]

Figure 4.6 (a-e) illustrates the varying pattern/trends in the likelihood of acceptability of BE interventions aimed at promoting a healthy diet for different levels of intervention (as per Nuffield's intervention ladder) for different groups of individuals and their neighbourhood.

Figure 4.6 (a) shows changes in the likelihood of acceptability (measured in 'odds ratio') across varying levels of intervention intrusion as reported by women compared to men. Overall, the odds of 'moderate-high' agreement to intervention declined with the increasing intrusion. Women were more likely to accept interventions that are least intrusive (lowest rung of the intervention ladder). For instance, women were 1.8 to 2 times more likely to support interventions classified in the first four rungs of the ladder – provide information, enable choice, guide choice through changing the default policy, and guide choice through incentives. As the level of intrusion increased, a drop in the likelihood was seen for the highest two rungs of the ladder – restrict and eliminate choice.

Conversely, an overall upward trend in the likelihood of acceptability was shown by immigrants compared to individuals born in Canada. As shown in figure 4.6 (b), immigrants were 1.9 to 2.2 times more likely to agree with implementing more intrusive interventions such as guiding choice through disincentives, restricting, and eliminating choice. However, they were 40% less likely to support interventions that enable choice.

Respondents who were retired proved significantly different from the reference group (employed individuals), in two models. As shown in figure 4.6 (c), they were almost 1.8 times

---

[14] Complete results of the model fitted for each level of intervention separately for the food and physical activity domain are provided in Tables 4.6 & 4.7

more likely to support interventions that guide choice through changing default policy and eliminates choice.

As shown in figure 4.6 (d), individuals who had a university level of education compared to those who had high school or less showed the highest support for the intervention on the 5th level of the intervention ladder, guiding choice through disincentives. They also showed increased support for the least intrusive intervention – providing information; however, the odds were lower than the former (AOR 2.3 vs. 1.6). Other points of results approached an odds ratio of 1 and were not significantly different from the reference group (individuals with high school or less education).

Figure 4.6 (e) illustrates the trend in the likelihood of acceptability for individuals who came from the least ethnically concentrated neighbourhood compared to those from most ethnically concentrated neighbourhoods. Overall, individuals from the least ethnically concentrated neighbourhoods showed a higher odds of support across all levels of intervention, and the support was highest for the 5th level of the intervention ladder, guiding choice through disincentives. The odds ratio dropped at the third and fourth points, guiding choice by changing default policy and through incentive.
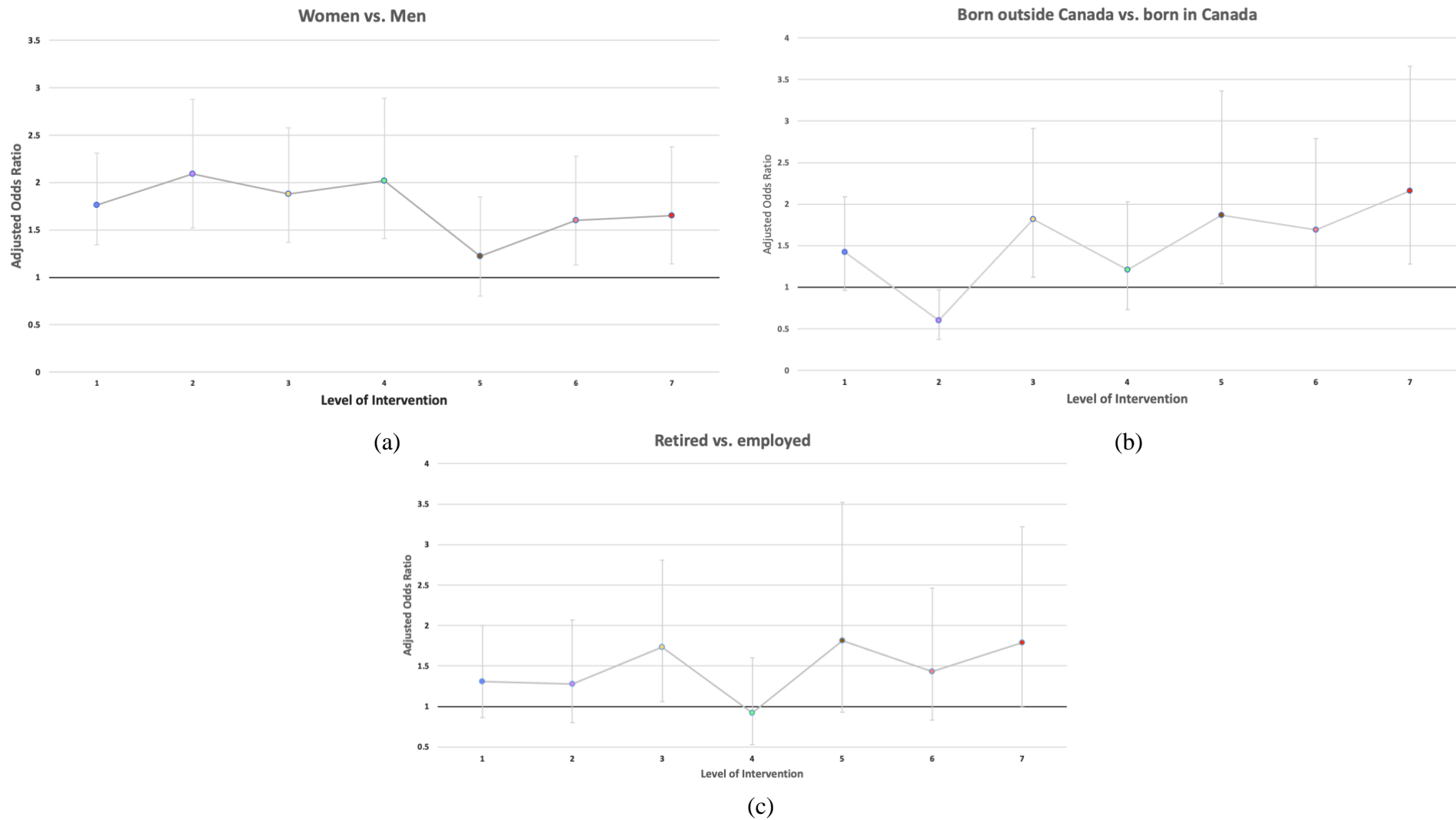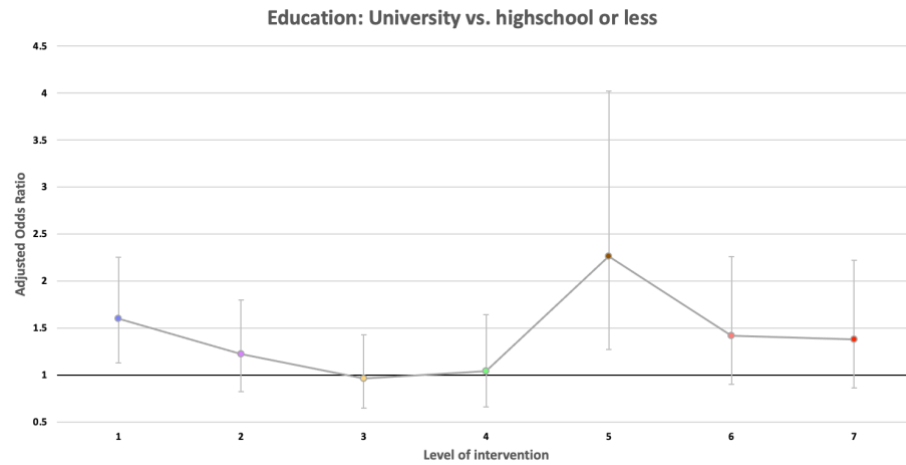
Figure 4.6 (a-e) Association between key individual and neighbourhood-level factors and 'moderate-high' acceptability across different levels of interventions related to the food environment[15]

---

[15] Significant results for 4.6 (a) were found for models of intervention level 1,2,3,4,6 and 7; for 4.6 (b) were 2,3,5,6, and 7; for 4.6 (c) were 3 and 7
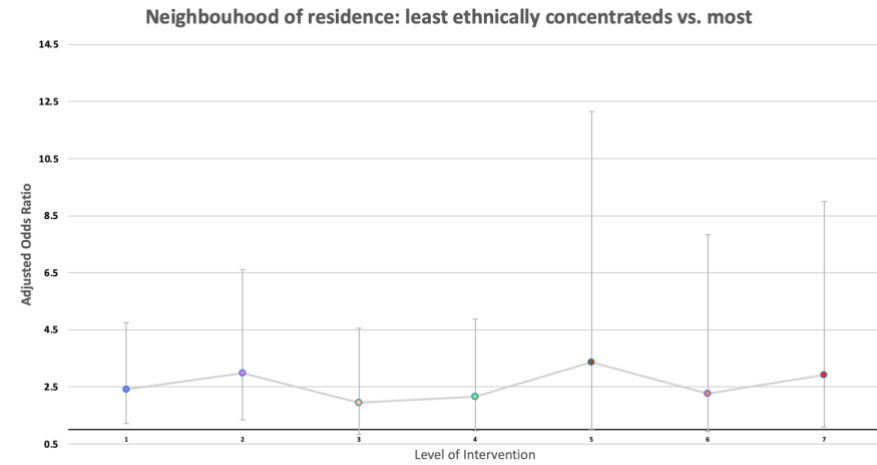
Figure 4.6 (a-e) Association between key individual and neighbourhood-level factors and 'moderate-high' acceptability across different levels of interventions related to the food environment, Continued[16]

---

[16] Significant results for 4.6 (d) were found for models of intervention level 1 and 5; for 4.3 (e) were 1,2,3,5,6 and 7.

Table 4.6 Association between individual and neighbourhood-level factors and 'moderate-high' acceptability across different levels of intervention related to the food environment

Individual and neighbourhood-level characters	Provide information	Enable choice	Guide choice through changing the default policy	Guide choice through incentives	Guide choice through disincentives	Restrict choice	Eliminate choice
	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
	AOR [95%]	AOR [95%]	AOR [95%]	AOR [95%]	AOR [95%]	AOR [95%]	AOR [95%]
Individual-level factors							
Gender							
Men	1	1	1	1	1	1	1
Women	**1.76*** [1.34 - 2.31]	**2.09*** [1.52-2.88]	**1.88*** [1.37-2.58]	**2.02*** [1.41-2.89]	1.22 [.80-1.85]	**1.60** [1.13-2.28]	**1.65** [1.14-2.38]
Age							
Above 65	1	1	1	1	1	1	1
18-34	1.06 [.64-1.77]	0.94 [.52-1.70]	1.23 [.68-2.22]	**2.02*** [1.02-3.99]	1.46 [.64-3.30]	1.09 [.56-2.13]	0.98 [.48-1.99]
35-64	1.14 [.76-1.72]	1.15 [.72-1.84]	1.31 [.82-2.10]	1.38 [.80-2.40]	1.19 [.62-2.28]	0.84 [.49-1.44]	0.91 [.51-1.61]
Born in Canada							
Yes	1	1	1	1	1	1	1
No	1.42 [.96-2.09]	**0.60*** [.37-.97]	**1.82**** [1.12-2.91]	1.21 [.73-2.03]	**1.87*** [1.04-3.36]	**1.69*** [1.02-2.79]	**2.16**** [1.28-3.66]
Current employment							
Employed	1	1	1	1	1	1	1
Unemployed	0.99 [.55-1.79]	0.72 [.36-1.44]	0.99 [.49-2.00]	0.91 [.43-1.92]	1.09 [.39-3.06]	1.53 [.70-3.34]	1.66 [.73-3.74]
Retired	1.31 [.86-2.00]	1.28 [.80-2.07]	**1.73*** [1.06-2.81]	0.92 [.53-1.60]	1.81 [.93-3.52]	1.43 [.83-2.46]	**1.79*** [.99-3.22]

68

Student and other	1.20 [.82-1.75]	1.22 [.79-1.90]	1.14 [.73-1.77]	1.36 [.84-2.19]	1.34 [.74-2.42]	1.06 [.64-1.74]	1.13 [.67-1.90]

Educational attainment

high school or less	1	1	1	1	1	1	1
trade school/college	0.89 [.64-1.25]	0.94 [.64-1.37]	0.86 [.58-1.26]	1.17 [.75-1.81]	1.19 [.69-2.07]	0.96 [.61-1.49]	1.14 [.72-1.82]
University	**1.60**** [1.13-2.25]	1.22 [.82-1.80]	0.96 [.65-1.43]	1.04 [.66-1.64]	**2.26**** [1.27-4.02]	1.42 [.90-2.26]	1.38 [.86-2.22]

Annual HH income

Above $80k	1	1	1	1	1	1	1
$40-79k	1.04 [.75-1.43]	1.03 [.72-1.49]	1.19 [.81-1.73]	1.37 [.88-2.12]	1.09 [.63-1.88]	1.48 [.94-2.31]	0.93 [.58-1.48]
$39k or less	1.33 [.90-1.96]	0.88 [.55-1.40]	1.35 [.87-2.11]	**2.27**** [1.34-3.84]	1.34 [.71-2.52]	0.93 [.54-1.61]	0.73 [.42-1.26]

