Assessing the Preconception Dietary Intake of Canadian Adults using a new, short dietary assessment tool: The PREP'D Study

by

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Abstract

Background: A self-administered, 24-question dietary tool, called the Diet Screening for Adults in Canada (D-SAC), was chosen for use by the Canadian, Healthy Life Trajectories Initiative (HeLTI-Canada). Assessment of the reproducibility and comparability (to another dietary assessment tool) of the D-SAC questionnaire was required, so that HeLTI researchers could interpret dietary intake information and support participants in making optimal dietary changes. Study 1 compared dietary intake and diet quality collected using the D-SAC to 24-hour food recalls; reproducibility of the D-SAC was also determined. Study 2 was a pilot study that applied the D-SAC in a group of Canadian adults of child-bearing age to assess their preconception dietary intake. This study was conducted because very little is known about women's and men's diet during this phase of the life course, despite it being critical for a healthy life trajectory. Study 2 also assessed dietary intake of Canadian women and men and compared intake between those who are planning a pregnancy and those who are not**. Methods:** English-speaking women and men, between the ages of 18-45, living in Canada, who had reliable access to the internet were recruited for both studies. Those who were currently pregnant were excluded. All participants were recruited online. *Study 1:* Participants completed the D-SAC questionnaire, followed by five, 24-hour recalls, and then a final D-SAC questionnaire. All assessments took place over approximately one month. Reproducibility was assessed using Pearson and Intraclass correlation analyse and paired t-tests. Differences in the frequency of weekly food and beverage intake and dietary quality between the D-SAC and 24-hour recalls was compared using weighted kappa and Bland-Altman analysis. *Study 2:* The D-SAC was included as part of a cross-sectional survey that examined Canadian women's and men's knowledge, attitudes, beliefs, and self-reported behaviours related to preconception health. Frequency of weekly food and beverage intake, dietary patterns and diet quality scores were compared between women and men and between those who were planning a pregnancy and those who were not. Multivariable regression analysis was used to assess participant characteristics associated with different dietary patterns and different levels of diet quality. **Results:** *Study 1:* Dietary quality determined by the D-SAC was reproducible over a one-month period. The D-SAC was moderately comparable to repeated 24-hour recalls in estimating weekly intake of many foods and beverages. The D-SAC performed best when estimating intake of moderate-quality foods, but overestimated intake of high-quality foods and underestimated intake of low-quality foods. *Study 2:* Overall, women's and men's food and beverage intake did not align with Canada's Food Guide recommendations; superficially their intake of higher quality foods was below inadequate. Women (β=2.1, 95% CI: 0.9, 3.3), participants who had completed post-

secondary education (β=3.4, 95% CI: 1.6 5.2), met weekly physical activity requirements (β=3.5, 95% CI: 2.7, 4.3), and were older (β=0.1, 95% CI: 0.05, 0.2) tended to have a higher total quality score. However, participants who had children (β=-4.1, 95% CI: -6.80, -1.5), those who smoked (β=-2.4*, 95% CI: -4.5, -0.3), and those who had a BMI >30 kg/m2 had a significantly lower total quality score (β=-1.8, 95% CI: -2.9, -0.6) compared to those with a BMI between 18.5 and 24.9 kg/m2. Pregnancy intention was generally not associated with differences in dietary intake or quality although a greater proportion of women actively planning a pregnancy consumed less alcohol and more water on a weekly basis as compared to those who were not planning a pregnancy, and a greater proportion of men who were actively planning a pregnancy with their partners consumed more low-fat dairy products and less calorie-containing beverages than those who were not planning a pregnancy with their partners. **Conclusions:** Intake assessed using the D-SAC is reproducible. Overall, the ability of the D-SAC to assess individuals' dietary intake of food and beverage groups and diet quality compares well to 24-hour recalls but should be interpreted cautiously when determining absolute intake of high and low-quality foods and beverages. There is room for improvement in the preconception dietary intake of Canadians regardless of their intention to become pregnant.

Preface

This thesis is an original work by Dragana Misita. The research projects, of which this thesis is a part, received research ethics approval from the University of Alberta Research Ethics Board, Project Name "Validation of PrimeScreen 2020", Pro00098686, June 9, 2021 (Study 1); Project Name "Exploring Beliefs and Attitudes about Preconception Care – Alberta" (Pro00087716), May 3, 2019 (Study 2); and the University of Toronto, Project Name " Exploring the Preconception Care Attitudes and Beliefs of Women and Men in Canada: A Formative Research Study", (REB#18-309c).

