Impact of a farmers' market nutrition coupon program on diet quality and psychosocial well-being among low-income adults

NCT03952338

October 27, 2024

BACKGROUND

Income is amongst the strongest determinants of diet quality [1, 2] and overall health.[1] A clear socioeconomic gradient exists whereby individuals with lower incomes experience higher rates of nutrition-related chronic diseases [3-5] relative to those with higher incomes. Low household income is also a key determinant of household food insecurity,[6, 7] which is associated with lower diet quality [8-11] and inadequate nutrient intake.[12, 13] Evidence suggests that low-income populations tend to consume diets lower in fruits and vegetables and higher in refined white grains, high-fat meats, fried foods and added fats.[14, 15] These inequities in diet quality may partly explain the greater vulnerability of low-income and food insecure populations to poor health outcomes [14, 16-18] and undernutrition.[12, 13]

The many factors underpinning differential dietary patterns among low-income groups can be conceptualized through the socioecological model.[19, 20] The socioecological model depicts the complex and reciprocal interactions among multiple levels of influence, including individual, social, community, and policy level factors that shape dietary patterns and health outcomes.[19-22] At the individual level, factors such as psychological state [15, 23] and nutrition-related knowledge [23] have been shown to influence dietary patterns.[22, 24-27] For instance, high self-efficacy for consuming fruits and vegetables is associated with greater fruit and vegetable intake.[28, 29] The social level encompasses social and cultural contexts that influence dietary patterns.[23, 30] Low-income populations generally have low social support [29, 31] and social capital,[32-34], which are, in turn, associated with poorer dietary intake and health outcomes.[29, 35] The community level includes the physical environments in which people live and work.[20, 27] Studies from the United States (U.S.) [20, 36-39] and Canada [40] have shown that disadvantaged neighbourhoods generally have more fast food outlets, which are associated with greater purchasing and consumption of unhealthy foods.[37] The policy level

encompasses policies that influence the distribution of dietary patterns and health outcomes across a population.[1, 41] Interventions at the policy level provide significant potential for sustainable, cost-effective and equitable health impacts.[42, 43] Fiscal policies that influence food prices and affordability (e.g., taxation, subsidies) are particularly important for supporting healthy dietary patterns among low-income groups,[44] because the economic resources of low-income populations are often insufficient to purchase healthy foods consistent with dietary recommendations.[14, 45, 46] Given the multi-level contexts in which dietary patterns are situated, interventions at any single level (e.g., individual level interventions) are unlikely to substantially improve diet quality and health outcomes among low-income populations.[20, 47] Policies and interventions that address determinants of poor dietary patterns and ill health at all levels [48-50] are required to effectively reduce nutrition and health inequities.[51, 52] Notably, farmers' market healthy food subsidy programs are growing in interest as multi-component interventions that aim to improve access to and intake of nutritious among low-income populations.[53-56] As government funded food subsidy programs, farmers' market subsidy programs clearly operate at the policy level.

At the community level, farmers' markets have the potential to alleviate barriers associated with accessing healthy foods,[39, 57, 58] as they offer fresh, local produce [39, 59, 60] and can be set up in communities that otherwise have limited access to healthy foods.[61] Although some studies suggest that the high perceived and objective cost of produce at farmers' markets is a barrier for low-income populations,[62-64] others have found that low-income shoppers in the U.S. perceived farmers' market prices to be reasonable/fair,[64] and that farmers' market subsidy programs reduce food insecurity among program participants.[65, 66] Moreover, objective price comparisons in U.S. and Canadian markets showed that prices were lower or comparable to those at other food retailers.[39, 67, 68] Farmers' market food subsidies also support local farmers and promote sustainable local food systems

[69] by increasing awareness of farmers' markets within communities [70] and increasing the customer base, thereby generating increased sales.[71]

Farmers' market food subsidy programs can also influence social level determinants of dietary intake.[28, 72] Farmers' markets act as social spaces, increasing social interactions between community members and farmers,[59, 73] thereby fostering a sense of community and increasing psychosocial well-being of program participants.[74] These social aspects of farmers' markets are particularly important for low-income groups, as social exclusion and isolation are associated with food insecurity and low-income status.[75, 76] Finally, at the individual level, farmers' market healthy food subsidy programs have been shown to improve participant fruit and vegetable intake,[61, 66, 77-80] and farmers' market programs that offer nutrition skill-building activities may enhance participant food- and nutrition-related knowledge and skills [28, 81] and attitudes towards the importance of fruit and vegetable consumption.[81]

Farmers' market food subsidy programs may, therefore, represent a promising multi-level approach to improving the diet quality and psychosocial well-being [82] of low-income populations; however, several knowledge gaps remain.[61] First, given the short-term nature of the intervention, it is unclear whether any positive program outcomes will be sustained over time. However, one study demonstrated that provision of a farmers' market fruit and vegetable subsidy of $10/week for 6 months resulted in an increase in fruit and vegetable intake of 1.4 servings/1000kcal, which was sustained 6 months following program completion.[78] Second, although prior studies have examined the impact of farmers' market subsidies on fruit and vegetable intake,[61, 66, 77-80] psychosocial well-being,[74] and food insecurity,[65, 66] potential positive impacts of farmers' market subsidies on other relevant outcomes such as subjective social status, sense of community, mental well-being, and malnutrition risk have not been examined. Subjective social status and sense of community are closely associated with social

participation and support.[83-85] In addition, poor mental well-being (e.g., depression, stress) in low-income populations is often linked to financial strain [86, 87] and social isolation and exclusion.[76] Therefore, we hypothesize that the combined financial support from subsidies and the social aspects of shopping at farmers' markets and participating in skill-building activities may improve participants' mental well-being, subjective (i.e., perceived) social status, and sense of community. Moreover, farmers' market subsidies may influence malnutrition risk by providing additional funds to purchase nutritious foods.

In addition, most previous studies have been cross-sectional [57, 77, 88-92] or used a pre/post design,[53, 56, 93] and/or lacked a control group,[56, 57, 94] each of which does not allow for causal inference.[61] Most have also been conducted over short time frames. Randomized controlled trials (RCT) conducted over longer time frames can provide stronger evidence of the dietary and health impacts of farmers' market food subsidy programs and their sustainability over time.[61] Furthermore, most studies have only assessed changes in fruit and vegetable consumption and have measured dietary intake using brief fruit and vegetable screeners [61] rather than more comprehensive and valid assessment tools such as food frequency questionnaires and 24-hour dietary recalls.[61, 70] Assessment of overall dietary intake is important, as when one aspect of diet changes, such as fruit and vegetable intake, concurrent changes occur in other aspects of dietary intake.[95] Moreover, studies suggest that use of farmers' market food subsidies may differ according to age and sex;[80, 96-98] however, evidence is limited on how the impacts of such programs vary across these groups. Finally, the majority of studies have been conducted in the U.S., and evidence from other nations is sparse.[39]

In British Columbia (BC), Canada, the average monthly cost to purchase a healthy diet for a family of four is $1,019,[99] nearly one-half the income from low-wage employment.[100] The BC Farmers' Market Nutrition Coupon Program (FMNCP) is a healthy eating initiative that offers a healthy food subsidy, along

with supportive nutrition skill-building activities, for low-income populations.[101] It is the only government-funded program of this type in Canada. Between 2007 and 2017, households received $15/week. This amount was determined based on a U.S. farmers' market coupon program that provided on average $10-30 for participants [102] and based on the availability of funds. The amount increased to $21/week in 2017 to account for increased food costs. In 2018, the BC FMNCP served over 11,000 individuals, including 532 pregnant women, 1,084 seniors, and 4,965 children.[103] The program facilitates access to nutritious foods for low-income families, pregnant women, and older adults by providing participants with coupons valued at $21/week to purchase fruits, vegetables, dairy, meat/poultry/fish, eggs, nuts, and cut herbs from participating BC farmers' markets.[101] Farmers' markets that participate in the BC FMNCP operate 1-2 days per week, with hours that vary by location. While coupons may only be redeemed from June to November, most communities offer indoor markets that are open year-round.[101, 104] The goal of the BC FMNCP is to provide financial support for low-income households to purchase and consume healthier foods, thereby improving diet quality [47, 105] and overall health.[106, 107] The program also aims to minimize further marginalization of low-income individuals by encouraging their participation in farmers' markets, which are important social spaces that may foster social and mental well-being.[54, 108, 109] Currently, the FMNCP operates in 57 BC communities and reaches over 3900 households;[101] however, the need remains substantial, with over 15 communities on waiting lists to participate. It is unclear if the BC FMNCP is achieving its aims, as the program's outcomes have not been rigourously investigated.