Perceived Health

Excellent	1	1	1	1	1	1	1
Very good	0.72 [.47-1.11]	0.69 [.41-1.14]	0.55 [.34-.88]	**0.39**** [.22-.70]	**0.53*** [.28-.98]	**0.35***** [.20-.61]	**0.30***** [.17-.54]
Good	**0.54**** [.35-.83]	**0.43***** [.26-.72]	**0.40***** [.24-.65]	**0.44**** [.25-.77]	**0.32***** [.17-.61]	**0.24***** [.14-.43]	**0.21***** [.11-.38]
Fair	**0.60*** [.37-.97]	**0.46**** [.25-.82]	**0.40**** [.23-.71]	0.60 [.32-1.13]	**0.43*** [.20-.89]	**0.31***** [.16-.60]	**0.29**** [.15-.57]
Poor	0.72 [.35-1.47]	0.81 [.34-1.91]	0.47 [.20-1.06]	1.33 [.54-3.27]	0.82 [.30-2.28]	0.47 [.19-1.18]	0.31 [.11-.82]

Home tenure

less than 1 year	1	1	1	1	1	1	1
1-5 years	0.97 [.56-1.68]	**0.45*** [.22-.88]	0.76 [.41-1.41]	0.93 [.47-1.85]	1.17 [.50-2.77]	0.51 [.25-1.03]	0.73 [.35-1.52]
6-10 years	0.68 [.37-1.23]	**0.33**** [.16-.68]	**0.50*** [.25-.99]	**0.45*** [.21-.95]	1.62 [.64-4.10]	**0.46*** [.21-1.00]	0.64 [.29-1.40]
more than 10 years	0.87 [.51-1.50]	**0.29***** [.14-.58]	0.67 [.36-1.23]	0.61 [.31-1.20]	1.01 [.43-2.36]	0.54 [.27-1.08]	0.63 [.30-1.29]

Neighbourhood factors

favourability of active living environment						
1 (very low)						
1	1	1	1	1	1	1
2(low)						
1.40	1.10	1.08	1.06	1.00	1.19	1.45
[.97-2.02]	[.72-1.68]	[.70-1.66]	[.65-1.74]	[.55-1.81]	[.73-1.97]	[.85-2.47]
3 (moderate)						
1.42	1.00	1.19	1.19	0.94	1.37	1.57
[.91-2.19]	[.60-1.66]	[.71-1.98]	[.66-2.13]	[.46-1.92]	[.76-2.47]	[.84-2.93]
4 (high)						
0.50	0.93	1.57	0.97	1.93	1.25	1.32
[.15-1.67]	[.26-3.28]	[.46-5.31]	[.23-4.02]	[.37-10.05]	[.28-5.58]	[.28-6.11]
5 (very high)						

Quintiles of instability

1 (least unstable)						
1	1	1	1	1	1	1
2						
0.93	1.34	1.24	0.89	0.87	0.74	0.94
[.57-1.53]	[.77-2.32]	[.70-2.18]	[.46-1.72]	[.39-1.95]	[.39-1.41]	[.47-1.89]
3						
1.05	1.23	1.18	1.32	1.06	0.71	0.78
[.63-1.77]	[.66-2.29]	[.64-2.16]	[.65-2.67]	[.46-2.44]	[.33-1.52]	[.37-1.66]
4						
1.55	1.50	1.25	1.21	1.23	0.97	1.07
[.97-2.48]	[.88-2.54]	[.70-2.22]	[.61-2.40]	[.54-2.76]	[.50-1.90]	[.53-2.15]
5(most unstable)						
1.26	1.55	1.19	1.54	1.05	0.81	1.06
[.79-2.00]	[.90-2.67]	[.66-2.15]	[.80-2.96]	[.47- 2.32]	[.42-1.58]	[.53-2.12]

Quintiles of Ethnic Concentration

| 5 = most ethnically concentrated						
1	1	1	1	1	1	1
4						
1.91**	**2.09****	**1.64***	1.68	**3.15***	**2.94***	**2.72***
[1.05-3.47]	[.99-4.41]	[.71-3.75]	[.79-3.60]	[1.09-9.08]	[1.09-7.92]	1.07-6.87]
3						
2.06**	**2.37****	**2.07***	2.05	**2.92***	**2.53***	2.16
[1.09-3.88]	[1.14-4.91]	[.97-4.40]	[.93-4.48]	[0.95-8.95]	[.93-6.91]	[.88-5.31]
2						
1.26	**1.79**	1.68	1.35	**2.26***	2.24	1.98
[0.68-2.32]	[.87-3.67]	[.75-3.75]	[.60-2.99]	[.75-6.76]	[.81-6.17]	[.76-5.16]
1 = least ethnically concentrated						
2.42**	**2.99****	**1.95***	2.17	**3.37***	**2.72***	**2.93***
[1.23-4.76]	[1.35-6.61]	[.83-4.57]	[.96-4.88]	[1.02-11.12]	[.94-7.83]	[1.09-7.90]

Estimates significant at *P < 0.05; ** P < 0.01; *** P < 0.001; 'AOR' Adjusted Odds Ratio, 'CI' Confidence Interval

4.6.2 Varying effects of individual and neighbourhood-level factors on overall acceptability of BE interventions aimed at promoting physical activity across different levels of intervention intrusion

Figure 4.7 (a-c) illustrates the varying patterns/trends in the likelihood of acceptability of BE interventions aimed at promoting physical activity for varying levels of intervention for different groups of individuals.

Figure 4.7 (a) shows variation in odds of acceptability for immigrants as compared to those born in Canada. A decreasing trend in the likelihood of support was seen for most intrusive intervention levels, such as guiding choice through disincentives, restricting, and eliminating choice. Immigrants indicated the lowest support for 1st level of intervention (results were not significant) and intervention that guided choice through incentives. On the contrary, as shown in figure 4.7 (b), individuals who self-identified as Indigenous showed a clear upward trend in support with the increasing level of intrusion, with the exception of a drop in the degree of support for interventions that guided choice through incentives. It was evident, that Indigenous respondents were 1.8 to 2.2 times more likely to agree with implementing more intrusive interventions.

In three models, respondents with a university education proved significantly different from the reference group (individuals with a high school education or less). As shown in figure 4.7 (c), individuals with a university education were 30-60% more likely to support interventions belonging to the lowest rung of the intervention ladder. Further, the odds of support peaked (almost 220%) at the 6th level, restricting choice.
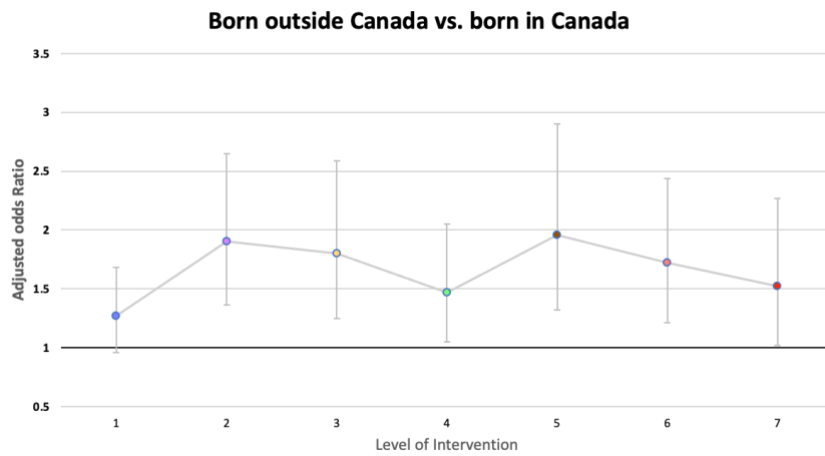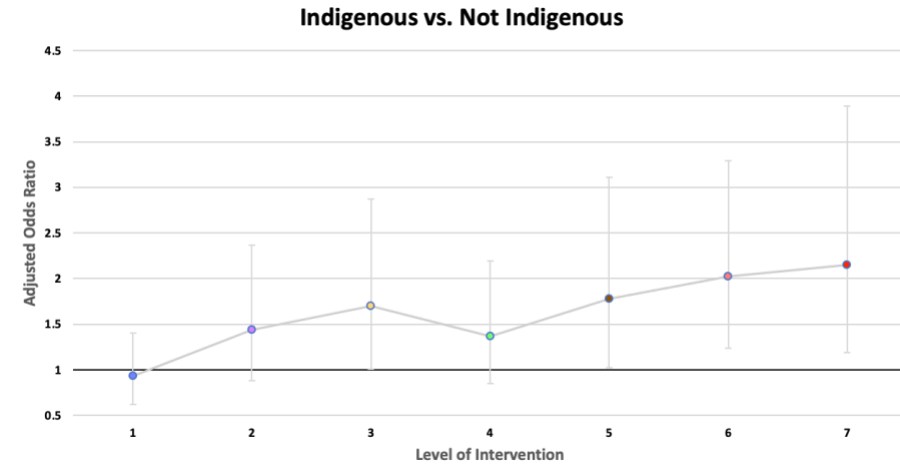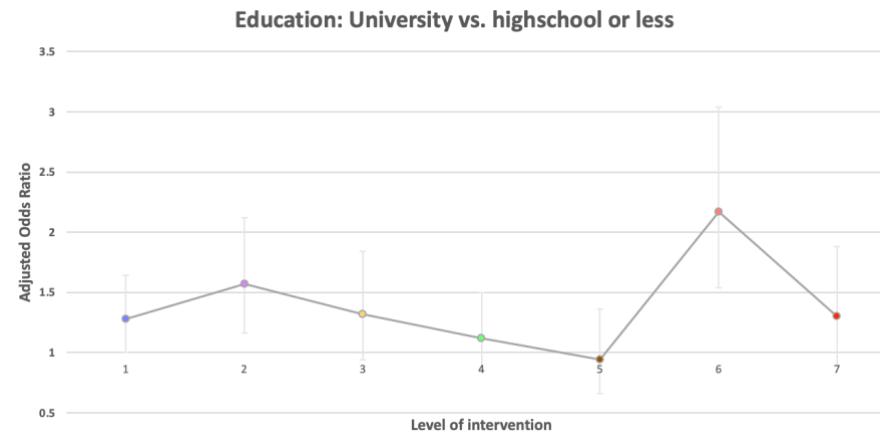
Figure 4.7 (a-c) Association between key individual and neighbourhood-level factors and 'moderate-high' acceptability across different levels of intervention related to physical activity[17]

---

[17] Significant results for 4.7 (a) were found for models of intervention level 2,3,4,5,6 and 7; for 4.7 (b) were 3,5,6 and 7; and 4.7 (c) were 1,2 and 6.

Table 4.7 Association between individual and neighbourhood-level factors and 'moderate-high' acceptability across different levels of interventions related to physical activity

	Provide information	Enable choice	Guide choice through changing the default policy	Guide choice through incentives	Guide choice through disincentives	Restrict choice	Eliminate choice
Individual and neighbourhood-level characters	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
	AOR [95%]	AOR [95%]	AOR [95%]	AOR [95%]	AOR [95%]	AOR [95%]	AOR [95%]
Individual-level factors							
Age							
Above 65	1	1	1	1	1	1	1
18-34	1.08 [.75-1.55]	0.84 [.54-1.30]	0.89 [.55-1.45]	0.74 [.48-1.14]	0.66 [.38-1.12]	1.44 [.90-2.29]	0.67 [.39-1.18]
35-64	1.02 [.78-1.34]	0.72 [.52-1.01]	0.73 [.50-1.07]	0.91 [.66-1.25]	0.68 [.45-1.02]	1.08 [.75-1.57]	0.84 [.55-1.28]
Born in Canada							
Yes	1	1	1	1	1	1	1
No	1.27 [.96-1.68]	**1.90*** [1.36-2.65]	**1.80*** [1.25-2.59]	**1.47*** [1.05-2.05]	**1.96*** [1.32-2.90]	**1.72** [1.21-2.44]	**1.52*** [1.02-2.27]
Indigenous status							
No	1	1	1	1	1	1	1
Yes	0.93 [.62-1.40]	1.44 [.88-2.37]	**1.70*** [1.01-2.87]	1.37 [.85-2.19]	**1.78*** [1.02-3.11]	**2.02** [1.24-3.29]	**2.15** [1.19-3.89]
Current employment							
Employed	1	1	1	1	1	1	1
Unemployed	1.36 [.86-2.15]	1.07 [.62-1.86]	0.96 [.52-1.77]	0.98 [.57-1.68]	0.82 [.41-1.64]	1.29 [.74-2.24]	0.70 [.32-1.53]