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List of Abbreviations

Diet Screening for Adult Canadians (D-SAC)
Non-communicable diseases (NCDs
Developmental Origins of Health and Disease (DOHaD)
Gestational weight gain (GWG)
neural tube defects (NTDs)
Body mass index (BMI)
Large for gestational age (LGA)
Low protein diet (LPD)
London Measure of Unplanned Pregnancy (LMUP)
Society of Obstetricians and Gynaecologists of Canada (SOGC)
Public Health Agency of Canada (PHAC)
Health care providers (HCPs)
Canada's Food Guide (CFG)
Dietary Guidelines for Americans (DGA)
Healthy Life Trajectories Initiatives (HeLTI)
Canadian Institute of Health and Research (CIHR)
Randomized control trial (RCT)
The Pregnancy Study Online (PRESTO)
Diet History Questionnaire (DHQ)
National Cancer Institute (NCI)
Trans Fatty Acids (TFA)
Food frequency questionnaires (FFQs)
Central Pennsylvania Women's Health Study (CePAWHS)
Healthy Eating Index (HEI)
Diet Quality Index (DQI)
DQI for Pregnancy (DQI-P)
Dietary patterns analysis (DPA)
principal components analysis (PCA)
Automated Self-Administered 24 Hour dietary assessment tool (ASA-24)
Intraclass correlation coefficients (ICC)
Diet Quality Index Revised (DQI-R)
National Health and Nutrition Examination Survey (NHANES)
Lower reference nutrient intake (LRNI)
Global Physical Activity Questionnaire (GPAQ)
Total Quality Score (TQS)
High Quality Scores(HQS)
Low Quality Score (LQS)
Mediterranean Dietary Pattern (MDP)
Western Dietary Pattern (WDP)
Central Pennsylvania Women's Health Study (CePAWHS)
Healthy Life Trajectories Initiative (HeLTI)

Thesis Approach

This thesis research project is written in a manuscript format. The first chapter of this thesis highlights relevant background information, research objectives, and the significance of this work. The second chapter (i.e., first manuscript) focuses on the assessment of reproducibility and comparability of the Diet Screening for Adult Canadians (D-SAC), a new, 24-question dietary screening tool that was developed to assess diet quality in the Canadian Healthy Life Trajectories Initiative (HeLTI-Canada) study. The third chapter (i.e., second manuscript) outlines the findings related to preconception dietary intake among a large Canadian sample, using the D-SAC. Finally, the fourth chapter summarizes the key findings and provides an overview of the overall conclusion and significance of this thesis project. With this in mind, there is some duplication and overlap in text throughout this document.

Chapter 1:
Literature Review

Pregnancy Health & Associated Health Outcomes

Non-communicable diseases (NCDs), also known as chronic diseases, are collectively responsible for almost 70% of all deaths worldwide[1]. In Canada, 44% of adults over the age of 20 have one of 10 common chronic diseases, such as diabetes, hypertension, heart disease[2]. While these statistics raise concerns about the severity and prevalence of chronic diseases, researchers are continually exploring how NCDs can be prevented. Chronic disease prevention is a complex and multifactorial process that begins before we are even born. The Developmental Origins of Health and Disease (DOHaD) hypothesis suggests that conditions in utero can program individuals short and long-term health outcomes in offspring, including their risk of chronic disease later in life[3-5]. Epidemiological data shows a strong association between maternal nutrition during pregnancy and adult health and disease. For example, data from the widely known Dutch famine cohort shows that poor nutrition in utero is associated with changes in insulin-glucose metabolism. Specifically, being exposed to famine during gestation has been associated with impaired glucose tolerance and thus an increased risk of type 2 diabetes[6]. Adults conceived during the famine were also more likely to be obese compared to adults who were conceived before or after the famine, despite their birthweights being similar[7,8]. Thus, understanding how to improve women's nutrition in pregnancy has been an active area of DOHaD-related research

Prioritizing Preconception Nutrition

While improvements women's diets in the antenatal period have been shown to have modest reductions in gestational weight gain (GWG) and improvements in dietary behaviours, they have not been clearly associated with better maternal or newborn health outcomes including gestational diabetes, preeclampsia, large for gestational age, or preterm births[9]. In addition, while micronutrient supplementation starting in pregnancy corrects some maternal nutrient deficiencies, it has a modest effect on increasing birthweight, these corrections have not regularly been associated with improved child health outcomes[9]. Thus, improving diet and nutrition in pregnancy may not be the most effective way to optimize long-term health and reduce disease risk.