This study was co-designed with the BC Association of Farmers' Markets and the FMNCP in order to achieve the following objectives:

1) Conduct a RCT to examine the impact of the BC FMNCP on the following outcomes immediately post-intervention and at 16 weeks post-intervention among low-income adults:

a. mean overall diet quality (primary outcome);

b. mean diet quality subscores, mental well-being scores, sense of community, odds of experiencing household food insecurity and odds of malnutrition risk (secondary outcomes); and

c. mean subjective social status (exploratory outcome)

METHODS

Study design

Using a parallel group RCT, we will collect data at three time points: baseline (Time 1; 0 weeks, June 2019), immediately following the BC FMNCP (Time 2; 10-15 weeks, October 2019) and 16 weeks after the BC FMNCP ends (Time 3; 26-31 weeks, February 2020).

Program overview

The BC FMNCP functions through a collaborative partnership between the BC Association of Farmers' Markets, the BC Ministry of Health, farmers' markets and community partners (i.e., local non-profit organizations). The BC Association of Farmers' Markets supports, develops and promotes farmers' markets across BC [101] and oversees the operations of the FMNCP. The FMNCP is supported by the province of BC and the Provincial Health Services Authority. Community partners distribute coupons to program participants from their organization locations (e.g., pregnancy outreach and community services agencies) on a weekly or biweekly basis and offer nutrition skill-building activities such as cooking classes or community gardens to promote nutrition- and food-related knowledge and skills.[101]

Recruitment

The FMNCP Director will identify approximately 15 BC communities for the study (from the existing FMNCP and from program waiting lists) with the aim of achieving similar rural/urban coverage as the existing FMNCP. Within each community, the FMNCP director will recruit community partners by contacting those who are members of the BC Association of Farmers' Markets and offer nutrition skill-building activities for low-income groups. Community partners within study communities will be responsible for identifying and enrolling eligible low-income adults into the study from among their existing clients and will share study details via phone, email or in-person, using posters and other recruitment aids as needed. Community partners will assess eligibility using a screening questionnaire and will obtain voluntary, informed consent from eligible participants.

Eligibility criteria

Individuals will be eligible to participate if they meet the following criteria:

- Adults (≥ 18 years)
- Low-income as determined by community-specific thresholds (~$18,000/year annual household income before taxes)
- No expected change in household income prior to study completion
- ≤ 8 people living in the home (including the participant)
- No expected change in household composition prior to study completion
- Primary food shopper for the household
- Does not self-report dementia or Alzheimer's Disease
- Able to speak, read and write in English (or have someone who can assist them)
- No plans to move from principal residence prior to study completion
- Has not previously participated in the BC FMNCP

Randomization

Following baseline data collection, eligible participants will be randomized to the FMNCP group (n=132) or a no-intervention control group (n=132), with a 1:1 allocation ratio. An independent researcher from the Clinical Research Unit at the University of Calgary will generate a blocked randomization sequence that stratifies participants into blocks according to sex (male, female), geographic location (rural, urban), pregnancy (yes, no) and breastfeeding (yes, no). Blocked randomization will help to ensure balanced representation of participants in study arms.[110] REDCap (Research Electronic Data Capture), a secure, web-based data collection and management application [111] hosted at the University of Calgary, will be used to randomize participants into the FMNCP and control groups on the basis of this randomization sequence. The study coordinator will subsequently communicate participant group assignments to community partners and participants. Allocation concealment will be ensured via secure storage of the randomization sequence separately from the participant database, which will only be accessible by the study coordinator and the Clinical Research Unit. Researchers will remain blinded to respondent condition throughout the study. Although participants cannot be blinded to group allocation, they will be blinded to the specific study objectives to reduce expectancy bias, whereby communication of expected study outcomes influences participants' behaviour.[112-115]

Intervention

In the existing BC FMNCP, community partners distribute one to two sheets of coupons per week (each sheet contains $21 in coupons) to program participants for a total of 16 sheets. Coupons can be used over 16-20 weeks to purchase fruits, vegetables, dairy, meat/poultry/fish, eggs, nuts, and cut herbs at participating BC farmers' markets. However, to allow sufficient time to recruit participants for this study, community partners will distribute 16 coupon sheets to the FMNCP group over 10-15 weeks (households with 5-8 individuals will receive 32 coupon sheets). To ensure participants receive all 16 coupon sheets,

community partners will provide two coupon sheets per household during weeks 1-6 of the intervention. Participants may redeem coupons at farmers' markets at a frequency of their choice (e.g., redeem coupons weekly or redeem several weeks' worth of coupons simultaneously). Participants in the FMNCP group will be invited to participate in nutrition skill-building activities (e.g., cooking classes) offered by community partners throughout the intervention period, although participation is not required (this is consistent with the existing FMNCP). The types and frequency of nutrition skill-building activities offered vary across community partners. For the duration of the study, the control group will not receive coupons nor be eligible to participate in nutrition skill-building activities but will be eligible to participate in the BC FMNCP the following farmers' market season. As participants in the control group already receive other supports from community partners, they will continue to meet with their community partner as they normally would throughout the intervention period.

Data collection

Data will be collected from the FMNCP and control groups at three time points: Time 1: baseline (0 weeks), Time 2: immediately post-intervention (10-15 weeks), and Time 3: 16 weeks post-intervention (26-31 weeks). At each time point, participants will complete a questionnaire assessing sociodemographic characteristics, health-related variables, and secondary and exploratory outcomes, followed by a 24-hour dietary recall to assess diet quality. The questionnaire and dietary recall will be integrated within a web-based platform developed and pilot tested by the researchers [116]. A second dietary recall will be completed 2-5 days later to better estimate usual intake and account for within-individual variation in diet quality. All participants will receive cash incentives valued at $20 at baseline and $40 at each Time 2 and 3. Participants will also receive small gifts prior to data collection at Time 2 and 3, which will serve as a reminder for the upcoming data collection.

At baseline, researchers will provide participants with a username and password to access the web-based platform. Participants will be encouraged, but not required, to complete baseline data collection at a community partner location immediately after providing informed consent. Community partners will record whether data collection was completed at a community partner location or elsewhere (e.g., home). Immediately post-intervention and at 16 weeks post-intervention, participants will receive an email requesting that they complete data collection (i.e., questionnaire and dietary recall) at a location of their choice.

Questionnaire

The questionnaire will be administered via REDCap at all three time points and will collect data on sociodemographic characteristics, health-related variables, sense of community, mental well-being, household food insecurity, malnutrition risk, and subjective social status. Questions related to the FMNCP intervention (e.g., coupon receipt) will be included in the questionnaire at Time 2 only.

Sociodemographic characteristics and health-related variables

Sociodemographic characteristics and health-related variables that will be assessed include date of birth, sex, race/ethnicity, years lived in Canada, marital status, household size, number of children living in the home, perceived physical health, pregnancy/breastfeeding, smoking status, height, weight, educational level, employment status, annual household income, main source of income, and community of residence.

Mental well-being

Mental well-being will be assessed using the valid 14-item Warwick-Edinburgh Mental Well-Being Scale.[117] Scale items are positively phrased and assess various aspects of mental well-being such as

positive affect (e.g., optimism), psychological functioning (e.g., self-confidence) and satisfaction with interpersonal relationships over the past two weeks.[118-120] The scale has been validated in a variety of age, sex, and socioeconomic status groups [120] and cultural contexts,[117] has captured change within short-term interventions,[121-124] and has demonstrated high test-retest reliability with an intra-class correlation of 0.83.[120] Responses are scored on a 5-point Likert scale from 1 (none of the time) to 5 (all of the time) and are summed to provide a single score ranging from 14 to 70.[117, 119] A higher score indicates higher perceived mental well-being.[117]

Household food insecurity

Household food insecurity will be assessed using Health Canada's validated 18-item Household Food Security Survey Module (HFSSM), which includes a 10-item adult scale and an 8-item child scale for households with children under 18 years of age.[125] The HFSSM typically assesses experiences of household food insecurity over the past year;[126] however, similar to how the HFSSM has been modified in previous studies,[127-130] it will be modified to assess experiences of household food insecurity in the past month. The HFSSM assesses experiences of marginal (one affirmative response), moderate (adult subscale 2-5 affirmative responses/child subscale 2-4 affirmative responses) and severe (adult subscale ≥ 6 affirmative responses/child subscale ≥ 5 affirmative responses) food insecurity.[125] The HFSSM has been validated in a variety of population groups and languages,[131, 132] has captured changes in food security status during short-term interventions,[129] and has good test-retest reliability with a Pearson correlation coefficient of r=0.75.[133]

Sense of community

Sense of community will be assessed using the validated 8-item Brief Sense of Community Scale.[134] Scale components are designed to assess each sense of community dimension according to the McMillan-

Chavis (1986) Model [135, 136] for sense of community, which includes four elements: membership, influence, integration and fulfillment of needs, and a shared emotional connection.[135, 136] Each item is scored using a Likert Scale of 1 (strongly disagree) to 5 (strongly agree).[134] Total sense of community scores can range from 8 to 40 with a higher score indicating greater needs fulfillment, group membership, influence and emotional connection within the community.