Retired	1.22	**0.70***	1.10	0.91	0.93	1.05	1.10
	[.92-1.61]	[.49-.98]	[.74-1.62]	[.65-1.27]	[.61-1.41]	[.72-1.54]	[.71-1.70]
Student and other	1.11	0.94	1.03	1.32	0.82	1.01	1.39
	[.83-1.47]	[.67-1.34]	[.70-1.52]	[.94-1.86]	[.53-1.28]	[.69-1.46]	[.88-2.18]

Educational attainment

high school or less	1	1	1	1	1	1	1
trade school/college	1.06	1.16	0.96	0.98	0.92	1.08	0.85
	[.83-1.35]	[.86-1.57]	[.69-1.34]	[.73-1.30]	[.64-1.33]	[.77-1.53]	[.57-1.25]
University	**1.28***	**1.57****	1.32	1.12	0.94	**2.17*****	1.30
	[1.00-1.64]	[1.16-2.12]	[.94-1.84]	[.84-1.50]	[.66-1.36]	[1.54-3.04]	[.89-1.88]

Annual HH income

Above $80k	1	1	1	1	1	1	1
$40-79k	1.16	1.16	1.18	**1.32***	1.23	**1.30***	1.03
	[.91-1.48]	[.88-1.52]	[.85-1.64]	[1.01-1.74]	[.87-1.72]	[.96-1.76]	[.72-1.48]
$39k or less	1.21	1.26	**1.67***	**1.40***	1.29	1.42*	1.06
	[.91-1.60]	[.86-1.84]	[1.13-2.46]	[.99-1.98]	[.84-1.98]	[.97-2.06]	[.68-1.66]

Perceived Health

Excellent	1	1	1	1	1	1	1
Very good	0.78	0.72	1.08	**0.68***	0.75	**0.59****	**0.58****
	[.58-1.05]	[.51-1.03]	[.73-1.60]	[.48-.96]	[.50-1.12]	[.41-.85]	[.38-.87]
Good	**0.69****	**0.67***	0.89	**0.68***	**0.56****	**0.46*****	**0.54****
	[.52-.93]	[.47-.94]	[.60-1.32]	[.49-.96]	[.37-.85]	[.32-.66]	[.35-.81]
Fair	0.73	0.75	0.91	**0.62***	**0.47****	**0.52****	**0.38*****
	[.51-1.04]	[.49-1.15]	[.57-1.47]	[.41-.93]	[.28-.79]	[.34-.82]	[.22-.66]
Poor	1.06	1.06	0.97	1.10	0.78	1.33	**0.37***
	[.61-1.84]	[.53-2.14]	[.46-2.04]	[.56-2.15]	[.35-1.76]	[.68-2.57]	[.15-.92]

Home tenure

less than 1 year	1	1	1	1	1	1	1
1-5 years	**0.53****	0.83	0.70	0.65	0.62	0.69	1.05
	[.35-.80]	[.50-1.38]	[.42-1.18]	[.40-1.05]	[.35-1.13]	[.42-1.14]	[.56-1.97]
6-10 years	**0.46*****	**0.52***	**0.55***	**0.44****	**0.51***	**0.54***	0.96
	[.29-.72]	[.30-.90]	[.31-.97]	[.26-.75]	[.26-.97]	[.31-.94]	[.49-1.89]
more than 10 years	**0.54****	**0.60***	**0.46****	**0.49****	0.57	**0.59***	0.78
	[.35-.81]	[.36-.98]	[.28-.78]	[.30-.78]	[.32-1.02]	[.36-.97]	[.42-1.44]

Neighbourhood variables

Quintiles of instability

1 (least unstable)	1	1	1	1	1	1	1
2	0.80 [.53-1.19]	1.01 [.60-1.69]	0.84 [.47-1.49]	0.88 [.57-1.34]	0.98 [.57-1.71]	0.91 [.54-1.54]	0.99 [.52-1.85]
3	0.90 [.60-1.35]	1.13 [.62-2.07]	0.96 [.48-1.89]	1.07 [.59-1.95]	0.88 [.42-1.85]	0.79 [.44-1.39]	0.79 [.34-1.83]
4	0.96 [.65-1.42]	1.18 [.72-1.94]	1.06 [.64-1.74]	1.04 [.64-1.70]	1.01 [.56-1.83]	1.02 [.64-1.62]	1.19 [.64-2.21]
5(most unstable)	0.94 [.64-1.37]	1.23 [.79-1.93]	1.15 [.67-1.97]	1.00 [.66-1.53]	1.14 [.60-2.17]	1.16 [.71-1.89]	1.38 [.74-2.59]

Quintiles of Dependency

1 (least dependent)	1	1	1	1	1	1	1
2	1.14 [.85-1.53]	1.09 [.70-1.69]	1.12 [.71-1.76]	1.15 [.76-1.74]	1.12 [.64-1.94]	1.05 [.67-1.63]	0.76 [.39-1.48]
3	0.96 [.63-1.47]	1.07 [.66-1.72]	0.99 [.60-1.65]	0.91 [.49-1.70]	1.01 [.53-1.94]	1.19 [.74-1.93]	0.84 [.42-1.68]
4	0.99 [.65-1.50]	0.90 [.58-1.41]	1.21 [.77-1.90]	0.93 [.59-1.44]	1.18 [.72-1.92]	1.00 [.65-1.55]	0.96 [.57-1.64]
5 (most dependent)	0.96 [.61-1.49]	1.06 [.57-1.99]	1.13 [.59-2.16]	0.97 [.53-1.79]	0.98 [.52-1.85]	1.08 [.64-1.82]	0.84 [.42-1.66]

Quintiles of Ethnic Concentration

1 = least ethnically concentrated	1	1	1	1	1	1	1
2	0.91 [.62-1.34]	0.70 [.42-1.16]	0.74 [.46-1.19]	0.86 [.58-1.29]	0.85 [.51-1.43]	0.79 [.50-1.25]	0.76 [.42-1.35]
3	0.93 [.65-1.33]	0.87 [.55-1.38]	0.81 [.50-1.32]	0.96 [.60-1.54]	0.99 [.59-1.66]	0.99 [.65-1.50]	0.76 [.45-1.29]
4	1.05 [.72-1.51]	0.88 [.51-1.52]	0.85 [.54-1.34]	0.96 [.60-1.55]	1.05 [.61-1.79]	0.92 [.56-1.52]	0.80 [.49-1.31]
5 = most ethnically concentrated)	0.78 [.44-1.36]	0.72 [.33-1.55]	0.55 [.27-1.14]	0.64 [.29-1.38]	0.74 [.28-1.97]	0.75 [.41-1.40]	0.70 [.33-1.48]

Amenity Dense Neighborhood

non-amenity dense neighbourhood	1	1	1	1	1	1	1
amenity dense neighbourhood	0.96	1.09	0.89	1.03	1.01	1.04	0.77
	[.71-1.31]	[.73-1.63]	[.56-1.43]	[.70-1.50]	[.58-1.74]	[.69-1.56]	[.46-1.31]
high amenity density neighbourhood	1.19	1.10	1.74	0.54	0.89	1.04	0.85
	[.32-4.41]	[.27-4.38]	[.40-7.58]	[.08-3.54]	[.16-4.87]	[.27-4.01]	[.15-4.88]

Estimates significant at *P < 0.05; ** P < 0.01; *** P < 0.001; 'AOR' Adjusted Odds Ratio, 'CI' Confidence Interval

CHAPTER 5

DISCUSSION

5.1 General Discussion

The study aimed to estimate the current level of public acceptability of a range of built environment interventions varying in intrusiveness that support a healthy diet and physical activity in Saskatoon and Regina and identify individual and neighbourhood-level factors associated with the level of acceptability of these diverse interventions. A cross-sectional sample of 2133 respondents were examined with linkage to respondents' respective neighbourhood-level characteristics. Further, inspired by the 'Intervention ladder' proposed by Nuffield's council on bioethics, BE interventions were classified into different levels, and the moderating role of intrusiveness of intervention was explored.

Overall support for BE interventions aimed to promote healthy eating and physical activity was 41% and 27%; however, support for individual interventions varied. In both domains, that is, interventions aimed to promote healthy eating and physical activity, as expected, a relatively higher proportion of individuals showed stronger agreement with the least intrusive interventions that represented the lowest rungs of the intervention ladder. These interventions focused mainly on such activities as informing and educating the public and enabling individuals to change their behaviours. This finding supports previous research(147), suggesting that some interventions that were perceived as least intrusive were also perceived to be more effective than others. However, few exceptions were observed with interventions aimed at promoting physical activity. Interventions such as creating safer street intersections by increasing curb extensions, reserved bus lanes, separated bike lanes, and city speed limit though they represented the 2nd and 3rd level of the intervention ladder, were supported by a relatively lower proportion of individuals. It should be noted that such interventions may also

imply a disincentive for drivers but an incentive for walkers/cyclists. Perhaps, respondents' perspective and hidden trade-offs have significantly influenced their decision and support shown for these interventions.

A relatively lower proportion of agreement was observed for most of the more intrusive interventions: tax on sugar beverages, limiting fast-food close to schools, limiting beverage size in municipal buildings, eliminating junk food in restaurants, vending machines, etc., road tolls to enter downtown, traffic calming through narrow streets and speedbumps, and closing entire streets to motor vehicles. Further, the lowest proportion of people supported interventions that incur a monetary loss, such as tax on sugar-sweetened beverages and road tolls to enter downtown. However, this was not true for other interventions of a similar level of intrusiveness, such as increased fines for motor vehicle drivers and cyclists, as comparatively more people were supportive of these interventions.

It is important to note that all the BE items consisted of a larger proportion of people who were rather indecisive, i.e., reported somewhat agree or somewhat disagree, than firm decisions like strongly agree or strongly disagree. In a related study, Kawa and colleagues(148) grouped survey individuals into 3 clusters: nudgeable, conditionally mixed nudgeable, and un-nudgeable. The 'nudgeable individuals' seemed to accept all interventions equally, while the 'un-nudgeable' group showed low acceptance of almost all interventions and generally appeared uninterested. However, the exciting finding is that the 'conditionally mixed nudgeable' group was divided in their acceptance. Moreover, for these individuals, accepting a nudge depended on certain conditions. However, these individuals were similar to the nudgeable cluster regarding their perception of influential factors such as perceived social norms. The large proportion of individuals indicating only slight agreement or disagreement can be compared to this 'conditionally mixed nudgeable' cluster.

In examining the collective perception of interventions as a function of the types of interventions represented in the ladder, a higher proportion of people showed moderate to high support for interventions that are less intrusive. In contrast, a lower proportion of people supported more intrusive interventions. This is directly in line with previous studies indicating higher support for interventions of lower intrusiveness(148,149).

Interventions that guide choice through changing the default policy showed a drop in support while moving along the intervention ladder, which can partly be explained by the nature and type of interventions represented in this level (i.e., 3rd level of the intervention ladder). For instance, the public did not welcome changing side dishes in restaurants for a healthier option, separated bike lanes, and limiting speed in the entire city to 40km/hr, which reflects that the public was less supportive of interventions that significantly restrict their freedom. Similarly, Hagman and colleagues(149) examined the support for ten different types of nudge-policies and found that all the nudges received majority support except for nudges that involved changing default policy. In support of these findings, another study(147) indicated that changing defaults was perceived as one of the most intrusive types of intervention as well as one of the least effective. Moreover, as mentioned earlier, these interventions may be rewarding for those specific groups of people while unrewarding for others.

In examining individual and neighbourhood-level factors associated with the acceptability, factors such as sex, age, country of birth, current employment, educational attainment, perceived health, and ethnic concentration of neighbourhood of residence were associated with the acceptability of BE interventions aimed to promote healthy eating. On the other hand, factors such as country of birth, Indigenous status, educational attainment, annual household income, perceived health, home tenure, home type, favourability of active living

environment, and residential instability were significantly associated with the acceptability of BE interventions related to physical activity.

In both domains, a higher proportion of immigrants and individuals with university education indicated 'moderate-high' support. Moreover, the odds of acceptability were 45% to 88% higher for immigrants and those with a university education compared to individuals born in Canada and with a high school education or less. Further, perceived health showed a 'U' shaped relationship, with a higher proportion of individuals who perceived their health as either excellent or poor showing a higher proportion of agreement than those who rated their health in-between. This finding can partly be explained by the tendency of healthy people aspiring to improve or maintain their health and those with relatively poor health wanting to improve health and use the opportunities that are made available.

A higher proportion of agreement with BE interventions related to food was observed among women and younger (18-34 years) and older adults (above 65 years). Similarly, Reisch and Sustain(134) examined approval for fifteen different types of nudges across six European nations. They found that older adults (70 years and above) support nudges, especially those involving information provision, more than the younger population. Further, after controlling for other factors, women proved twice as likely to agree with implementing food interventions than men – a finding consistently documented by various other studies (134,147).

A higher proportion of individuals who self-identified as Indigenous, those with lower income, and those who had been residing in their residence for less than five years indicated support for implementing BE interventions related to physical activity. Further, in the multivariable analysis, it was found that those who resided in their current residence for more than five years were 44-55% less likely to show support interventions promoting physical activity than those who lived for less than five years.