Emerging evidence suggests that setting up an optimal health trajectory must start in the preconception period for both women and men[9,10]. For example, it is widely known and accepted that maternal folic acid supplementation of 0.4 mg starting at least two months prior to conception reduces risk of neural tube defects (NTDs)[11]. Since half of pregnancies in Canada are unplanned[12] and timely folic acid supplementation is necessary to reduce the risk of adverse outcomes, achieving adequate folic acid status amongst all adults of child-bearing age will help reduce the risk of NTDs. Pre-pregnancy weight is also associated with maternal and child health outcomes. Women who have a higher pre-pregnancy weight or body mass index (BMI) are more likely to develop gestational diabetes mellitus[13], have a caesarean delivery[14,15], have an increased risk of preterm birth[16], and have large for gestational age (LGA) offspring[15,17]. In addition, a healthy maternal dietary pattern or greater maternal dietary quality prior to pregnancy has been associated with a reduced risk of developing hypertension in pregnancy[18,19], gestational diabetes

mellitus[19] and experiencing adverse birth outcomes[20,21]. Reducing pregnancy complications, child health outcomes, and long-term NCD risk will require that women have their best possible dietary intake prior to conceiving, regardless of their intention to become pregnant. When considering the role of male's preconception diet, emerging evidence within animal models, suggests that it is directly linked with child health postnatally. Fleming et al (2018) conducted a meta-analysis exploring paternal and maternal protein undernutrition in mice and associated effects of lifetime health of offspring. They found that "suboptimal maternal and paternal protein intake around conception have similar effects on offspring weight but differing effects on offspring blood pressure"[10]. Specifically, they found that maternal intake of a low protein diet (LPD) was associated with offspring hypertension while paternal intake of a LPD was associated with hypotension in adult offspring. In addition, both maternal and paternal LPD was associated with an overall increase in offspring birthweight[10]. Regarding paternal preconception diet and its influence on offspring health, Ng et al (2010) found that a paternal high-fat diet fed to rats 10 weeks before conception reduced female offspring's pancreatic β-cell function, impaired insulin secretion, increased body weight and glucose intolerance[22]. To our knowledge, no human studies have examined preconception dietary intake in males and their link child health outcomes.

While it has been assumed that women are highly motivated to improve their dietary habits when planning a pregnancy, there is evidence that women's dietary intake does not significantly change from preconception to pregnancy[23,24]. However, research assessing dietary intake in the prenatal period is limited. This information is crucial in understanding what parts of the diet require attention so that diet quality can be optimized throughout the years when reproduction is possible to promote optimal nutritional intake and status in pregnancy. This information will help

ensure that important dietary changes can be identified and addressed in a timely manner, prior to conception, when possible, within the context of women's real-life circumstances.

In sum, there is accumulating evidence to prioritize preconception nutrition and dietary intake. Clearly, effective strategies focused on optimizing dietary habits and nutritional intake of women and men prior to pregnancy are needed. Timely preconception dietary assessment and intervention is important in promoting healthier pregnancies and improving the long-term trajectory of health outcomes across the lifespan.

Defining the Preconception Period

There is no standard definition for the "preconception period". Stephenson et al (2018) proposes considering three perspectives on this: 1) from a biological perspective which defines preconception as being the time around conception; 2) from an individual perspective which defines preconception as starting when a woman or couple decides they want to have a baby; and 3) from a public health perspective which defines preconception as starting as early as adolescence[99]. There is no consensus on how to prioritize or synthesize these themes, however they are all important when considering how to optimize short and long-term health outcomes of parents and children.

Pregnancy Intention and Pregnancy Planning Behaviours

Intention to become pregnant or have a child may be measured by a simple yes/no statement, however, this oversimplification of intention is problematic as it does not take into account those who may be planning a pregnancy in the future, those who may experience unplanned

pregnancies, and those who are unsure of their pregnancy intent, but may not be using any contraceptives. There is no agreement upon a "gold standard" for measuring pregnancy intention, however, the London Measure of Unplanned Pregnancy (LMUP) [http://www.lmup.com/] is a validated tool that is often used[25,26]. It is important to note that this tool measures pregnancy intention retrospectively and does not assess current or future intention. Considering current or future intention to conceive is necessary for prospective studies assessing associations between pregnancy intention, life-style related factors such as diet and various health outcomes.