Malnutrition risk

Malnutrition risk will be calculated using the validated Malnutrition Universal Screening Tool (MUST).[137, 138] The MUST assesses malnutrition risk using body mass index (BMI) (scored as 0 = BMI > 20, 1 = BMI 18.5-20, 2 = BMI < 18.5), unplanned weight loss in the past 3-6 months (scored as 0 = < 5% of body weight, 1 = 5-10% of body weight, 2 = > 10% of body weight) and acute disease effect score (acute illness with no or likely no nutritional intake for > 5 days).[138] Unplanned weight loss will be modified to the past 3 months to accommodate the study timeline. In addition, acute disease effect is unlikely to occur in community settings [138] and will, therefore, be excluded.[139, 140] Overall malnutrition risk will be obtained by adding together subscores for BMI and unplanned weight loss, with 0 indicating low risk, 1 indicating medium risk, and ≥2 indicating high risk of malnutrition.[139] The MUST is an appropriate tool to assess malnutrition in community-dwelling [140, 141] adults aged ≥18 years,[141-143] as it was designed to screen for malnutrition in all patient groups and care settings.[141] The MUST has been used to assess change in short-term interventions [144] and has demonstrated high test-retest reliability with a Cohen's kappa coefficient of κ=0.94.[145]

Subjective social status

Subjective social status will be assessed using the validated MacArthur Scale of Subjective Social Status community ladder,[146, 147] which consists of a single-item visual analog scale whereby respondents

place themselves on a ladder rung according to their perceived social standing relative to others in their community.[146, 148] Response values can range from 1 to 10, with a higher score indicating higher perceived social status.[146] The subjective social status community ladder has been used to capture changes from short-term interventions.[149]

FMNCP intervention data

At Time 2 only, participants in both the intervention and control groups will report whether they received FMNCP coupons and attended nutrition skill-building activities (to assess contamination of the control group), how often and how much of their own money was spent at farmers' markets during the intervention period and the types of foods purchased.

Dietary intake

Participants will complete two unannounced dietary recalls at each time point. Twenty-four hour dietary recalls are a recommended dietary assessment method to evaluate the effect of an intervention on diet quality, as they have less systematic error than other self-reported dietary assessment tools.[150, 151] Administration of unannounced dietary recalls minimizes reactivity bias, where participants adjust their dietary intake in anticipation of having to report it.[152]

Participants will record all foods and beverages consumed (excluding supplements) from midnight to midnight the previous day using Health Canada's validated Automated Self-Administered 24-hour Dietary Recall (ASA24-Canada-2018),[151, 153-155] an automated online dietary assessment tool.[154, 155] The ASA24 collects information regarding dietary intake in a series of four steps: 1) foods consumed at each meal/snack, 2) queries regarding omitted meals/snacks, 3) details (e.g., cooking methods, portions), and 4) review of commonly forgotten items.[151, 156] The ASA24 concludes with a question querying

whether reported intake was less than usual, usual, or more than usual.[156] The ASA24 has been used with older, multi-ethnic, and disadvantaged adults [113-115, 151, 157] and was preferred by a majority of participants compared to interviewer-administered recalls;[113] however, in a recent study among BC FMNCP participants, we identified several usability issues with the ASA24.[116] For example, participants reported difficulties in searching for specific foods and making changes to entered meals.[116] We will aim to address these challenges by including a pictorial user guide in survey invitation emails, and by training community partners to assist participants in-person with the ASA24-Canada-2018. Further, participants and community partners will have access to a toll-free study helpline available 10 hours/day, 6 days/week during data collection. Helpline operators will provide assistance via telephone or email, and include three registered dietitians and the study coordinator, all of whom completed a half-day training session. Interrater reliability in entering meals into the ASA24-Canada-2018 among the helpline operators was high, with an intraclass correlation of 0.98.

The purpose of the helpline is two-fold: 1) to serve as a support platform for community partners to ask questions and update researchers, and 2) to assist participants in completing data collection. If needed, helpline operators will verbally read all questions to participants and enter their responses online on their behalf. To maintain blinding, operators will remind participants not to disclose their group assignment during the call. Supporting participants during data collection will help to minimize missing and inaccurate data and participant attrition. To further minimize attrition, if data collection is not completed within 48-hours of the initial prompt, researchers will make up to four attempts to contact participants by email and/or phone. Community partners will also remind participants to complete data collection.

Data collected by community partners and farmers' market vendors

Community partners will maintain records of the number of coupons distributed to each participant (by recording the unique bar code number on each coupon) and the frequency and types of nutrition skill-building activities attended. Farmers' market vendors will track coupon redemption and foods purchased with coupons (e.g., fruits, vegetables, dairy) by using checkboxes on the back of each coupon. Farmers' market managers will collect redeemed coupons from vendors and submit them to the FMNCP. They will complete tracking sheets noting the number of coupons redeemed and foods purchased with coupons.

Statistical analysis plan

Healthy Eating Index-2015

Diet quality scores and subscores will be calculated using the validated Healthy Eating Index-2015 (HEI-2015),[158-162] a tool used to assess conformance with the 2015-2020 Dietary Guidelines for Americans.[161] HEI-2015 subscores will be examined to gain insight into the specific dietary components that change in response to the intervention.[163] HEI scores are associated with indicators of socioeconomic position [164] and chronic disease.[18, 160, 165-168] Although Canadian adaptations of the HEI have been developed, they have either not been validated, are not density-based, or reflect dietary recommendations that are no longer current.[9, 169] Given that dietary recommendations in Canada and the U.S. are similar,[170-172] the HEI-2015 remains an appropriate tool to assess diet quality of Canadians.[9]

The HEI-2015 encompasses thirteen dietary components to assess overall diet quality,[161] including nine 'adequacy' components (recommended foods/nutrients, including total fruits , whole fruits, total vegetables, greens and beans, whole grains, dairy, total protein foods, seafood and plant proteins, fatty acids) and four 'moderation' components (foods/nutrients recommended to limit, including refined grains, sodium, added sugars, saturated fats). Component scores are density-based and, therefore,

independent of energy intake.[161, 163] Diet quality (total HEI-2015 scores and subscores) will be calculated using the simple HEI scoring algorithm.[161] This method provides scores at the individual level and can, therefore, accommodate the multi-level nature of our data and include covariates.[161] HEI-2015 scores will be calculated using three nutrient databases linked to the ASA24-Canada-2018:[173] the Canadian Nutrient File and the U.S. Department of Agriculture's (USDA) Food and Nutrient Database for Dietary Surveys to convert dietary intakes to energy and nutrient intakes, and the USDA Food Patterns Equivalents Database to convert dietary intakes to dietary constituents (e.g., fruits) and measurement units consistent with HEI-2015 scoring standards (e.g., cup-equivalents of fruit).[162, 163, 174, 175] Ratios for each of the dietary constituents (e.g., quantity of fruit per 1000 kcal) will be calculated for each participant and scored using HEI-2015 scoring standards. The total score for each participant will be derived by adding the scores for intake of 'adequacy' and 'moderation' components with possible scores ranging from 0-100. A higher score indicates a higher quality diet.[161]

Statistical analyses

Descriptive analyses will be conducted to examine participant characteristics by group at each time point. Characteristics of study completers (i.e., provided data at Time 3) and non-completers will also be compared.