Additionally, after controlling for individual-level factors, respondents living in the least ethnically concentrated neighbourhoods were almost four times more likely to support interventions promoting a healthy diet than those from most ethnically concentrated neighbourhoods. Further, respondents representing other quintiles of ethnic concentration also showed a higher likelihood of support than those from most ethnically concentrated neighbourhoods.

Quite interestingly, while comparing individual-level effects to that of neighbourhood-level, there seemed to be an opposite effect. That is, immigrants and Indigenous respondents were more supportive of BE interventions; conversely, neighbourhoods with the most ethnic concentration showed relatively lower support. It should be noted, however, that with the exception of neighbourhood attribute, ethnic concentration, other attributes of neighbourhoods were not significantly associated with the acceptability of BE intervention related to food or physical activity. In Chapter 2, a conceptual model proposed by Gifford and colleagues(138) was discussed to hypothesise how individuals' personal factors such as age, income, length of residence, and the physical aspects of their residential environment influence their thinking (i.e., satisfaction, attachment) and behaviour (i.e., mobility, leisure). However, the present study did not show a robust relationship between the neighbourhood attributes and individuals' acceptability of the BE interventions, especially after controlling for individual factors. One plausible explanation is the affinity of individuals for the status quo. The seminal study by William and Richard(150) showed that individuals' decisions tend to carry the status quo, and they prefer to let things as they are currently. People select and reside in neighbourhoods based on a mix of characteristics that they prefer and benefit them. Therefore, they might treat such neighbourhood and its aspects as "the right amount" of intervention that is ideal for their lifestyle.

In examining the effects of individual and neighbourhood-level factors across different levels of intrusion, a consistent finding across all levels of interventions related to food was that women approve of BE interventions more than men do. In addition, women showed a relatively increased likelihood of support for interventions at the less intrusive end of the continuum. However, the likelihood of women's support remained stronger for most intrusive interventions related to food that focused on restricting and eliminating choice. Studies have attributed this tendency to women having greater empathetic concerns(151) and interest in healthy eating(152) than men.

Immigrants, overall, showed a higher likelihood of support for all interventions except for, surprisingly, the interventions that guides choice through incentives. The highest likelihood of support from immigrants was indicated for the most intrusive level of intervention: eliminating choice. Conversely, for interventions related to physical activity, the degree of likelihood of support declined with the increasing level of intrusiveness. Another noteworthy finding was that the Indigenous respondents showed an increased likelihood of support for interventions with increasing levels of intrusion. They showed the highest likelihood of support for intervention eliminating choice. Hagman and colleagues(149) assessed the public attitudes toward nudge interventions that focused on private (e.g., cafeteria re-design) and social welfare (e.g., organ donation) among Sweden and American respondents. The authors also examined respondents' perceived intrusiveness of the interventions. Almost 80% of the respondents reported Cafeteria re-design as acceptable, although 65% of them viewed it as intrusive to freedom of choice.

Another study(148) that investigated the factors affecting the acceptance of healthy eating nudges in a cafeteria setting among university students found that the students' perceived responsibility of a cafeteria or university to promote healthy eating influenced their acceptability. A relatable finding in the present study is that individuals of all socio-

demographic groups, i.e., women, immigrants, and retired individuals, showed an increased likelihood of support for interventions of a higher level of intrusion that included limiting beverage size in municipal buildings, limiting fast-food close to schools and eliminating junk food in restaurants, vending machines, etc. Perhaps, individuals perceive places like schools and municipal buildings as responsible for promoting healthy eating, thus showing a higher likelihood of support.

The present study employed Nuffield's 'intervention ladder' to classify and examine BE interventions as per their level of intrusion. However, several studies have used alternate taxonomies to organize diverse interventions. For instance, Hansen and Jespersen(153) used the cognitive mechanism to distinguish nudges/intervention as system 1 and system 2, where system 1 uses intuitive and automatic thinking, and system 2 uses reflective and rational thinking. Automatic thinking is characterised by being fast, instinctive, and effortless, while reflective thinking needs conscious processing of information. Felsen and colleagues(154), in a survey conducted on people in Canada and the United States, found that system 2 nudges were generally preferred over system 1. It should be noted that the classification of the interventions based on Nuffield's intervention ladder provides a comprehensive guide and model for policymakers and public health officials to distinguish and organize built environment interventions as per their intrusiveness. However, this classification does not denote the perceived intrusiveness of the intervention receivers (i.e., the public) and is not considered a gold standard.

In summary, it was evident from the study findings that all interventions and their intrusiveness are not judged the same. The findings show that there were significant differences in who supported and who did not the types of interventions related to healthy eating and active living. In contrast to the expectations, however, the findings did not support a clear and robust

relationship between the type of neighbourhoods and the acceptability of built environment changes.

5.2 Study findings, timeline, and status quo

The data utilized in this current study were collected between October 6, 2020, and December 23, 2020, which may have several implications with regard to the study findings. As shown in Figure 5.1, in Saskatoon, Rapid Bus Transit (RBT) project was initiated by the City of Saskatoon in 2018. The project was proposed to meet the transportation needs of the growing city and provide infrastructure and support for greater use of walking and cycling for work and personal use by improving travel speed, reliability, capacity, and customer experience through transit signal priority, geometric priority, improved station, customer systems, and separated lanes. In April 2019, protected bike lanes in Saskatoon were a topic of debate in the city council. Dedicated bike lanes were added to the city's downtown in 2015 to keep cyclists safe and to promote cycling. However, the project failed to reach a consensus between local businesses and the cycling community and was strongly opposed by other stakeholders (Mayor and city council), eventually leading to the removal. Similarly, in October 2019, the city of Regina opened Regina's first two-way protected bike lane. In the same year, the city of Saskatoon closed the building that functioned as the farmer's market. However, there was persistent customer demand for farmer's market products.

The present study showed lower support for increasing reserved bus lanes, priority lights for busses and separated bike lanes and, the highest support for creating farmer's market. These results, collectively, may reflect respondents' attitudes towards the existing or failed attempts to transform the built environment. In addition to intrusiveness of interventions, factors such as perceived effectiveness, social/personal gain, and individuals' past and current

decisions may have significantly influenced the results. The power of some individual's preference of the status quo should not be underestimated.
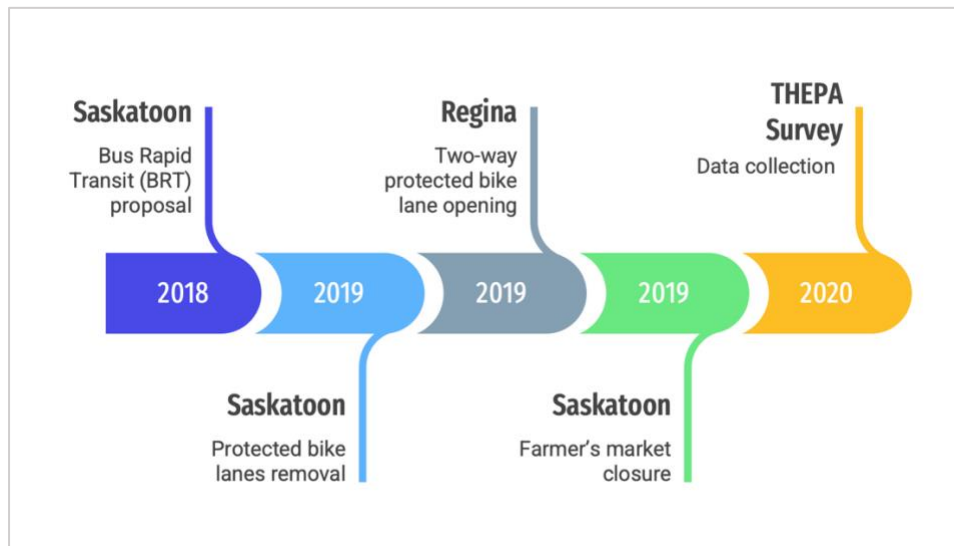
Figure 5.1 Timeline of events prior to surveying the respondents

5.3 Strength and limitations of the study

The present study is unique in many ways. Firstly, the study is strengthened by examining both individual and neighbourhood-level factors and their influence on the acceptability of BE interventions related to food and physical activity. Previous studies have often been limited by a selection of one or fewer interventions. The present study covered a wide range of BE interventions targeted to improve healthy eating and physical activity, expanding our understanding of potential variability in public acceptability for different types of intervention. Moreover, concurrently, the study explored two important domains in public health and health promotion: healthy eating and active living, broadening the knowledge base and allowing comparisons.

Missing neighbourhood-level observations were treated by an appropriate multiple imputation procedure, which is expected to produce unbiased estimates. However, only 64% of the observations were assigned to FSA in the primary data to link to the respondents' neighbourhood attributes, and 36% of the respondents' assignment to FSA was imputed, which might have affected the true relationship between the neighbourhood variables and acceptability. Then, multilevel regression analyses were conducted to account for the hierarchical structure of the data (individuals nested within neighbourhoods).

Another major strength of the study is its considerably large sample size. Although the sample was not perfectly representative of the actual urban population of Saskatchewan, appropriate weighting increases the generalizability of the study findings. However, a relatively smaller sample, for example, the Indigenous and immigrant population, may have impacted the statistical power of the regression analyses.

The results did not support the study hypothesis regarding neighbourhood and public acceptability. Some of the source data employed to link neighbourhood-level factors were old. Although it is probable that no actual relationship exists between neighbourhood characteristics and the acceptability of BE interventions, it is critical to test this hypothesis using the most recent data, especially data that corresponds in time to when the respondents participated in the survey. Further, the results of this study are based on the interventions we examined. Although these interventions have been included after a robust selection process, there is no guarantee that they will generalise to other interventions.

Finally, the study may suffer from a number of inherent biases pertaining to cross-sectional surveys, such as non-response bias, sampling bias, and social-desirability bias. Nevertheless, the study findings add to the existing knowledge on the public acceptability of BE interventions related to food and physical activity.

5.4 Policy implications and future direction

The present study provides useful, practical implications for designing and implementing BE interventions, particularly those that focus on promoting healthy eating and physical activity among the urban population.

Physical activity and diet are key modifiable risk factors that drive many non-communicable diseases, and BE plays a facilitating role in promoting a healthy lifestyle. In addition, many BE interventions have proved effective in promoting behaviour change. These interventions and policies, however, suffer from a lack of acceptance that challenges the success and effectiveness of the intervention. If policymakers have information on which interventions or level of intervention is perceived as acceptable by which group of people, interventions can be designed and targeted with higher potential effectiveness. Interventions will also prove sustainable if they are deemed acceptable by the target population. Therefore, knowledge of society's general interests and perceptions will facilitate the decision-making process by public policymakers in ways to promote behaviour change.

People generally endorse interventions that promote health, especially those in the realm of healthy eating and physical activity. However, the present study highlights that majority of individuals did not either strongly oppose or strongly agree with interventions. This provides a unique opportunity for public health officials to improve the perceptions of individuals who are mostly indecisive or slightly inclined towards supporting or opposing the intervention.

There are diverse BE interventions, and the present study is novel in examining a wide range of interventions in both domains, thus proving more inclusive in terms of the types of interventions included. However, studies of this kind may provide unique and more in-depth insights when complemented by qualitative research. Nevertheless, the study provides direct

evidence for the differential acceptability of diverse BE interventions related to healthy eating and physical activity. Furthermore, although there are numerous challenges in translating evidence to practice and achieving changes in policies and practices governing the built environment, a collaboration between urban planners, policymakers, and public health officials may enhance the decision-making and planning process in ways that encourage and enable individuals to be more physically active and healthy.

Considering these, future research should continue to investigate the influence of neighbourhood and individual factors on the acceptability of BE interventions, even more in-depth, with a holistic approach.

CHAPTER 6
CONCLUSION

This study provides previously lacking information on the acceptability of a range of interventions aimed at improving a healthy diet and physical activity. In addition, it provides insights into the attributes of individuals that support changes in the built environment and across different levels of intrusiveness of interventions.

It is evident that even though the examples of interventions that were the focus of the study were presented to the respondents in random order, they were perceived by the respondents as having different degrees of intrusiveness and it has been corroborated by the highest support shown for interventions that belonged to the lowest rungs of the Nuffield's intervention ladder in both the food and physical activity domain. However, the study findings suggest that people's judgment of the degree of intrusion of the intervention is not the principal driver of acceptability. When individuals believe that a BE intervention has a legitimate purpose in promoting healthy eating or physical activity, the majority are likely to support it, even if it is more intrusive. However, intrusive interventions are persistently criticized for 'manipulating or eliminating' people's choices. For this reason, it is expected that a stronger justification and clear indication of evidence for the desired effect should be put forth to weigh favourably against any loss of freedom of choice.

Factors such as gender, ethnicity, immigration status, and educational attainment significantly influence people's support for BE interventions. Further, not all strategies that employed fiscal disincentives were perceived as less acceptable. Perhaps, people's judgment was inevitably affected by the perceived effectiveness and invasiveness of the interventions. In addition, perceived social gain, individual gain, and status quo may have influenced the acceptability of some interventions.