Given that nearly half of pregnancies in Canada are unplanned[12], supports that help all people of child-bearing age optimize their diet, regardless of their intention to become pregnant are necessary. In addition, understanding how pregnancy intention influences changes in dietary behaviours has not been widely studied, but this information can help further research aimed at exploring individual motivations for change and ways in which adults of child-bearing potential may need support in optimizing their diet prior to and during pregnancy. Nkrumah et al (2020) conducted a systematic review and meta-analysis to explore the association between women's pregnancy intentions and diet (assessed as food groups, energy and macronutrients, diet quality, and caffeine, iodine, and folate intake) or physical activity behaviors in the preconception and antenatal periods. While they highlighted that further research is needed to consolidate their findings, they reported that pregnancy intention was not associated with improved dietary or physical activity behaviors amongst women during the preconception period; specifically, they found that pregnancy intentions were not associated with fruit, vegetable, or caffeine intake or physical activity within preconception[27]. Antenatally, however, women who had intended pregnancies were more likely to report having healthier diets, lower caffeine intake, and higher

physical activity as compared to women who had unintended pregnancies. Studies assessing prenatal and antenatal energy, macronutrient intake, iodine and folate intake and pregnancy intention were limited and/ or inconsistent. The findings from this review may suggest that women prioritize dietary changes after becoming pregnant rather than prior to conceiving. The authors of this review highlighted that studies exploring the relationships between pregnancy intentions and preconception and antenatal smoking and alcohol consumption were far more readily available than studies exploring the relationship between pregnancy intentions and diet, suggesting that more research is needed assessing diet in this area. Research assessing whole diet and multiple food and beverage groups versus the intake of specific nutrients or single components of diet in preconception is also needed.

A study conducted in the United Kingdom used a cross-sectional survey to determine the extent to which women prepare for pregnancy[28]. After adjusting for age, ethnicity, education, number of previous live births, medications, previous miscarriage/stillbirth, and LMUP score, there was a significant association between receiving input from a health professional on positive behaviour change during the pre-pregnancy period, making healthier diet changes and taking folic acid. Unfortunately, details of what constituted healthier diet changes were not reported. Lang et al (2021) conducted a retrospective study to investigate associations between pregnancy planning, socio-demographic characteristics, and preconception health behaviours in Australian women[29]. Women who were planning a pregnancy had significantly higher odds of reporting any folic-acid use, reviewing immunizations, and accessing information from health professionals. They also had significantly lower odds of alcohol consumption and ever taking illicit drugs compared to those who did not plan their pregnancies. Limitations of most studies exploring associations

between pregnancy intention and changes in women's health behaviour is their retrospective study design. Studying these associations prospectively may decrease the risk of recall and social-desirability bias. Most of these studies also lack extensive dietary data assessment; and may be limited to, caffeine and alcohol intake. While important, intake of these two compounds does not reflect other important dietary components that could have a lasting role on health.

A qualitative study conducted with preconception, pregnant, and postpartum women in Australia that explored women's preconception health attitudes and behaviours found that women perceived optimizing lifestyle behaviours such as dietary intake, regular physical activity, reducing alcohol intake and pre-pregnancy vitamin supplementation as important actions to adopt in preconception[30]. Whether or not women performed these health behaviours was not investigated. These findings may suggest that women understand what health behaviours they should be prioritizing prior to pregnancy or perhaps are being recommended to prioritize. Future work is needed to document the actual health behaviours, timing of changes relative to each other, the facilitators and barriers to these changes, and how they are associated with conceiving and pregnancy outcomes.

Literature exploring dietary changes men and partners make when intending to conceive a child with their partner is extremely scarce. There is however some, research exploring partners' roles in supporting women to make nutrition-related behaviour changes. For example, Martin et al (2016) assessed the acceptability of "adherence partners" for supporting pregnant women in Kenya and Ethiopia with their calcium and iron-folic acid supplement intake[31]. The majority of women in this study chose their husbands as their adherence partner. Almost all women with

adherence partners reported that they would recommend this strategy to others and highlighted that adherence partners supported them by reminding and encouraging them, bringing them their supplements, and helping them address related side-effects[31]. There is also evidence to suggest that partner's alcohol use is positively related to women's prenatal alcohol use[32-34], suggesting that partners diet-related behaviour change, or lack thereof, may influence the changes women make prenatally. How partners, themselves, change to prepare for conception does not have a strong presence in the available literature and may not have been considered to date. Women have overwhelmingly been the focus of pregnancy planning research. For example, Mitchel et al (2012) assessed what health behaviours both women and men felt women should take action on before getting pregnant, and perceptions of health behaviours that men should take action on were not assessed[35].