Analyses will be intention-to-treat, in which participants will be analysed within the groups to which they were randomized regardless of adherence (e.g., failure to redeem coupons) or dropout. The analyses will include all participants who provided data at baseline. Repeated measures mixed-effect regression will assess differences in changes in mean HEI-2015 scores, HEI-2015 subscores, mental well-being, sense of community, and subjective social status between the FMNCP and control groups immediately post-intervention and 16 weeks post-intervention. Multinomial logistic regression will be used to assess

differences in the odds of experiencing household food insecurity and malnutrition risk for the FMNCP group compared to the control group immediately post-intervention and 16 weeks post-intervention. Statistical models will include intervention group (FMNCP vs control), time from baseline, intervention-by-time interaction, blocking variables (i.e., sex, rural/urban, pregnancy, breastfeeding), baseline values of the outcome, data collection mode (online, phone), household size, and place of data collection (community partner, other) as fixed effects covariates. Participant-specific (i.e., repeated measures) and rural/urban variations in outcomes will be modeled using random effects. Models will also include covariates specific to each outcome to increase the precision of estimates.[95] For the primary outcome of overall diet quality, models will include children living in the home (yes, no), sex, age, BMI, marital status, race/ethnicity, perceived health, smoking, day of dietary recall completion, and dietary recall number (i.e., dietary recall 1 or 2). Models that are and are not adjusted for an indicator of energy intake misreporting (the ratio of reported energy intake to total estimated energy expenditure) will be presented. Adjusted group differences (i.e., FMNCP vs control) in outcomes will be estimated using 95% confidence intervals and corresponding p-values.

Subgroup analyses will examine whether the impact of the intervention on primary and secondary outcomes differs according to age group or sex. Dose-response analyses will examine whether the impact of the BC FMNCP on overall diet quality depends on the number of coupons redeemed and the number of nutrition skill-building activities attended. Interactions will be retained in statistical models if $p<0.10$. Analyses will be conducted in Stata (v15.1, Stata Corp, TX, USA), with $p<0.05$ indicating statistically significant differences between groups.

Missing data

Missing data will be handled using full information maximum likelihood under a missing at random assumption. We will also attempt to minimize missing data by reviewing all data within 24 hours of receipt and by contacting participants to fill-in missing or implausible responses within 48 hours. Participants who drop out of the study will be asked to provide reasons for drop out to assess the plausibility of a missing at random assumption.

Sensitivity analyses

Monte Carlo Markov Chain multiple imputation, inverse probability weighting and available case analysis will be used in a sensitivity analysis to investigate the impact of different assumptions about missing data on estimated program impacts.[176-178] Given the possibility of non-random attrition, pattern mixture methods models [179] will be used to explore the robustness of study findings to the assumption that data were missing not at random.[180]

Sample size calculation

The sample size was calculated from a RCT that investigated the impact of a fruit and vegetable rebate on HEI-2010 scores in low-income participants in the U.S.,[95] and a cross-sectional study that assessed average diet quality scores in disadvantaged Canadians.[36] In the RCT, diet quality in the intervention group was 4.7 points higher (95% CI 2.4, 7.1) at follow-up compared to controls.[95] This difference can be translated to, for example, an additional half serving of fruit per day, which is clinically meaningful and achievable.[107, 165] Assuming a type I error of 5%, an attrition rate of 30% by the 26- to 31-week follow up, and potential design effects based on sampling within different communities (estimated at 1.1, or an inflation of 10%), 264 participants are required for 80% power to detect a 4.7-point difference in diet quality.

1. Solar O, Irwin A. A conceptual framework for action on the social determinants of health. Social Determinants of Health. Discussion Paper 2. Geneva, Switzerland: World Health Organization; 2010.
2. Power EM. Determinants of healthy eating among low-income Canadians. Can J Public Health. 2005;96:S37-S42.
3. Evans JM, Newton RW, Ruta DA, MacDonald TM, Morris AD. Socio-economic status, obesity and prevalence of Type 1 and Type 2 diabetes mellitus. Diabetic medicine : a journal of the British Diabetic Association. 2000;17(6):478-80.
4. Tang M, Chen Y, Krewski D. Gender-related differences in the association between socioeconomic status and self-reported diabetes. Int J Epidemiol. 2003;32(3):381-5.
5. Melchior M, Goldberg M, Krieger N, Kawachi I, Menvielle G, Zins M, et al. Occupational class, occupational mobility and cancer incidence among middle-aged men and women: a prospective study of the French GAZEL cohort*. Cancer causes & control : CCC. 2005;16(5):515-24.
6. Tarasuk V, Mitchell, A, Dachner, N. Household food insecurity in Canada 2014: Toronto: Research to identify policy options to reduce food insecurity (PROOF); 2016 [cited 2019 January 7]. Available from: https://proof.utoronto.ca/.
7. Jessiman-Perreault G, McIntyre L. The household food insecurity gradient and potential reductions in adverse population mental health outcomes in Canadian adults. SSM - Population Health. 2017;3:464-72.
8. Kirkpatrick SI, Dodd KW, Reedy J, Krebs-Smith SM. Income and race/ethnicity are associated with adherence to food-based dietary guidance among US adults and children. J Acad Nutr Diet. 2012;112(5):624-35 e6.
9. Guarriguet D. Diet quality in Canada. In: Canada S, editor. Ontario2009. p. 43-51.
10. Wang DD LY, Chiuve SE, Hu FB, Willett WC. Improvements in US diet helped reduce disease burden and lower premature deaths, 1999–2012; Overall diet remains poor. Health affairs. 2015;34(11):1916–22.
11. Kant AK SA, Graubard BI, Schairer C. A prospective study of diet quality and mortality in women. JAMA. 2000;283(16):2109-15.
12. Bowman S. Low economic status is associated with suboptimal intakes of nutritious foods by adults in the National Health and Nutrition Examination Survey 1999-2002. Nutrition Research. 2007;27(9):515-23.
13. Tarasuk V, Fitzpatrick S, Ward H. Nutrition inequities in Canada. Appl Physiol Nutr Metab. 2010;35(2):172-9.
14. Darmon N DA. Does social class predict diet quality? Am J Clin Nutr. 2008;87:11.
15. Moore CJ, Cunningham SA. Social position, psychological stress, and obesity: a systematic review. J Acad Nutr Diet. 2012;112(4):518-26.
16. Tanumihardjo SA, Anderson C, Kaufer-Horwitz M, Bode L, Emenaker NJ, Haqq AM, et al. Poverty, obesity, and malnutrition: an international perspective recognizing the paradox. J Am Diet Assoc. 2007;107(11):1966-72.
17. Hiza HA, Casavale KO, Guenther PM, Davis CA. Diet quality of Americans differs by age, sex, race/ethnicity, income, and education level. J Acad Nutr Diet. 2013;113(2):297-306.
18. Schwingshackl L, Bogensberger B, Hoffmann G. Diet Quality as Assessed by the Healthy Eating Index, Alternate Healthy Eating Index, Dietary Approaches to Stop Hypertension Score, and Health Outcomes: An Updated Systematic Review and Meta-Analysis of Cohort Studies. J Acad Nutr Diet. 2018;118(1):74-100 e11.

19. Townsend N, Foster C. Developing and applying a socio-ecological model to the promotion of healthy eating in the school. Public Health Nutr. 2013;16(6):1101-8.
20. Story M, Kaphingst KM, Robinson-O'Brien R, Glanz K. Creating healthy food and eating environments: policy and environmental approaches. Annu Rev Public Health. 2008;29:253-72.
21. Turrell G, Hewitt B, Patterson C, Oldenburg B. Measuring socio-economic position in dietary research: is choice of socio-economic indicator important? Public Health Nutr. 2003;6(2):191-200.
22. Robinson T. Applying the Socio-ecological Model to Improving Fruit and Vegetable Intake Among Low-Income African Americans. Journal of Community Health. 2008;33(6):395-406.
23. Raine KD. Determinants of Healthy Eating in Canada: An Overview and Synthesis. Canadian Journal of Public Health. 2005:S8-S14.
24. Wang Y, Chen X. How much of racial/ethnic disparities in dietary intakes, exercise, and weight status can be explained by nutrition- and health-related psychosocial factors and socioeconomic status among US adults? J Am Diet Assoc. 2011;111(12):1904-11.
25. Havas S AJ, Damron D, Langenberg P, Ballesteros M, Feldman R. Final Results of the Maryland WIC 5-A-Day Promotion Program. American Joumal of Public Health. 1998;88(8).
26. Henry JL TA, Surkan PJ, Steeves EA, Hopkins LC, Gittelsohn J. Psychosocial determinants of food acquisition and preparation in low-income, urban African American households. Health Education & Behavior. 2018;45(6):10.
27. Brown AG, Hudson LB, Chui K, Metayer N, Lebron-Torres N, Seguin RA, et al. Improving heart health among Black/African American women using civic engagement: a pilot study. BMC Public Health. 2017;17(1):112.
28. Anderson JV BD, Brown RM, McLean DF, Garcia EM, Breer ML, Schillo BA. 5 a day fruit and vegetable intervention improves consumption in a low income population. J Am Diet Assoc. 2001;101(2):8.
29. Steptoe A P-PL, McKay C, Rink E, Hilton S, Cappuccio F. Psychological factors associated with fruit and vegetable intake and with biomarkers in adults from a low-income neighborhood. Health Psychology. 2003;22(2):8.
30. Delormier T, Frohlich KL, Potvin L. Food and eating as social practice--understanding eating patterns as social phenomena and implications for public health. Sociol Health Illn. 2009;31(2):215-28.
31. Mackenbach JP. The persistence of health inequalities in modern welfare states: the explanation of a paradox. Soc Sci Med. 2012;75(4):761-9.
32. Lancee B, Van de Werfhorst HG. Income inequality and participation: A comparison of 24 European countries. Soc Sci Res. 2012;41(5):1166-78.
33. Pichler F, Wallace C. Social capital and social class in Europe: the role of social networks in social stratification. European Sociological Review. 2009;25(3):319-32.
34. Moore S, Stewart S, Teixeira A. Decomposing social capital inequalities in health. J Epidemiol Community Health. 2014;68(3):233-8.
35. Carroll-Scott A, Gilstad-Hayden K, Rosenthal L, Peters SM, McCaslin C, Joyce R, et al. Disentangling neighborhood contextual associations with child body mass index, diet, and physical activity: the role of built, socioeconomic, and social environments. Soc Sci Med. 2013;95:106-14.