Further, it is critical to remember that attitude towards BE interventions depends on the policymaker and the political party associated with the implementation. The same set of interventions that were perceived as acceptable may be opposed and viewed as less favourable when other associated stakeholders are opposed. Support for interventions may also be affected by the framing of interventions as it plays a crucial role in people's judgment and attitude change. For example, individuals might oppose interventions if the question highlighted restrictions on their personal freedom.

The present study could not find clear evidence of the relationship between neighbourhood and acceptability. Perceived neighbourhood factors rather than objective measures may help explain these results because what individuals perceive their neighbourhood to may be different from what they actually are. Perhaps, examining these factors will shed light on the mediating effect of neighbourhood of residence.

Public policymakers often encounter the issue of respecting the autonomy or potential beneficial outcome while implementing interventions and policies aimed to promote health. Information of this kind on how the public deems the acceptability of interventions and how the degree of acceptability is influenced by the demographics and intrusion of the intervention may help policymakers plan and redesign interventions in ways that is more acceptable, thus successful.

REFERENCES

1. World Health Organization. Noncommunicable diseases country profiles 2018. World Health Organization. World Health Organisation. 2018.

2. Bennett JE, Stevens GA, Mathers CD, Bonita R, Rehm J, Kruk ME, et al. NCD Countdown 2030: worldwide trends in non-communicable disease mortality and progress towards Sustainable Development Goal target 3.4. Vol. 392, The Lancet. 2018.

3. World Health Organization. Global Health Estimates 2018: Disease burden by Cause, Sex, by Country and Region, 2000-2016. World Health Organization. 2018;

4. WHO. WHO. Global status report on noncommunicable diseases 2010: description of the global burden of NCDs, their risk factors and determinants. New Dir Youth Dev. 2013;2013(140).

5. World Health Organization. World Health Organization. Global status report on non-communicable diseases.2014. WHO Library. 2014;(2014).

6. Risks G health. Global health risks : mortality and burden of disease attributable to selected major risks Geneva. WHO PRESS. 2016;

7. Vuori I. Health benefits of physical activity with special reference to interaction with diet. Public Health Nutr [Internet]. 2001 Apr 27 [cited 2021 Sep 20];4(2b):517–28. Available from: https://www.cambridge.org/core/product/identifier/S1368980001001434/type/journal_article

8. Warburton DER, Bredin SSD. Health benefits of physical activity: A systematic review of current systematic reviews. Vol. 32, Current Opinion in Cardiology. 2017.

9. Chastin SFM, de Craemer M, de Cocker K, Powell L, van Cauwenberg J, Dall P, et al. How does light-intensity physical activity associate with adult cardiometabolic health and mortality? Systematic review with meta-analysis of experimental and observational studies. Vol. 53, British Journal of Sports Medicine. 2019.

10. Morris JN, Heady JA, Raffle PAB, Roberts CG, Parks JW. CORONARY HEART-DISEASE AND PHYSICAL ACTIVITY OF WORK. The Lancet. 1953;262(6795).

11. World Health Organization. Global Recommendations on Physical Activity for Health WHO, Geneva 2010. Vol. 60, Global Recommendations on Physical Activity for Health. 2010.

12. Tabák AG, Herder C, Rathmann W, Brunner EJ, Kivimäki M. Prediabetes: A high-risk state for diabetes development. Vol. 379, The Lancet. 2012.

13. Reduction of the incidence of type 2 diabetes with lifestyle intervention or metformin. Vol. 34, International Urology and Nephrology. 2002.

14. Sofi F, Cesari F, Abbate R, Gensini GF, Casini A. Adherence to Mediterranean diet and health status: Meta-analysis. BMJ. 2008;337(7671).

15. Mills S, Brown H, Wrieden W, White M, Adams J. Frequency of eating home cooked meals and potential benefits for diet and health: Cross-sectional analysis of a population-based cohort study. International Journal of Behavioral Nutrition and Physical Activity. 2017;14(1).

16. Zmora N, Suez J, Elinav E. You are what you eat: diet, health and the gut microbiota. Vol. 16, Nature Reviews Gastroenterology and Hepatology. 2019.

17. Bradbury KE, Appleby PN, Key TJ. Fruit, vegetable, and fiber intake in relation to cancer risk: Findings from the European Prospective Investigation into Cancer and Nutrition (EPIC). In: American Journal of Clinical Nutrition. 2014.

18. Rhodes RE, Janssen I, Bredin SSD, Warburton DER, Bauman A. Physical activity: Health impact, prevalence, correlates and interventions. Psychol Health. 2017;32(8).

19. Dunn AL, Trivedi MH, O'Neal HA. Physical activity dose-response effects on outcomes of depression and anxiety. In: Medicine and Science in Sports and Exercise. 2001.

20. Warburton DER, Gledhill N, Quinney A. The effects of changes in musculoskeletal fitness on health. Canadian Journal of Applied Physiology. 2001;26(2).

21. Teychenne M, White RL, Richards J, Schuch FB, Rosenbaum S, Bennie JA. Do we need physical activity guidelines for mental health: What does the evidence tell us? Ment Health Phys Act. 2020;18.

22. Cooney G, Dwan K, Mead G. Exercise for depression. JAMA - Journal of the American Medical Association. 2014;311(23).

23. da Silva MA, Singh-Manoux A, Brunner EJ, Kaffashian S, Shipley MJ, Kivimäki M, et al. Bidirectional association between physical activity and symptoms of anxiety and depression: The whitehall II study. Eur J Epidemiol. 2012;27(7).

24. Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: A systematic analysis for the Global Burden of Disease Study 2010. The Lancet. 2012;380(9859).

25. Janssen I. Health care costs of physical inactivity in Canadian adults. Applied Physiology, Nutrition and Metabolism. 2012;37(4).

26. Kipping RR, Jago R, Lawlor DA. Obesity in children. Part 1: Epidemiology, measurement, risk factors, and screening. Vol. 337, BMJ. 2008.

27. The Lancet Gastroenterology & Hepatology. Obesity: another ongoing pandemic. Vol. 6, The Lancet Gastroenterology and Hepatology. 2021.

28. Hebebrand J, Hinney A. Environmental and Genetic Risk Factors in Obesity. Vol. 18, Child and Adolescent Psychiatric Clinics of North America. 2009.

29. Pi-Sunyer FX. Health implications of obesity. In: American Journal of Clinical Nutrition. 1991.

30. Pi-Sunyer X. The medical risks of obesity. Postgrad Med. 2009;121(6).

31. Apovian CM. Obesity: definition, comorbidities, causes, and burden. Vol. 22, The American journal of managed care. 2016.

32. Statistics Canada. Health Fact Sheets Overweight and obese adults, 2018. Statistics Canada. 2019.

33. Bancej C, Jayabalasingham B, Wall RW, Rao DP, Do MT, de Groh M, et al. Trends and projections of obesity among Canadians. Health Promotion and Chronic Disease Prevention in Canada. 2015;35(7).

34. Fogelholm M, Kukkonen-Harjula K. Does physical activity prevent weight gain - A systematic review. Vol. 1, Obesity Reviews. 2000.

35. Donnelly JE, Blair SN, Jakicic JM, Manore MM, Rankin JW, Smith BK. Appropriate physical activity intervention strategies for weight loss and prevention of weight regain for adults. Vol. 41, Medicine and Science in Sports and Exercise. 2009.

36. Swift DL, Johannsen NM, Lavie CJ, Earnest CP, Church TS. The role of exercise and physical activity in weight loss and maintenance. Prog Cardiovasc Dis. 2014;56(4).

37. Boulé N, Prud'homme D. Physical Activity in Obesity Management. Canadian Adult Obesity Clinical Practice Guidelines: Physical Activity in Obesity ManagementAvailable from: https://obesitycanada.ca/guidelines/physicalactivity Accessed [date]. 2020;

38. Rippe JM, Hess S. The role of physical activity in the prevention and management of obesity. J Am Diet Assoc. 1998;98(10 SUPPL. 2).

39. World Health Organization. Diet, nutrition and the prevention of chronic diseases. Report of a Joint WHO/FAO expert consultation. WHO technical report series no. 916. Vol. 916, WHO technical report series. 2003.

40. Rolls BJ, Morris EL, Roe LS. Portion size of food affects energy intake in normal-weight and overweight men and women. American Journal of Clinical Nutrition. 2002;76(6).

41. Karl JP, Roberts SB. Energy density, energy intake, and body weight regulation in adults. Advances in Nutrition. 2014;5(6).

42. Vernarelli JA, Mitchell DC, Rolls BJ, Hartman TJ. Dietary energy density is associated with obesity and other biomarkers of chronic disease in US adults. Eur J Nutr. 2015;54(1).

43. Bray GA, Siri-Tarino PW. The Role of Macronutrient Content in the Diet for Weight Management. Vol. 45, Endocrinology and Metabolism Clinics of North America. 2016.

44. Hooper L, Abdelhamid A, Moore HJ, Douthwaite W, Skeaff CM, Summerbell CD. Effect of reducing total fat intake on body weight: Systematic review and meta-analysis of randomised controlled trials and cohort studies. Vol. 345, BMJ (Online). 2013.

45. Smethers AD, Rolls BJ. Dietary Management of Obesity: Cornerstones of Healthy Eating Patterns. Vol. 102, Medical Clinics of North America. 2018.

46. Hills AP, Byrne NM, Lindstrom R, Hill JO. Small changes to diet and physical activity behaviors for weight management. Vol. 6, Obesity Facts. 2013.

47. Sallis JF, Glanz K. Physical activity and food environments: Solutions to the obesity epidemic. Milbank Quarterly. 2009;87(1).

48. Moore L v., Diez Roux A v., Nettleton JA, Jacobs DR. Associations of the local food environment with diet quality - A comparison of assessments based on surveys and geographic information systems. Am J Epidemiol. 2008;167(8).

49. Frank LD, Engelke PO. The built environment and human activity patterns: Exploring the impacts of urban form on public health. J Plan Lit. 2001;16(2).

50. Egger G, Swinburn B. An "ecological" approach to the obesity pandemic. Vol. 315, British Medical Journal. 1997.

51. Diez Roux A v. Residential Environments and Cardiovascular Risk. In: Journal of Urban Health. 2003.

52. Cummins S, Macintyre S. Food environments and obesity - Neighbourhood or nation? Vol. 35, International Journal of Epidemiology. 2006.

53. Schulz A, Northridge ME. Social determinants of health: Implications for environmental health promotion. Vol. 31, Health Education and Behavior. 2004.

54. de Vet E, de Ridder DTD, de Wit JBF. Environmental correlates of physical activity and dietary behaviours among young people: A systematic review of reviews. Obesity Reviews. 2011;12(5).

55. Booth ML, Owen N, Bauman A, Clavisi O, Leslie E. Social-cognitive and perceived environment influences associated with physical activity in older Australians. Prev Med (Baltim). 2000;31(1).

56. World Health Organization (WHO). Interventions on diet and physical activity. What works? Summary Report. In: WHO, ed. World Health Organization. 2009.

57. Sallis JF, Bauman A, Pratt M. Environmental and policy interventions to promote physical activity. In: American Journal of Preventive Medicine. 1998.

58. Kahn EB, Ramsey LT, Brownson RC, Heath GW, Howze EH, Powell KE, et al. The effectiveness of interventions to increase physical activity: A systematic review. Vol. 22, American Journal of Preventive Medicine. 2002.

59. Brownson RC KJMRPKRL. The Effectiveness of Urban Design and Land Use and Transport Policies and Practices to Increase Physical Activity: A Systematic Review. J Phys Act Health. 2006;3(2).

60. Humpel N, Owen N, Leslie E. Environmental factors associated with adults' participation in physical activity. A review. Vol. 22, American Journal of Preventive Medicine. 2002.

61. Fitzpatrick K, Greenhalgh-Stanley N, ver Ploeg M. Food deserts and diet-related health outcomes of the elderly. Food Policy. 2019;87.

62. Papas M, Alberg A, Ewing R, Helzlsouer K, Gary-Webb T, Klassen A. The Built Environment and Obesity. Epidemiol Rev. 2007 Oct;29:129–43.

63. Lopez RP. Neighborhood risk factors for obesity. Obesity. 2007;15(8).

64. Statistics Canada. Canada's rural population since 1851. Census in Brief. 2015.

65. Public Health Agency of Canada, Canada PHA of, Public Health Agency of Canada. The Chief Public Health Officer's Report on the State of Public Health in Canada 2017 – Designing Healthy Living. Growing Older - Adding Life to Years. 2017.

66. Pohanka M, Fitzgerald S. Urban sprawl and you: how sprawl adversely affects worker health. Vol. 52, AAOHN journal : official journal of the American Association of Occupational Health Nurses. 2004.

67. Frumkin H. Urban sprawl and public health. Vol. 117, Public Health Reports. 2002.

68. Turcotte M. Dependence on cars in urban neighbourhoods. Statistics Canada. 2005.

69. Owen N, Sparling PB, Healy GN, Dunstan DW, Matthews CE. Sedentary behavior: Emerging evidence for a new health risk. Vol. 85, Mayo Clinic Proceedings. 2010.

70. Bento AM, Cropper ML, Mobarak AM, Vinha K. The effects of Urban spatial structure on travel demand in the United States. Review of Economics and Statistics. 2005;87(3).

71. Vlahov D, Galea S. Urbanization, urbanicity, and health. In: Journal of Urban Health. 2002.

72. Smith M, Hosking J, Woodward A, Witten K, MacMillan A, Field A, et al. Systematic literature review of built environment effects on physical activity and active transport - an update and new findings on health equity. International Journal of Behavioral Nutrition and Physical Activity. 2017;14(1).

73. Mayne SL, Auchincloss AH, Michael YL. Impact of policy and built environment changes on obesity-related outcomes: A systematic review of naturally occurring experiments. Obesity Reviews. 2015;16(5).

74. Cohen DA, Golinelli D, Williamson S, Sehgal A, Marsh T, McKenzie TL. Effects of Park Improvements on Park Use and Physical Activity. Policy and Programming Implications. Am J Prev Med. 2009;37(6).

75. Sekhon M, Cartwright M, Francis JJ. Acceptability of healthcare interventions: An overview of reviews and development of a theoretical framework. BMC Health Serv Res. 2017;17(1).

76. Kitson A, Harvey G, McCormack B. Enabling the implementation of evidence based practice: A conceptual framework. Qual Saf Health Care. 1998;7(3).

77. Proctor E, Silmere H, Raghavan R, Hovmand P, Aarons G, Bunger A, et al. Outcomes for implementation research: Conceptual distinctions, measurement challenges, and research agenda. Administration and Policy in Mental Health and Mental Health Services Research. 2011;38(2).

78. Hardus PM, van Vuuren CL, Crawford D, Worsley A. Public perceptions of the causes and prevention of obesity among primary school children. Int J Obes. 2003;27(12).

79. Oliver JE, Lee T. Public opinion and the politics of obesity in America. Vol. 30, Journal of Health Politics, Policy and Law. 2005.

80. Clark MI, Berry TR, Spence JC, Nykiforuk C, Carlson M, Blanchard C. Key stakeholder perspectives on the development of walkable neighbourhoods. Health Place. 2010;16(1).

81. Firth CL, Stephens ZP, Cantinotti M, Fuller D, Kestens Y, Winters M. Successes and failures of built environment interventions: Using concept mapping to assess stakeholder perspectives in four Canadian cities. Soc Sci Med. 2021;268.

82. Stankov I, Howard NJ, Daniel M, Cargo M. Policy, research and residents' perspectives on built environments implicated in heart disease: A concept mapping approach. Int J Environ Res Public Health. 2017;14(2).

83. Schüle SA, Bolte G. Interactive and independent associations between the socioeconomic and objective built environment on the neighbourhood level and individual health: A systematic review of multilevel studies. Vol. 10, PLoS ONE. 2015.

84. Riva M, Gauvin L, Barnett TA. Toward the next generation of research into small area effects on health: A synthesis of multilevel investigations published since July 1998. Vol. 61, Journal of Epidemiology and Community Health. 2007.

85. Institute of Medicine. Does the Built Environment Influence Physical Activity?: Examining the Evidence - Special Report 282. Washington, DC: The National Academies Press. 2005.

86. Popkin BM, Adair LS, Ng SW. Global nutrition transition and the pandemic of obesity in developing countries. Nutr Rev. 2012;70(1).

87. Arena R, McNeil A, Sagner M, Hills AP. The Current Global State of Key Lifestyle Characteristics: Health and Economic Implications. Vol. 59, Progress in Cardiovascular Diseases. 2017.

88. Monteiro CA. Nutrition and health. The issue is not food, nor nutrients, so much as processing. Vol. 12, Public Health Nutrition. 2009.

89. Roberto CA, Swinburn B, Hawkes C, Huang TTK, Costa SA, Ashe M, et al. Patchy progress on obesity prevention: Emerging examples, entrenched barriers, and new thinking. Vol. 385, The Lancet. 2015.

90. Popkin BM, Duffey K, Gordon-Larsen P. Environmental influences on food choice, physical activity and energy balance. In: Physiology and Behavior. 2005.

91. Hill JO, Peters JC. Environmental contributions to the obesity epidemic. Vol. 280, Science. 1998.

92. Egger G, Swinburn B. An "ecological" approach to the obesity pandemic. BMJ. 1997 Aug 23;315(7106).

93. Davis FD. User acceptance of information technology: system characteristics, user perceptions and behavioral impacts. Int J Man Mach Stud. 1993;38(3).

94. Glanz K, Sallis JF, Saelens BE, Frank LD. Healthy nutrition environments: Concepts and measures. Vol. 19, American Journal of Health Promotion. 2005.

95. Rahmanian E, Gasevic D, Vukmirovich I, Lear SA. The association between the built environment and dietary intake - a systematic review. Vol. 23, Asia Pacific Journal of Clinical Nutrition. 2014.

96. Caspi CE, Sorensen G, Subramanian S v., Kawachi I. The local food environment and diet: A systematic review. Health Place. 2012;18(5).

97. Shannon N. Zenk, Amy J. Schulz, Srimathi Kannan, Laurie L. Lachance, Graciela Mentz, William Ridella. Neighborhood Retail Food Environment and Fruit and Vegetable Intake in a Multiethnic Urban Population. Am J Health Promot. 2012;23(4).

98. Rose D, Richards R. Food store access and household fruit and vegetable use among participants in the US Food Stamp Program. Public Health Nutr. 2004;7(8).

99. Ransley JK, Donnelly JK, Botham H, Khara TN, Greenwood DC, Cade JE. Use of supermarket receipts to estimate energy and fat content of food purchased by lean and overweight families. Appetite. 2003;41(2).

100. Cheadle A, Psaty BM, Curry S, Wagner E, Diehr P, Koepsell T, et al. Community-level comparisons between the grocery store environment and individual dietary practices. Prev Med (Baltim). 1991;20(2).

101. Dixon BN, Ugwoaba UA, Brockmann AN, Ross KM. Associations between the built environment and dietary intake, physical activity, and obesity: A scoping review of reviews. Vol. 22, Obesity Reviews. 2021.

102. Faith MS, Fontaine KR, Baskin ML, Allison DB. Toward the reduction of population obesity: Macrolevel environmental approaches to the problems of food, eating, and obesity. Vol. 133, Psychological Bulletin. 2007.

103. Hollands GJ, Shemilt I, Marteau TM, Jebb SA, Lewis HB, Wei Y, et al. Portion, package or tableware size for changing selection and consumption of food, alcohol and tobacco. Vol. 2017, Cochrane Database of Systematic Reviews. 2015.

104. Auchincloss AH, Mallya GG, Leonberg BL, Ricchezza A, Glanz K, Schwarz DF. Customer responses to mandatory menu labeling at full-service restaurants. Am J Prev Med. 2013;45(6).

105. Dixon BN, Ugwoaba UA, Brockmann AN, Ross KM. Associations between the built environment and dietary intake, physical activity, and obesity: A scoping review of reviews. Vol. 22, Obesity Reviews. 2021.

106. Handy SL, Boarnet MG, Ewing R, Killingsworth RE. How the built environment affects physical activity: Views from urban planning. Am J Prev Med. 2002;23(2 SUPPL. 1).

107. Gordon-Larsen P, Nelson MC, Page P, Popkin BM. Inequality in the built environment underlies key health disparities in physical activity and obesity. Pediatrics. 2006;117(2).

108. Wolch JR, Byrne J, Newell JP. Urban green space, public health, and environmental justice: The challenge of making cities "just green enough." Landsc Urban Plan. 2014;125.

109. Saelens BE, Sallis JF, Frank LD. Environmental correlates of walking and cycling: Findings from the transportation, urban design, and planning literatures. Vol. 25, Annals of Behavioral Medicine. 2003.

110. Hunter RF, Christian H, Veitch J, Astell-Burt T, Hipp JA, Schipperijn J. The impact of interventions to promote physical activity in urban green space: A systematic review and recommendations for future research. Vol. 124, Social Science and Medicine. 2015.

111. Ball K, Bauman A, Leslie E, Owen N. Perceived environmental aesthetics and convenience and company are associated with walking for exercise among Australian adults. Prev Med (Baltim). 2001;33(5).

112. Veitch J, Ball K, Crawford D, Abbott GR, Salmon J. Park improvements and park activity: A natural experiment. Am J Prev Med. 2012;42(6).

113. Tester J, Baker R. Making the playfields even: Evaluating the impact of an environmental intervention on park use and physical activity. Prev Med (Baltim). 2009;48(4).

114. Evenson KR, Herring AH, Huston SL. Evaluating change in physical activity with the building of a multi-use trail. In: American Journal of Preventive Medicine. 2005.

115. Fitzhugh EC, Bassett DR, Evans MF. Urban trails and physical activity: A natural experiment. Am J Prev Med. 2010;39(3).

116. Vadiveloo MK, Dixon LB, Elbel B. Consumer purchasing patterns in response to calorie labeling legislation in New York City. International Journal of Behavioral Nutrition and Physical Activity. 2011;8.

117. Sutherland LA, Kaley LA, Fischer L. Guiding Stars: The effect of a nutrition navigation program on consumer purchases at the supermarket. American Journal of Clinical Nutrition. 2010;91(4).

118. Capacci S, Mazzocchi M, Shankar B, Brambila Macias J, Verbeke W, Pérez-Cueto FJ, et al. Policies to promote healthy eating in Europe: A structured review of policies and their effectiveness. Nutr Rev. 2012;70(3).

119. Edwards N, Barker PM. The importance of context in implementation research. J Acquir Immune Defic Syndr (1988). 2014;67.

120. Kaplan HC, Brady PW, Dritz MC, Hooper DK, Linam WM, Froehle CM, et al. The influence of context on quality improvement success in health care: A systematic review of the literature. Vol. 88, Milbank Quarterly. 2010.

121. Nilsen P, Bernhardsson S. Context matters in implementation science: A scoping review of determinant frameworks that describe contextual determinants for implementation outcomes. Vol. 19, BMC Health Services Research. 2019.

122. Diepeveen S, Ling T, Suhrcke M, Roland M, Marteau TM. Public acceptability of government intervention to change health-related behaviours: A systematic review and narrative synthesis. BMC Public Health. 2013;13(1).

123. Witt JC, Elliott SN, Martens BK. Acceptability of Behavioral Interventions Used in Classrooms: The Influence of Amount of Teacher Time, Severity of Behavior Problem, and Type of Intervention. Behav Disord. 1984;9(2).

124. Humbert ML, Chad KE, Spink KS, Muhajarine N, Anderson KD, Bruner MW, et al. Factors that influence physical activity participation among high- and low-SES youth. Qual Health Res. 2006;16(4).

125. Tannenbaum D, Fox CR, Rogers T. On the misplaced politics of behavioural policy interventions. Nat Hum Behav. 2017;1(7).

126. Nuffield Council on Bioethics. Public health: ethical issues. London, UK; 2007.

127. Kar-Purkayastha I. Public health: ethical issues. Int J Epidemiol. 2009;38(4).

128. Silvia PJ. Reactance and the dynamics of disagreement: Multiple paths from threatened freedom to resistance to persuasion. Eur J Soc Psychol. 2006;36(5).

129. Marteau TM, Hollands GJ, Fletcher PC. Changing human behavior to prevent disease: The importance of targeting automatic processes. Vol. 337, Science. 2012.

130. Hilbert A, Rief W, Braehler E. What determines public support of obesity prevention? Vol. 61, Journal of Epidemiology and Community Health. 2007.

131. Branson C, Duffy B, Perry C, Wellings D. Acceptable Behaviour? Public opinion on behaviour change policy. Behaviour. 2012;

132. Stok FM, de Ridder DTD, de Vet E, Nureeva L, Luszczynska A, Wardle J, et al. Hungry for an intervention? Adolescent's ratings of acceptability of eating-related intervention strategies. BMC Public Health. 2016;16(1).

133. Thaler RH, Sunstein CR. Nudge: Improving decisions about health, wealth, and happiness. Nudge: Improving Decisions about Health, Wealth, and Happiness. 2008.

134. Reisch LA, Sunstein CR. Do europeans like nudges? Judgm Decis Mak. 2016;11(4).

135. Sunstein CR, Reisch LA, Rauber J. A worldwide consensus on nudging? Not quite, but almost. Regul Gov. 2018;12(1).

136. Pe'Er E, Feldman Y, Gamliel E, Sahar L, Tikotsky A, Hod N, et al. Do minorities like nudges? The role of group norms in attitudes towards behavioral policy. Judgm Decis Mak. 2019;14(1).