36. McInerney M, Csizmadi I, Friedenreich CM, Uribe FA, Nettel-Aguirre A, McLaren L, et al. Associations between the neighbourhood food environment, neighbourhood socioeconomic status, and diet quality: An observational study. BMC Public Health. 2016;16:984.
37. Maguire ER BT, Monsivais P. Area deprivation and the food environment over time: A repeated cross-sectional study on take away outlet density and supermarket presence in Norfolk, UK, 1990–2008. Health & Place 2015;33:142–7.
38. Smoyer-Tomic KE, Spence JC, Raine KD, Amrhein C, Cameron N, Yasenovskiy V, et al. The association between neighborhood socioeconomic status and exposure to supermarkets and fast food outlets. Health Place. 2008;14(4):740-54.
39. Larsen K GJ. A farmers' market in a food desert: Evaluating impacts on the price and availability of healthy food. Health &Place. 2009;15:1158–62.
40. Minaker LM, Shuh A, Olstad DL, Engler-Stringer R, Black JL, Mah CL. Retail food environments research in Canada: A scoping review. Canadian Journal of Public Health. 2016;107(S1):eS4-eS13.
41. Gregson J, Foerster SB, Orr R, Jones L, Benedict J, Clarke B, et al. System, Environmental, and Policy Changes: Using the Social-Ecological Model as a Framework for Evaluating Nutrition Education and Social Marketing Programs with Low-Income Audiences. Journal of Nutrition Education. 2001;33:S4-S15.
42. Mozaffarian D. Dietary and Policy Priorities for Cardiovascular Disease, Diabetes, and Obesity: A Comprehensive Review. Circulation. 2016;133:40.
43. Graff SK, Kappagoda M, Wooten HM, McGowan AK, Ashe M. Policies for healthier communities: historical, legal, and practical elements of the obesity prevention movement. Annu Rev Public Health. 2012;33:307-24.
44. Cassady D, Jetter KM, Culp J. Is price a barrier to eating more fruits and vegetables for low-income families? J Am Diet Assoc. 2007;107(11):1909-15.
45. Turrell G. Socioeconomic differences in food preference and their influence on healthy food purchasing choices. Journal of Human Nutrition and Dietetics. 1998;11:15.
46. Darmon N, Drewnowski A. Contribution of food prices and diet cost to socioeconomic disparities in diet quality and health: a systematic review and analysis. Nutr Rev. 2015;73(10):643-60.
47. Black AP BJ, Eyles H, Morris P, Vally H, O'Dea K. Food subsidy programs and the health and nutritional status of disadvantaged families in high income countries: a systematic review. BMC Public Health. 2012;12:24.
48. McLeroy KR BD, Steckler A, Glanz K. An ecological perspective on health promotion programs. Health education quarterly. 1988;15(4):351-77.
49. Lytvyak E, Olstad DL, Schopflocher DP, Plotnikoff RC, Storey KE, Nykiforuk CI, et al. Impact of a 3-year multi-centre community-based intervention on risk factors for chronic disease and obesity among free-living adults: the Healthy Alberta Communities study. BMC Public Health. 2016;16:344.
50. World Health Organization PHAoC. Health equity through intersectoral action: an analysis of 18 country case studies. Public Health Agency of Canada; 2008. p. 40.
51. Gans KM, Gorham G, Risica PM, Dulin-Keita A, Dionne L, Gao T, et al. A multi-level intervention in subsidized housing sites to increase fruit and vegetable access and intake: Rationale, design and methods of the 'Live Well, Viva Bien' cluster randomized trial. BMC Public Health. 2016;16(1).

52. Gordon-Larsen P, Popkin B. Understanding socioeconomic and racial/ethnic status disparities in diet, exercise, and weight: underlying contextual factors and pathways. J Am Diet Assoc. 2011;111(12):1816-9.
53. Durward CM, Savoie-Roskos M, Atoloye A, Isabella P, Jewkes MD, Ralls B, et al. Double Up Food Bucks Participation is Associated with Increased Fruit and Vegetable Consumption and Food Security Among Low-Income Adults. J Nutr Educ Behav. 2018.
54. Freedman DA, Vaudrin N, Schneider C, Trapl E, Ohri-Vachaspati P, Taggart M, et al. Systematic Review of Factors Influencing Farmers' Market Use Overall and among Low-Income Populations. J Acad Nutr Diet. 2016;116(7):1136-55.
55. Dimitri C, Oberholtzer L, Zive M, Sandolo C. Enhancing food security of low-income consumers: An investigation of financial incentives for use at farmers markets. Food Policy. 2015;52:64-70.
56. Savoie-Roskos M, Durward C, Jeweks M, LeBlanc H. Reducing Food Insecurity and Improving Fruit and Vegetable Intake Among Farmers' Market Incentive Program Participants. J Nutr Educ Behav. 2016;48(1):70-6 e1.
57. Ruelas V, Iverson E, Kiekel P, Peters A. The role of farmers' markets in two low income, urban communities. J Community Health. 2012;37(3):554-62.
58. Jilcott Pitts SB, Wu Q, McGuirt JT, Crawford TW, Keyserling TC, Ammerman AS. Associations between access to farmers' markets and supermarkets, shopping patterns, fruit and vegetable consumption and health indicators among women of reproductive age in eastern North Carolina, U.S.A. Public Health Nutr. 2013;16(11):1944-52.
59. Lowery B, Sloane D, Payán D, Illum J, Lewis L. Do Farmers' Markets Increase Access to Healthy Foods for All Communities? Comparing Markets in 24 Neighborhoods in Los Angeles. Journal of the American Planning Association. 2016;82(3):252-66.
60. Sadler RC. Strengthening the core, improving access: Bringing healthy food downtown via a farmers' market move. Applied Geography. 2016;67:119-28.
61. McCormack LA, Laska MN, Larson NI, Story M. Review of the nutritional implications of farmers' markets and community gardens: a call for evaluation and research efforts. J Am Diet Assoc. 2010;110(3):399-408.
62. Lucan SC, Maroko AR, Sanon O, Frias R, Schechter CB. Urban farmers' markets: Accessibility, offerings, and produce variety, quality, and price compared to nearby stores. Appetite. 2015;90:23-30.
63. Wheeler AL, Chapman-Novakofski K. Farmers' Markets: Costs Compared With Supermarkets, Use Among WIC Clients, and Relationship to Fruit and Vegetable Intake and Related Psychosocial Variables. Journal of Nutrition Education and Behavior. 2014;46(3):S65-S70.
64. Freedman DA, Vaudrin N, Schneider C, Trapl E, Ohri-Vachaspati P, Taggart M, et al. Systematic Review of Factors Influencing Farmers’ Market Use Overall and among Low-Income Populations. Journal of the Academy of Nutrition and Dietetics. 2016;116(7):1136-55.
65. Savoie-Roskos M, Durward C, Jeweks M, LeBlanc H. Reducing Food Insecurity and Improving Fruit and Vegetable Intake Among Farmers' Market Incentive Program Participants. J Nutr Educ Behav. 2016;48(1):70-6.e1.
66. Durward CM, Savoie-Roskos M, Atoloye A, Isabella P, Jewkes MD, Ralls B, et al. Double Up Food Bucks Participation is Associated with Increased Fruit and Vegetable Consumption and Food Security Among Low-Income Adults. J Nutr Educ Behav. 2018;51(3):342-7.