137. Adams J, Mytton O, White M, Monsivais P. Why Are Some Population Interventions for Diet and Obesity More Equitable and Effective Than Others? The Role of Individual Agency. Vol. 13, PLoS Medicine. 2016.

138. Gifford R, Steg L, Reser JP. Environmental Psychology. In: IAAP Handbook of Applied Psychology. 2011.

139. The Canadian Urban Environmental Health Research Consortium (CANUE). Data portal. Internet. 2022.

140. Statistics Canada. Dissemination area: Detailed definition. 2018.

141. Ross N, Wasfi R, Herrmann T, Gleckner W. Canadian Active Living Environments Database (Can-ALE) User Manual & Technical Document. Geo-Social Determinants of Health Research Group, Department of Geography, McGill University: Montreal, QC, Canada. 2018;

142. Setton E, Redivo A. Green roads metrics. 2020.

143. Luan H, Fuller D. Urban Sprawl Index for Canada. 2020.

144. Matheson FI, Dunn JR, Smith KLW, Moineddin R, Glazier RH. Élaboration de l'indice de marginalisation canadien: un nouvel outil d'étude des inégalités. Canadian Journal of Public Health. 2012 Sep 1;103(S2):S12–6.

145. Statistics Canada CM and HC. Proximity Measures Database. Computer file. 2020.

146. Statistics Canada. Census Profile, 2016 Census. 2021.

147. Yi S, Kanetkar V, Brauer P. Customer support for nudge strategies to promote fruit and vegetable intake in a university food service. BMC Public Health. 2022;22(1):1–20.

148. Kawa C, Gijselaers WH, Nijhuis JFH, Ianiro-Dahm PM. Are You "Nudgeable"? Factors Affecting the Acceptance of Healthy Eating Nudges in a Cafeteria Setting. Int J Environ Res Public Health. 2022;19(7):4107.

149. Hagman W, Andersson D, Västfjäll D, Tinghög G. Public views on policies involving nudges. Rev Philos Psychol. 2015;6(3):439–53.

150. Samuelson W, Zeckhauser R. Status Quo Bias in Decision Making. J Risk Uncertain. 1988;1(1):7–59.

151. Sunstein CR, Reisch LA, Kaiser M. Trusting nudges? Lessons from an international survey. J Eur Public Policy. 2019;26(10):1417–43.

152. Wardle J, Haase AM, Steptoe A, Nillapun M, Jonwutiwes K, Bellisie F. Gender differences in food choice: the contribution of health beliefs and dieting. Annals of behavioral medicine. 2004;27(2):107–16.

153. Hansen PG, Jespersen AM. Nudge and the manipulation of choice: A framework for the responsible use of the nudge approach to behaviour change in public policy. European Journal of Risk Regulation. 2013;4(1):3–28.

154. Felsen G, Castelo N, Reiner PB. Decisional enhancement and autonomy: public attitudes towards overt and covert nudges. Judgm Decis Mak. 2013;8(3).

APPENDIX A

Survey Questionnaire

Survey: Final Document

RESIDENTIAL LOCATION

Q1.

Since we are interested in understanding points of view of citizens living in different Canadian cities, can you provide us the name of the city you reside in? _____

Q2.

We are also interested in neighbourhoods. To allow us to identify your neighbourhood …

> a) Could you provide us with the postal code of your residence?

__ __ __ __ __ __

➡️ **If refuse**

Could you provide us with the 3 first digits of your postal code of your residence?

__ __ __

b) How long have you resided at this location?

> Less than one year
> Between 1 year and 5 years
> Between 6 and 10 years
> More than 10 years
> I don't know / I prefer not to answer

c) What type of lodging do you live in?

> Single-family home or semi-detached house
> Duplex or triplex
> Townhouse, apartment, or condo building
> Student residence
> Seniors' residence
> Shelter or crisis center
> I don't know / I prefer not to answer

CHANGES TO LAND USE AND BUILT ENVIRONMENT OF NEIGHBOURHOODS

In the next set of questions, we ask about services, facilities, regulations, and policies related to food that are available in your residential neighbourhood.

For these questions, your residential neighbourhood is the area which is within 15-minute walking distance of where people live. This is often 8 to 10 city blocks.

Q3.

To what extent would you agree with the implementation of each of the following measures in the area where you live? (PLEASE PRESENT ITEMS IN RANDOM ORDER)

	Completely agree	Somewhat agree	Somewhat disagree	Completely disagree	I don't know / I prefer not to answer
1. Hold newspaper, radio, social media campaigns to promote healthy eating	O	O	O	O	O
2. Modify zoning laws to allow creation of new stores selling healthy foods	O	O	O	O	O
3. Offer more urban spaces for community garden and urban agriculture	O	O	O	O	O
4. Change the usual side dish in restaurants for a healthier option like salad instead of fries	O	O	O	O	O
5. Create public markets or farmers markets	O	O	O	O	O
6. Support local and sustainable food production by creating gardens on the roofs of buildings	O	O	O	O	O
7. Impose municipal regulations to limit fast food outlets around schools	O	O	O	O	O
8. Eliminate the offer of chips, candy and other unhealthy foods in restaurants, cafeterias, and vending machines in municipal buildings like arenas and recreation centres	O	O	O	O	O
41. Provide money to purchase healthy foods like fruits and vegetables	O	O	O	O	O
42. Impose a tax on sugar-sweetened beverages	O	O	O	O	O
44. Organize activities demonstrating how to start a vegetable garden.	O	O	O	O	O
45. Limit the size of sugar-sweetened beverages sold in municipal buildings like arenas and recreation centres.	O	O	O	O	O

LIFESTYLE BEHAVIOURS

Q4

We will now ask about the **walking** you have done over the past seven days. This includes walking to get around, walking to maintain your health or for your leisure.

a) **In the past seven days,** how many days did you walk for at least ten consecutive minutes?

0 or none
1
2
3
4
5
6
7
I don't know / I prefer not to answer

Ask next questions if person reports walking 10 minutes on at least one day in the previous 7 days. If not, go one to next question

b) On those days that you walked at least 10 consecutive minutes, on average, approximately how much time per day did you spend walking?

Minutes or hours
I don't know / I prefer not to answer

c) And what was the main reason that you walked?

Walking to get around
Walking to stay healthy, for leisure or for the pleasure of walking
Walking the dog
I don't know / I prefer not to answer

Q5

We will now ask about the **bicycling** you have done over the past seven days. This includes bicycling to get around, bicycling to maintain your health or for your leisure or bicycling for the pleasure of bicycling.

a) **In the past seven days**, how many days did you bicycle for at least ten consecutive minutes?

0 or none
1

2
3
4
5
6
7
I don't know / I prefer not to answer

Ask next questions if person reports bicycling 10 minutes on at least one day in the previous 7 days. If not go on to next question

b) On those days that you bicycled for at least ten consecutive minutes, on average, approximately how much time per day did you spend bicycling?

Minutes or hours
I don't know / I prefer not to answer

c) And what was the main reason that you bicycled?

Bicycling to get around
Bicycling to stay healthy, for leisure or for the pleasure of bicycling
Both
I don't know / I prefer not to answer

Q6.

We will now ask about the vigorous physical activity that you perform in your leisure time other than walking and bicycling.

Vigorous physical activity causes you to breathe faster than normal and could include activities like lifting heavy weights, digging, shoveling snow, doing aerobic exercises or practising sports.

Think of the various vigorous physical activities that you did for at least 10 consecutive minutes in the past 7 days.

a) **During the past 7 days**, on how many days did you perform at least one intense physical activity for at least ten consecutive minutes during your leisure time?

0 or none
1
2
3
4
5
6
7
I don't know / I prefer not to answer

Ask this question only if the person reports at least one day when there was vigorous physical activity of at least 10 minutes in the previous 7 days.

b) On average, how long were you vigorously active, on those days that you did at least one physical activity?

> Minutes or hours
> I don't know / I prefer not to answer

Q7

The next questions deal with your use of parks and green space close to your home.

a) **Over the past 7 days**, on how many days did you visit a park or a green space close to your home?

> 0 or none
> 1
> 2
> 3
> 4
> 5
> 6
> 7
> I don't know / I prefer not to answer

Ask this question only if the person reports at least one day when they visited a park or green space in the previous 7 days. If not go to next question.

b) On average, how much time did you spend in the park or green space?

> Minutes or hours
> I don't know / I prefer not to answer

c) And what was the main reason that you visited this park or green space?

> To do some physical activity
> To appreciate nature
> To rest
> To have a picnic
> To allow the children to play
> Other (specify):
> I don't know / I prefer not to answer

Q8

Which of the following statements best describe your gardening habits?

> I garden in the vegetable garden in the yard of my home
> I garden in a lot in a community garden or collective garden
> I garden at my secondary residence

I do little or no gardening
I don't know / I prefer not to answer

CHANGES TO LAND USE AND BUILT ENVIRONMENT OF NEIGHBOURHOODS (CONTINUATION)

In the next set of questions, we ask about services, facilities, regulations, and policies related to transportation and parks that are available in your residential neighbourhood.

For these questions, your residential neighbourhood is the area which is within 15-minute walking distance of where people live. This is often 8 to 10 city blocks.

Q3.

To what extent would you agree with the implementation of each of the following measures in the area where you live? (PLEASE PRESENT ITEMS IN RANDOM ORDER)

	Completely agree	Somewhat agree	Somewhat disagree	Completely disagree	I don't know / I prefer not to answer
9. Educate motor vehicle drivers on proper road sharing behaviours	O	O	O	O	O
10. Broadcast public information messages on active transportation	O	O	O	O	O
11. Improve access to public transportation	O	O	O	O	O
12. Improve greenness by planting trees and flowers	O	O	O	O	O
13. Develop safer street intersections by increasing the number of curb extensions	O	O	O	O	O
14. Build protected bicycle infrastructure like separated bike lanes	O	O	O	O	O
15. Reduce automobile speed limits to maximum 30 km/hr in the vicinity of schools	O	O	O	O	O
16. Implement a speed limit of 40 km/hr throughout the city	O	O	O	O	O
17. Improve public transit infrastructure	O	O	O	O	O
18. Increase the number of reserved bus lanes	O	O	O	O	O
19. Develop new parks	O	O	O	O	O

20. Add road tolls to enter the downtown area	O	O	O	O	O
21. Increase police surveillance and enforcement to have motor vehicle drivers obey traffic laws	O	O	O	O	O
22. Increase the cost of fines for infractions to traffic laws by motor vehicle drivers	O	O	O	O	O
23. Increase police surveillance and enforcement to have bicyclists obey traffic laws	O	O	O	O	O
24. Increase the cost of fines for infractions to traffic laws by bicyclists	O	O	O	O	O
25. Implement traffic calming measures like making streets narrower and adding speed bumps	O	O	O	O	O
26. Close off entire street segments to motor vehicles	O	O	O	O	O
27. Improve play infrastructures and rest areas in parks	O	O	O	O	O
28. Increase the number of priority traffic lights for buses	O	O	O	O	O
29. Ban motor vehicles from circulating in front of schools when students are entering or leaving the school	O	O	O	O	O
30. Ban heavy vehicles from urban centers overnight	O	O	O	O	O
31. Redistribute road space to make more room for pedestrians and cyclists (shared streets)	O	O	O	O	O
38. Improve accessibility to parks and green space by reducing cost of parking	O	O	O	O	O
40. Improve accessibility to parks and green space by reducing cost of public transport to these destinations	O	O	O	O	O
32. Install hydroalcohol dispensers(disinfectant) close to play equipment in parks	O	O	O	O	O
33. Clean benches and play equipment in parks and green spaces	O	O	O	O	O
34. Communicate information related to respecting physical distancing when using of green space and parks	O	O	O	O	O
35. Provide access to public restrooms while requiring people to maintain physical distancing (waiting in line)	O	O	O	O	O
36. Modify the layout of urban furniture in parks to facilitate physical distancing	O	O	O	O	O
37. Delimit perimeters of utilisation to create family bubble spaces in parks	O	O	O	O	O
39. Modify the rules of use of parks and green space to facilitate physical distancing	O	O	O	O	O
43. Develop safer street intersections by increasing crossing time	O	O	O	O	O

Q9.

WHICH of the following statements best describes the work that you do or the main activity that you perform on a daily basis?

I am usually seated during the day and I do not have to move around often
I am often standing up or I often have to move around during the day but I do not have to lift or carry heavy objects
Generally, I lift or carry light objects or I must often go up stairs or inclines
I work hard physically and I carry very heavy objects
I don't know / I prefer not to answer

Q10. Present in the form of a matrix

During an average week, how often do you eat in restaurants?

Everyday
A few times a week
Once a week
Less than once a week
Never
I don't know / I prefer not to answer

Q11

Which situation best describes your lifetime experience with tobacco smoking?

I have never smoked
I quit smoking 12 or more months ago
I quit smoking less than 12 months ago
I smoke regularly or occasionally
I don't know / I prefer not to answer

The next set of questions deal with your sleeping habits.