67. Lee RE HK, Medina AV, Regan GR, Reese-Smith JY, Jokura Y, Maddock JE. A Picture of the Healthful Food Environment in Two Diverse Urban Cities. Environmental Health Insights. 2010 4:49-60.
68. McGuirt J, Jilcott S, Liu H, Ammerman A. Produce Price Savings for Consumers at Farmers' Markets Compared to Supermarkets in North Carolina. Journal of Hunger & Environmental Nutrition. 2011;6(1):86-98.
69. Parks CA, Stern KL, Fricke HE, Clausen W, Fox TA, Yaroch AL. Food Insecurity Nutrition Incentive Grant Program: Implications for the 2018 Farm Bill and Future Directions. J Acad Nutr Diet. 2019.
70. Anliker JA WM, Drake LT. An evaluation of the connecticut farmers' market coupon program. Journal of Nutrition Education. 1992;24(4):7.
71. Parks CA, Stern KL, Fricke HE, Clausen W, Fox TA, Yaroch AL. Food Insecurity Nutrition Incentive Grant Program: Implications for the 2018 Farm Bill and Future Directions. J Acad Nutr Diet. 2019;119(3):395-9.
72. Dailey AB, Hess A, Horton C, Constantian E, Monani S, Wargo B, et al. Healthy options: a community-based program to address food insecurity. J Prev Interv Community. 2015;43(2):83-94.
73. Alonso AD, O'Neill MA. Investing in the social fabric of rural and urban communities: a comparative study of two Alabama farmers' markets. Community Development. 2011;42(3):392-409.
74. Smith LT, Johnson DB, Beaudoin S, Monsen ER, LoGerfo JP. Qualitative assessment of participant utilization and satisfaction with the Seattle Senior Farmers' Market Nutrition Pilot Program. Prev Chronic Dis. 2004;1(1):A06.
75. Tarasuk VS. Household Food Insecurity with Hunger Is Associated with Women's Food Intakes, Health and Household Circumstances. J Nutr 2001;131:2670–6.
76. Goodman LA, Pugach M, Skolnik A, Smith L. Poverty and Mental Health Practice: Within and Beyond the 50-Minute Hour. J Clin Psychol. 2013;69(2):182-90.
77. Olsho LE, Payne GH, Walker DK, Baronberg S, Jernigan J, Abrami A. Impacts of a farmers' market incentive programme on fruit and vegetable access, purchase and consumption. Public Health Nutr. 2015;18(15):2712-21.
78. Herman DR, Harrison GG, Afifi AA, Jenks E. Effect of a targeted subsidy on intake of fruits and vegetables among low-income women in the Special Supplemental Nutrition Program for Women, Infants, and Children. Am J Public Health. 2008;98(1):98-105.
79. Cohen AJ, Richardson CR, Heisler M, Sen A, Murphy EC, Hesterman OB, et al. Increasing Use of a Healthy Food Incentive: A Waiting Room Intervention Among Low-Income Patients. American Journal of Preventive Medicine. 2017;52(2):154-62.
80. Young CR, Aquilante JL, Solomon S, Colby L, Kawinzi MA, Uy N, et al. Improving Fruit and Vegetable Consumption Among Low-Income Customers at Farmers Markets: Philly Food Bucks, Philadelphia, Pennsylvania, 2011. Preventing Chronic Disease. 2013;10.
81. Dannefer R, Abrami A, Rapoport R, Sriphanlop P, Sacks R, Johns M. A Mixed-Methods Evaluation of a SNAP-Ed Farmers' Market-Based Nutrition Education Program. J Nutr Educ Behav. 2015;47(6):516-25 e1.
82. Jilcott SB, Wade S, McGuirt JT, Wu Q, Lazorick S, Moore JB. The association between the food environment and weight status among eastern North Carolina youth. Public Health Nutr. 2011;14(9):1610-7.

83. Jorgensen BS, Jamieson RD, Martin JF. Income, sense of community and subjective well-being: Combining economic and psychological variables. Journal of Economic Psychology. 2010;31(4):612-23.
84. Brodsky AE OCP, Aronson RE. PSOC in community context: Multilevel correlates of a measure of psychological sense of community in low-income, urban neighborhoods. Journal of Community Psychology. 1999;27(6):659-79.
85. Cundiff JM, Smith TW, Uchino BN, Berg CA. Subjective Social Status: Construct Validity and Associations with Psychosocial Vulnerability and Self-Rated Health. Int J Behav Med. 2013;20(1):148-58.
86. Mistry RS LE, Benner AD, Chien N. Expanding the family economic stress model-Insights from a mixed methods approach. Journal of Marriage and Family. 2008(70):196-209.
87. Conger RD, Conger KJ, Martin MJ. Socioeconomic Status, Family Processes,and Individual Development. Journal of Marriage and Family. 2010;72(3):685-704.
88. Kunkel ME, Luccia B, Moore AC. Evaluation of the South Carolina seniors farmers' market nutrition education program. J Am Diet Assoc. 2003;103(7):880-3.
89. Balsam A, Webber D, Oehlke B. The farmers' market coupon program for low-income elders. J Nutr Elder. 1994;13(4):35-42.
90. Jilcott Pitts SB, Wu Q, Demarest CL, Dixon CE, Dortche CJ, Bullock SL, et al. Farmers' market shopping and dietary behaviours among Supplemental Nutrition Assistance Program participants. Public Health Nutr. 2015;18(13):2407-14.
91. Jilcott Pitts SB GA, Wu Q, Leah Mayo M, Ward RK, McGuirt JT, Rafferty AP, Lancaster MF, Evenson KR, Keyserling TC, et al. Farmers' market use is associated with fruit and vegetable consumption in diverse southern rural communities. Nutrition Journal. 2014;13.
92. Young CR, Aquilante JL, Solomon S, Colby L, Kawinzi MA, Uy N, et al. Improving fruit and vegetable consumption among low-income customers at farmers markets: Philly Food Bucks, Philadelphia, Pennsylvania, 2011. Prev Chronic Dis. 2013;10:E166.
93. Bowling AB, Moretti M, Ringelheim K, Tran A, Davison K. Healthy Foods, Healthy Families: combining incentives and exposure interventions at urban farmers' markets to improve nutrition among recipients of US federal food assistance. Health Promotion Perspectives. 2016;6(1):10-6.
94. Freedman DA, Bell BA, Collins LV. The Veggie Project: a case study of a multi-component farmers' market intervention. J Prim Prev. 2011;32(3-4):213-24.
95. Olsho LE, Klerman JA, Wilde PE, Bartlett S. Financial incentives increase fruit and vegetable intake among Supplemental Nutrition Assistance Program participants: a randomized controlled trial of the USDA Healthy Incentives Pilot. Am J Clin Nutr. 2016;104(2):423-35.
96. Hsiao B-s, Sibeko L, Wicks K, Troy LM. Mobile produce market influences access to fruits and vegetables in an urban environment. Public Health Nutrition. 2018;21(7):1332-44.
97. Wetherill MS, Williams MB, Gray KA. SNAP-Based Incentive Programs at Farmers' Markets: Adaptation Considerations for Temporary Assistance for Needy Families (TANF) Recipients. Journal of Nutrition Education and Behavior. 2017;49(9):743-51.e1.
98. Zepeda L. Which little piggy goes to market? Characteristics of US farmers' market shoppers. International Journal of Consumer Studies. 2009;33(3):250-7.
99. Provincial Health Services Authority. Food costing in BC 2017: Assessing the affordability of healthy eating. 2017.
100. BC Employment Standards Branch. Minimum wage factsheet 2016 [Available from: http://www2.gov.bc.ca/assets/gov/employment-business-and-economic-