Q12

How long do you usually spend sleeping each night?
Under less than 4 hours
4 hours to less than 6 hours
6 hours to less than 7 hours
7 hours to less than 8 hours
8 hours or more
I don't know / I prefer not to answer

Q13

How often do you have trouble going to sleep or staying asleep?
Never
Rarely
Sometimes

Most of the time
All of the time
I don't know / I prefer not to answer

LIFE IN YOUR NEIGHBOURHOOD

Q14

The next set of questions focuses what it's like to <u>live in your residential neighbourhood</u> (within 15 minutes walking distance from your home)…

	Completely agree	Somewhat agree	Somewhat disagree	Completely disagree	I don't know / I prefer not to answer
1. People in my neighbourhood are willing to help their neighbours	O	O	O	O	O
2. Mine is a close-knit neighbourhood	O	O	O	O	O
3. People in my neighbourhood can be trusted	O	O	O	O	O
4. People in my neighbourhood generally don't get along with each other	O	O	O	O	O
5. People in my neighbourhood do not share the same values	O	O	O	O	O
6. Community organisations in my neighbourhood can be trusted	O	O	O	O	O
7. Municipal organisations in my neighbourhood can be trusted	O	O	O	O	O
8. Commercial organisations in my neighbourhood can be trusted	O	O	O	O	O
9. My neighbourhood is a healthy place to live	O	O	O	O	O
10. I have a strong sense of belongingness to my neighbourhood.	O	O	O	O	O

YOUR IDEAS ON NEIGBOURHOODS AND LIFESTYLE BEHAVIOUR

Q15

Suggestion pour le questionnaire téléphonique (voir avec les collègues de BIP ce qu'ils en pensent) : poser cette question en dernier en avisant le participant qu'il s'agit de la dernière question/leur demander s'ils ont du temps pour une toute dernière question.

We would like you to write about <u>actions</u> that could make residential neighbourhoods healthier places to live.

What <u>program</u>, <u>construction project</u>, or <u>regulation</u> would make your neighbourhood a healthier place to live?

_____
_____
_____

SOCIODEMOGRAPHIC QUESTIONS

In this last section, we will ask questions to find out more about your personal characteristics.

Q16

Are you: A man
    A woman
    Other (specify):
    I prefer not to answer

Q17

In what year were you born? ___ ___ ___ ___
        I don't know / I prefer not to answer

Q18

In what country were you born?

  _____
    I don't know / I prefer not to answer

Q19

Do you consider yourself an Indigenous person?
    Yes
    No

I don't know / I prefer not to answer

Q20
At home, which language(s) do you speak: French
English
Both English and French
Another language
I don't know / I prefer not to answer

Q21
Aside from yourself, how many adults aged 18 years or over usually reside in your home:
_____ adult(s)
I don't know / I prefer not to answer

Q22
How many youths aged less than 18 years usually reside in your home:
_____ youth(s) aged less than 18 years
I don't know / I prefer not to answer

Q23
Last week, what was your main occupation?
Working at a paid job or self-owned business
Looking for paid work
Going to school
Caring for children
Household work
Retired
Maternity/paternity leave
Long term illness
Volunteering
Care-giving other than for children
Other
I don't know / I prefer not to answer

Q24
In the middle of March 2020 when governments began to implement confinement measures to fight the COVID-19 pandemic, what was your main occupation?
Working at the same paid job or self-owned business
Working at another paid job or self-owned business
Looking for paid work
Going to school

Caring for children
Household work
Retired
Maternity/paternity leave
Long term illness
Volunteering
Care-giving other than for children
Other: specify
I don't know / I prefer not to answer

Q25

Before the confinement of the middle of March, what mode of transportation did you use to get to your main occupation?

My main occupation was done from my home
Car, truck or van — as a driver.
Car, truck or van — as a passenger.
Bus.
Subway or elevated rail.
Light rail, streetcar or commuter train.
Passenger ferry.
Walked to work.
Bicycle.
Motorcycle, scooter or moped.
Other
I don't know / I prefer not to answer

Q26

Ask only if Q25 respondent answers:
Car, truck or van — as a driver.
Car, truck or van — as a passenger.
Bus.
Subway or elevated rail.
Light rail, streetcar or commuter train.
Passenger ferry.
Walked to work.
Bicycle.
Motorcycle, scooter or moped.
Other

Before the confinement of the middle of March, how much time ~~does~~ did it typically take you to get to your main occupation?
Less than 15 minutes

Between 15 and 29 minutes
Between 30 and 44 minutes
Between 45 and 59 minutes
More than 60 minutes
I don't know / I prefer not to answer

Q27

What is the highest level of education training you have completed thus far:
Primary school
High School
Trade school
College technical training
University diploma
I don't know / I prefer not to answer

Q28

What is your annual household income before taxes:
Less than 20 000$
20 000 – 39 999$
40 000 – 59 999$
60 000 – 79 999$
80 000 - 99 999$
100 000 – 119 999$
120 000 – 139 999$
140 000 – 159 999$
160 000 $ and over
I don't know / I prefer not to answer

Q29

Compared to other people of your age, would you say your health is... ?
Excellent
Very good
Good
Fair
Poor
I don't know / I prefer not to answer

Q30

How tall are you? *borne inférieure : 3 pieds, supérieure : 7 pieds (inférieure : 0,90 mètres supérieure : 2,15 mètres)
Feet & inches _____ OR Meters _____
I don't know / I prefer not to answer

Q31

How much to you weigh? *borne inférieure : 50 livres, supérieure : 600 livres (inférieure : 22 kg; supérieure : 275 kg)

Pounds _____ OR Kilogrammes _____

I don't know / I prefer not to answer

Thank you! We are very grateful to you for having completed this survey.

APPENDIX B

Number of observations under each FSA (n=27) in Saskatoon and Regina

Saskatoon		Regina	
FSA	Observations	FSA	Observations
S0K	50	S0G	18
S0L	2	S2V	2
S7C	1	S4L	5
S7H	91	S4N	105
S7J	76	S4P	45
S7K	130	S4R	104
S7L	61	S4S	127
S7M	56	S4T	88
S7N	76	S4V	96
S7R	13	S4W	30
S7S	13	S4X	70
S7T	33	S4Y	7
S7V	22	S4Z	6
S7W	33		
Total	657	Total	703

APPENDIX C

Prevalence of acceptability of BE interventions related to food environment by level of
intervention - Saskatoon and Regina combined

Level of intervention	Weighted % (95% CI)	
	No-low agreement	Moderate-high agreement
Provide information	56.89 [54.1-59.64]	43.11 [40.36-45.9]
Enable choice	43.71 [40.95-46.5]	56.29 [53.5-59.05]
Guide choice through changing the default policy	68.52 [65.84-71.09]	31.48 [28.91-34.16]
Guide choice through incentives	61.03 [58.15-63.83]	38.97 [36.17-41.85]
Guide choice through disincentives	81.26 [78.95-83.37]	18.74 [16.63-21.05]
Restrict choice	71.81 [69.2-74.29]	28.19 [25.71-30.8]
Eliminate choice	72.68 [70.04-75.16]	27.32 [24.84-29.96]

Prevalence of acceptability of BE interventions related to food environment for different
levels of intervention by region – Pearson chi-square test

Level of intervention	Weighted % (95% CI)				P-value
	No-low agreement		Moderate-high agreement		
	Saskatoon	Regina	Saskatoon	Regina	
Provide information	54.69 [51.01-58.33]	45.31 [41.67-48.99]	54.88 [50.68-59]	45.12 [41-49.32]	0.94
Enable choice	53.96 [49.73-58.12]	46.04 [41.88-50.27]	55.74 [52.12-59.31]	44.26 [40.69-47.88]	0.52
Guide choice through changing the default policy	54.91 [51.57-58.21]	45.09 [41.79-48.43]	56.29 [51.34-61.12]	43.71 [38.88-48.66]	0.64
Guide choice through incentives	53.08 [49.51-56.63]	46.92 [43.37-50.49]	57.48 [52.81-62.02]	42.52 [37.98-47.19]	0.14
Guide choice through disincentives	54.55 [51.42-57.66]	45.45 [42.34-48.58]	57.37 [51.04-63.48]	42.63 [36.52-48.96]	0.43
Restrict choice	55.52 [52.28-58.72]	44.48 [41.28,47.72]	53.35 [48.04-58.59]	46.65 [41.41-51.96]	0.49
Eliminate choice	54.52 [51.25-57.75]	45.48 [42.25-48.75]	55.11 [49.67-60.43]	44.89 [39.57-50.33]	0.85

Prevalence of acceptability of BE transformations related to physical activity by level of intervention intrusion – Saskatoon and Regina combined

Level of intervention	Weighted % (95% CI)	
	No-low agreement	Moderate-high agreement
Provide information	55.69 [52.87-58.47]	44.31 [41.53-47.13]
Enable choice	59.78 [56.99-62.51]	40.22 [37.49-43.01]
Guide choice through changing the default policy	77.02 [74.51-79.34]	22.98 [20.66-25.49]
Guide choice through incentives	63.85 [61.09-66.52]	36.15 [33.48-38.91]
Guide choice through disincentives	81.09 [78.74-83.23]	18.91 [16.77-21.26]
Restrict choice	76.79 [74.15-79.24]	23.21 [20.76-25.85]
Eliminate choice	82.68 [80.41-84.73]	17.32 [15.27-19.59]

Prevalence of acceptability of BE transformations related to physical activity for different levels of intervention by region – Pearson chi-square

Level of intervention	Weighted % (95% CI)				P-value
	No-low agreement		Moderate-high agreement		
	Saskatoon	Regina	Saskatoon	Regina	
Provide information	53.88 [50.15-57.57]	46.12 [42.43-49.85]	56.4 [52.24-60.48]	43.6 [39.52-47.76]	0.37
Enable choice	55.52 [52.02-58.98]	44.48 [41.02-47.98]	54.7 [50.25-59.07]	45.3 [40.93-49.75]	0.77
Guide choice through changing the default policy	57.12 [54.04-60.15]	42.88 [39.85-45.96]	49.9 [43.88-55.92]	50.1 [44.08-56.12]	<0.05
Guide choice through incentives	55.41 [51.99-58.78]	44.59 [41.22-48.01]	54.64 [49.96-59.23]	45.36 [40.77-50.04]	0.79
Guide choice through disincentives	55.66 [52.62-58.64]	44.34 [41.36-47.38]	54.73 [48.18-61.12]	45.27 [38.88-51.82]	0.79
Restrict choice	56.23 [53.06-59.35]	43.77 [40.65-46.94]	50.32 [43.98-56.66]	49.68 [43.34-56.02]	0.10
Eliminate choice	56.08 [53.03-59.07]	43.92 [40.93-46.97]	50.53 [43.71-57.33]	49.47 [42.67-56.29]	0.14

APPENDIX D

Ethical approval

UNIVERSITY OF SASKATCHEWAN

Behavioural Research Ethics Board (Beh-REB)   04-Jun-2021

Certificate of Approval Amendment

Application ID: 122

Principal Investigator: Nazeem Muhajarine

Department: Saskatchewan Population Health and Evaluation Research Unit

Locations Where Research Activities are Conducted: Saskatoon, Canada
Toronto, Canada
Montreal, Canada
Vancouver, Canada

Student(s): Allap Judge
Audrey Plante
Craig Albert
Kadia Saint-Onge
Sahana Ramamoorthy
Suvadra Datta Gupta

Funder(s): Centre Hospitalier de L'universite de Montreal

Sponsor: Canadian Institutes of Health Research

Title: MUSE (Multisectoral Urban Systems for health and Equity in Canadian cities)

Approved On: 19-May-2021

Expiry Date: 26-May-2022

Approval Of: Behavioural Amendment Form: 14-May-2021

Student added: Sahana Ramamoorthy

Acknowledgment Of:

Review Type: Delegated Review

CERTIFICATION

The University of Saskatchewan Behavioural Research Ethics Board (Beh-REB) is constituted and operates in accordance with the current version of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TPCS 2 2018). The University of Saskatchewan Behavioural Research Ethics Board has reviewed the above-named project. The proposal was found to be acceptable on ethical grounds. The principal investigator has the responsibility for any other administrative or regulatory approvals that may pertain to this project, and for ensuring that the authorized project is carried out according to the conditions outlined in the original protocol submitted for ethics review. This Certificate of Approval is valid for the above time period provided there is no change in experimental protocol or consent process or documents.

Any significant changes to your proposed method, or your consent and recruitment procedures should be reported to the Chair for Research Ethics Board consideration in advance of its implementation.

ONGOING REVIEW REQUIREMENTS

In order to receive annual renewal, a status report must be submitted to the REB Chair for Board consideration within one month prior to the current expiry date each year the project remains open, and upon project completion. Please refer to the following website for further instructions: https://vpresearch.usask.ca/researchers/forms.php.

Digitally Approved by Joni Aschim OBO Diane Martz, Chair, Behavioural Research Ethics Board
University of Saskatchewan