development/employment-standards-workplace-safety/employment-standards/factsheets-pdfs/pdfs/minimum_wage.pdf.
101. BC Association of Farmers' Markets. Farmers' Market Nutrition Coupon Program 2019 [Available from: http://www.bcfarmersmarket.org/nutrition-coupon-program.
102. Just RE WQ. Economic Evaluation of the Farmers' Market Nutrition Program. American Journal of Agricultural Economics. 1997;79:902-17.
103. BC Association of Farmers' Markets. BC Association of Farmers' Markets Annual Report 2018. 2018
104. The BC Farmers' Market Trail. Find a BC Farmers' Market 2020 [Available from: https://bcfarmersmarkettrail.com/markets/.
105. Harnack L, Oakes JM, Elbel B, Beatty T, Rydell S, French S. Effects of Subsidies and Prohibitions on Nutrition in a Food Benefit Program: A Randomized Clinical Trial. JAMA Intern Med. 2016;176(11):1610-8.
106. Laaksonen M, Talala K, Martelin T, Rahkonen O, Roos E, Helakorpi S, et al. Health behaviours as explanations for educational level differences in cardiovascular and all-cause mortality: a follow-up of 60 000 men and women over 23 years. Eur J Public Health. 2008;18(1):38-43.
107. Yip CSC, Chan W, Fielding R. The Associations of Fruit and Vegetable Intakes with Burden of Diseases: A Systematic Review of Meta-Analyses. J Acad Nutr Diet. 2019.
108. Holeva P. Growing Social Capital: Investigating the Relationship between Farmers' Markets and the Development of Community Support Networks in Ann Arbor, MI: Miami University; 2009.
109. Smithers J, Lamarche J, AE J. Unpacking the terms of engagement with local food at the Farmers' Market: Insights from Ontario. Journal of Rural Studies. 2008;24:337-50.
110. Efird J. Blocked randomization with randomly selected block sizes. Int J Environ Res Public Health. 2011;8(1):15-20.
111. Harris PA TR, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap) – A metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform. 2009;42(2):377-81.
112. Molendijk ML, Fried EI, Van der Does W. The SMILES trial: do undisclosed recruitment practices explain the remarkably large effect? BMC Med. 2018;16(1):243.
113. Thompson FE, Dixit-Joshi S, Potischman N, Dodd KW, Kirkpatrick SI, Kushi LH, et al. Comparison of Interviewer-Administered and Automated Self-Administered 24-Hour Dietary Recalls in 3 Diverse Integrated Health Systems. Am J Epidemiol. 2015;181(12):970-8.
114. Kirkpatrick SI, Gilsing AM, Hobin E, Solbak NM, Wallace A, Haines J, et al. Lessons from Studies to Evaluate an Online 24-Hour Recall for Use with Children and Adults in Canada. Nutrients. 2017;9(2).
115. Solbak NM, Siou G, Paek S, Rajabi AA, Vena JE, Kirkpatrick SI, et al., editors. Evaluating the feasibility of administering a combination of online dietary assessment tools in a cohort of adults in Alberta, Canada. International Society of Behavioral Nutrition and Physical Activity Annual Meeting; 2017; Victoria, BC Canada.
116. Kupis J, Johnson S, Hallihan G, Olstad DL. Assessing the Usability of the Automated Self-Administered Dietary Assessment Tool (ASA24) among Low-Income Adults. Nutrients. 2019;11(1).
117. Warwick Medical School. WEMWBS: Warwick-Edinburgh Mental Wellbeing Scale User guide - Version 2 Edinburgh: NHS Health Scotland; 2016 [Available from:

http://www2.warwick.ac.uk/fac/med/research/platform/wemwbs/researchers/userguide/wemwbs_user_guide_jp_02.02.16.pdf.
118. Stewart-Brown S, Tennant A, Tennant R, Platt S, Parkinson J, Weich S. Internal construct validity of the Warwick-Edinburgh Mental Well-being Scale (WEMWBS): a Rasch analysis using data from the Scottish Health Education Population Survey. Health Qual Life Outcomes. 2009;7:15.
119. Bartram DJ, Yadegarfar G, Sinclair JM, Baldwin DS. Validation of the Warwick-Edinburgh Mental Well-being Scale (WEMWBS) as an overall indicator of population mental health and well-being in the UK veterinary profession. Vet J. 2011;187(3):397-8.
120. Tennant R, Hiller L, Fishwick R, Platt S, Joseph S, Weich S, et al. The Warwick-Edinburgh Mental Well-being Scale (WEMWBS): development and UK validation. Health Qual Life Outcomes. 2007;5(1).
121. Manicavasagar V, Horswood D, Burckhardt R, Lum A, Hadzi-Pavlovic D, Parker G. Feasibility and Effectiveness of a Web-Based Positive Psychology Program for Youth Mental Health: Randomized Controlled Trial. Journal of Medical Internet Research. 2014;16(6).
122. Powell J, Hamborg T, Stallard N, Burls A, McSorley J, Bennett K, et al. Effectiveness of a Web-Based Cognitive-Behavioral Tool to Improve Mental Well-Being in the General Population: Randomized Controlled Trial. Journal of Medical Internet Research. 2012;15(1).
123. Schrank B, Brownell T, Jakaite Z, Larkin C, Pesola F, Riches S, et al. Evaluation of a positive psychotherapy group intervention for people with psychosis: pilot randomised controlled trial. Epidemiology and Psychiatric Sciences. 2015;25(3):235-46.
124. Tew GA, Howsam J, Hardy M, Bissell L. Adapted yoga to improve physical function and health-related quality of life in physically-inactive older adults: a randomised controlled pilot trial. BMC Geriatrics. 2017;17(1).
125. PROOF. Household Food Insecurity in Canada: A Guide to Measurement and Interpretation. 2018.
126. Tarasuk V, Mitchell A, Dachner N. Household Food Insecurity in Canada. 2014.
127. Tarasuk VS BG. Household food insecurity and hunger among families using food banks. Canadian Journal of Public Health. 1999 90(2):109-13.
128. Tarasuk VS. Household Food Insecurity with Hunger Is Associated with Women's Food Intakes, Health and Household Circumstances. J Nutr. 2001 131:2670–6.
129. Rivera RL, Maulding MK, Abbott AR, Craig BA, Eicher-Miller HA. SNAP-Ed (Supplemental Nutrition Assistance Program–Education) Increases Long-Term Food Security among Indiana Households with Children in a Randomized Controlled Study. The Journal of Nutrition. 2016;146(11):2375-82.
130. Dachner N, Ricciuto L, Kirkpatrick SI, Tarasuk V. Food Purchasing and Food Insecurity: Among Low-income Families in Toronto. Canadian Journal of Dietetic Practice and Research. 2010;71(3):e50-e6.
131. Health Canada. Canadian Community Health Survey, Cycle 2.2, Nutrition (2004): Income-Related Household Food Security in Canada. In: Promotion TOoNPa, editor. 2007.
132. Marques ES, Reichenheim ME, de Moraes CL, Antunes MM, Salles-Costa R. Household food insecurity: a systematic review of the measuring instruments used in epidemiological studies. Public Health Nutr. 2015;18(5):877-92.
133. Derrickson JP FA, Anderson JEL. The Core Food Security Module Scale Measure Is Valid and Reliable When Used with Asians and Pacific Islanders. J Nutr. 2000 130:2666–74.

134. Peterson NA, Speer PW, McMillan DW. Validation of A Brief Sense of Community Scale: Confirmation of the Principal Theory of Sense of Community. Journal of Community Psychology. 2008;36(1):61-73.
135. McMillan DW, Chavis D. Sense of Comunity: A Definition and Theory. Journal of Community Psychology. 1986;14:6-23.
136. Peterson NA, Speer PW, McMillan DW. Validation of A brief sense of community scale: Confirmation of the principal theory of sense of community. 2008;36(1):61-73.
137. Power L, Mullally D, Gibney ER, Clarke M, Visser M, Volkert D, et al. A review of the validity of malnutrition screening tools used in older adults in community and healthcare settings - A MaNuEL study. Clin Nutr ESPEN. 2018;24:1-13.
138. Todorovic V RC, Elia M. The 'MUST' explanatory booklet: A guide to the 'Malnutrition Universal Screening Tool' ('MUST') for adults Worcestershire, UK: The British Association for Parenteral and Enteral Nutrition (BAPEN); 2011 [Available from: https://www.bapen.org.uk/pdfs/must/must_explan.pdf.
139. Kvamme JM, Olsen JA, Florholmen J, Jacobsen BK. Risk of malnutrition and health-related quality of life in community-living elderly men and women: the Tromso study. Qual Life Res. 2011;20(4):575-82.
140. Scott A. Screening for malnutrition in the community- the MUST tool.pdf>. British Journal of Community Nursing. 2008 13(9):406-12.
141. The British Association for Parenteral and Enteral Nutrition. The 'MUST' report. Nutritional screening for adults- A multidisciplinary responsibility. Development and use of the Malnutrition Universal Screening Tool (MUST) for adults. Redditch, Worcs: BAPEN Office; 2003.
142. Cawood AL, Elia M, Sharp SKE, Stratton RJ. Malnutrition self-screening by using MUST in hospital outpatients: validity, reliability, and ease of use. Am J Clin Nutr. 2012;96(5):1000-7.
143. Sandhu A, Mosli M, Yan B, Wu T, Gregor J, Chande N, et al. Self-Screening for Malnutrition Risk in Outpatient Inflammatory Bowel Disease Patients Using the Malnutrition Universal Screening Tool (MUST). Journal of Parenteral and Enteral Nutrition. 2015;40(4):507-10.
144. Chao P-C, Chuang H-J, Tsao L-Y, Chen P-Y, Hsu C-F, Lin H-C, et al. The Malnutrition Universal Screening Tool (MUST) and a nutrition education program for high risk cancer patients: strategies to improve dietary intake in cancer patients. BioMedicine. 2015;5(3).
145. Cawood AL, Elia M, Sharp SK, Stratton RJ. Malnutrition self-screening by using MUST in hospital outpatients: validity, reliability, and ease of use. Am J Clin Nutr. 2012;96(5):1000-7.
146. University of California, MacArthur Research Network on SES and Health,. MacArthur Subjective Social Status Scale 2019 [Available from: https://macses.ucsf.edu/research/psychosocial/commladder.php.
147. Cundiff JM, Smith TW, Uchino BN, Berg CA. Subjective social status: construct validity and associations with psychosocial vulnerability and self-rated health. Int J Behav Med. 2013;20(1):148-58.
148. Zell E, Strickhouser JE, Krizan Z. Subjective social status and health: A meta-analysis of community and society ladders. Health Psychol. 2018;37(10):979-87.
149. Landefeld JC, Burmaster KB, Rehkopf DH, Syme SL, Lahiff M, Adler-Milstein S, et al. The association between a living wage and subjective social status and self-rated health: A quasi-experimental study in the Dominican Republic. Social Science & Medicine. 2014;121:91-7.

150. National Institute of Health. Dietary Assessment Primer: Evaluating the Effect of an Intervention on Diet. In: Institute NC, editor.
151. Kirkpatrick SI, Subar AF, Douglass D, Zimmerman TP, Thompson FE, Kahle LL, et al. Performance of the Automated Self-Administered 24-hour Recall relative to a measure of true intakes and to an interviewer-administered 24-h recall. Am J Clin Nutr. 2014;100(1):233-40.
152. Thompson FE SA. Nutrition in the prevention and treatment of disease. third ed. Coultston AM BC, Ferruzzi MG, , editor: Elsevier; 2013.
153. Subar AF, Kirkpatrick SI, Mittl B, Zimmerman TP, Thompson FE, Bingley C, et al. The Automated Self-Administered 24-hour dietary recall (ASA24): a resource for researchers, clinicians, and educators from the National Cancer Institute. J Acad Nutr Diet. 2012;112(8):1134-7.
154. ASA24- Canada. ASA24- Canada [Available from: http://asa24.ca/index.html.
155. National Cancer Institute. ASA24-Canada-2018 2019 [Available from: https://epi.grants.cancer.gov/asa24/respondent/asa24-canada-2018.html.
156. National Cancer Institute. ASA24® Frequently Asked Questions (FAQs) 2018 [Available from: https://epi.grants.cancer.gov/asa24/resources/faq.html#output.
157. Kirkpatrick SI, Guenther PM, Douglass D, Zimmerman T, Kahle LL, Atoloye A, et al. The Provision of Assistance Does Not Substantially Impact the Accuracy of 24-Hour Dietary Recalls Completed Using the Automated Self-Administered 24-H Dietary Assessment Tool among Women with Low Incomes. J Nutr. 2019;149(1):114-22.
158. Guenther PM, Casavale KO, Reedy J, Kirkpatrick SI, Hiza HA, Kuczynski KJ, et al. Update of the Healthy Eating Index: HEI-2010. J Acad Nutr Diet. 2013;113(4):569-80.
159. Guenther PM, Kirkpatrick SI, Reedy J, Krebs-Smith SM, Buckman DW, Dodd KW, et al. The Healthy Eating Index-2010 is a valid and reliable measure of diet quality according to the 2010 Dietary Guidelines for Americans. J Nutr. 2014;144(3):399-407.
160. Reedy J, Lerman JL, Krebs-Smith SM, Kirkpatrick SI, Pannucci TE, Wilson MM, et al. Evaluation of the Healthy Eating Index-2015. J Acad Nutr Diet. 2018;118(9):1622-33.
161. National Cancer Institute. Overview and background of the Healthy Eating Index 2018 [Available from: https://epi.grants.cancer.gov/hei/.
162. Krebs-Smith SM, Pannucci TE, Subar AF, Kirkpatrick SI, Lerman JL, Tooze JA, et al. Update of the Healthy Eating Index: HEI-2015. J Acad Nutr Diet. 2018;118(9):1591-602.
163. Kirkpatrick SI, Reedy J, Krebs-Smith SM, Pannucci TE, Subar AF, Wilson MM, et al. Applications of the Healthy Eating Index for Surveillance, Epidemiology, and Intervention Research: Considerations and Caveats. J Acad Nutr Diet. 2018;118(9):1603-21.
164. Mullie P, Clarys P, Hulens M, Vansant G. Dietary patterns and socioeconomic position. European journal of clinical nutrition. 2010;64(3):231-8.
165. Schwingshackl L, Hoffmann G. Diet quality as assessed by the Healthy Eating Index, the Alternate Healthy Eating Index, the Dietary Approaches to Stop Hypertension score, and health outcomes: a systematic review and meta-analysis of cohort studies. J Acad Nutr Diet. 2015;115(5):780-800 e5.
166. Potter J, Brown L, Williams RL, Byles J, Collins CE. Diet Quality and Cancer Outcomes in Adults: A Systematic Review of Epidemiological Studies. Int J Mol Sci. 2016;17(7).
167. Schwingshackl L, Hoffmann G. Does a Mediterranean-Type Diet Reduce Cancer Risk? Curr Nutr Rep. 2016;5:9-17.

168. Schwingshackl L, Schwedhelm C, Galbete C, Hoffmann G. Adherence to Mediterranean Diet and Risk of Cancer: An Updated Systematic Review and Meta-Analysis. Nutrients. 2017;9(10).
169. Woodruff SJ, Hanning RM. Development and implications of a revised Canadian Healthy Eating Index (HEIC-2009). Public Health Nutr. 2010;13(6):820-5.
170. Government of Canada. Dietary Reference Intakes 2013 [Available from: https://www.canada.ca/en/health-canada/services/food-nutrition/healthy-eating/dietary-reference-intakes.html.
171. Government of Canada. Canada's Food Guide 2019 [Available from: https://food-guide.canada.ca/en/.
172. U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015–2020 Dietary Guidelines for Americans. 8th ed2015.
173. National Cancer Institute. Comparison Among ASA24 Versions 2018 [Available from: https://epi.grants.cancer.gov/asa24/comparison.html#db.
174. USDA Agricultural Research Service. Food Patterns Equivalent Database 2018 [Available from: https://www.ars.usda.gov/northeast-area/beltsville-md-bhnrc/beltsville-human-nutrition-research-center/food-surveys-research-group/docs/fped-overview/.
175. National Cancer Institute. The Healthy Eating Index – Research uses of the HEI. 2018 [Available from: https://epi.grants.cancer.gov/hei/uses.html.
176. Dimitri C, Oberholtzer L, Zive M, Sandolo C. Enhancing food security of low-income consumers: an investigation of financial incentives for use at farmers' markets. Food Policy. 2015;52:64-70.
177. Fitzgerald J, Gottschalk P, Moffitt R. An analysis of sample attrition in panel data: The Michigan panel study of income dynamics 1997 [Available from: http://www.nber.org/papers/t0220.pdf.
178. Baulch B, Quisumbing A. Testing and adjusting for attrition in Household Panel Data: Chronic Poverty Research Centre; 2011 [Available from: http://www.chronicpoverty.org/publications/details/testing-and-adjusting-for-attrition-in-household-panel-data.
179. Li P, Stuart EA. Best (but oft-forgotten) practices: missing data methods in randomized controlled nutrition trials. Am J Clin Nutr. 2019;109(3):504-8.
180. Scharfstein D, McDermott A, Diaz I, Carone M, Lunardon N, Turkoz I. Global sensitivity analysis for repeated measures studies with informative drop-out: A semi-parametric approach. Biometrics. 2018;74(1):207-19.