The association between pregnancy intention and pregnancy planning in relation to dietary intake is an underexplored area. Better understanding of how women and men prioritize diet and make dietary changes when pregnancy planning is a crucial part of providing them with appropriate support, which may ultimately have strong population health benefits.

Current Preconception Nutrition Guidelines

While existing guidelines are primarily focused on optimizing women's health and diet in pregnancy[36-38], globally, there is need for guidance on nutritional intake in the preconception period, possibly including additional clinical practice guidelines. Dietary intervention prior to pregnancy is not a part of standard care in many high-income countries, including Canada,

despite evidence suggesting that healthy dietary intake patterns in both women and men prior to pregnancy can help optimize pregnancy and child health outcomes[9,10].

In 2016, clinical practice guidelines on female nutrition were published by the Society for Obstetrics and Gynecology Canada "to provide health care professionals in Canada with the basic knowledge and tools to provide nutrition guidance to women through their lifecycle"[39]. These guidelines highlight the importance of supplementary folic acid intake for all women of child-bearing age at least two to three months prior to pregnancy, optimizing weight prior to pregnancy, and recommend a low glycemic index diet to overweight women with polycystic ovary syndrome. More recently the Public Health Agency of Canada (PHAC) published the Family-Centered Maternity and Newborn Care National Guidelines which state that health care providers (HCPs) should "encourage positive health behaviours prior to conception" such as smoking and alcohol cessation and daily multivitamin intake containing 400 mcg of folic acid[40]. Canada's Dietary Guidelines for Health Professionals and Policy makers do not specifically address the preconception period[41]. The 2019 Canada's Food Guide (CFG) highlights that women who could become pregnant consume a daily multivitamin containing 0.4 mg of folic acid. CFG also highlights that healthy eating habits are important for women who are pregnant or breastfeeding[42]. Aside from recommending general healthy eating, the CFG also recommends that women consume "a little more food each day than they normally would" during the second and third trimesters of pregnancy and while breastfeeding, and provide guidance on food safety, iron supplementation, multivitamin intake, and weight during pregnancy. The newly updated 2020 Dietary Guidelines for Americans (DGA) specifically notes that following a healthy dietary pattern before pregnancy as well as during pregnancy and lactation is important and has the

potential to influence maternal and child health outcomes[36]. They recommend that all individuals follow a healthy dietary pattern throughout every stage of the life course. These guidelines also recommend that women who are planning a pregnancy take a daily prenatal vitamin and mineral supplement to meet folic acid, iodine, and vitamin D requirements. The DGA also recommends that women who are planning a pregnancy or are already pregnant take a supplement containing iron as recommend by their HCP. From a nutritional perspective, current guidelines within North America prioritize folic acid supplementation when pregnancy planning. While an important recommendation, current guidelines do not address folic acid supplementation amongst adults who experience unplanned pregnancies. Additional nutrition-related recommendations across guidelines tend to focus on supporting women in achieving a healthy pre-pregnancy weight and encourage alcohol and smoking cessation[39,40]. It is important to note that existing guidelines do not provide recommendations on ways that men can optimize their preconception dietary intake.

While all current recommendations are important and must be maintained, additional recommendations regarding nutrition services are required for HCPs who interact with women outside of pregnancy. Nutrition guidelines may also be revised to include more detailed direction to those of reproductive age. Recommendations are needed to support partners in optimizing their own health prior to conception and also address ways in which they can support women in doing the same before and throughout pregnancy. Another potential way to further strengthen preconception guidelines would be to provide HCP with guidance on how they might initiate and maintain these nutrition-focused conversations with women and their partners. A 2018 cross-sectional study aiming to understand gestational weight gain counselling practices of Canadian

HCPs found that only about one-third of them reported routinely discussing appropriate extra food requirements with pregnant women, and only 16% discussed recommended rate of gestational weight gain based on their GWG target[43]. This suggests that HCPs may need more support in having these conversations with women during and even before pregnancy.

Exploring how Canadian women and men need support in optimizing their diets will help inform future clinical practice guidelines. Comprehensive guidelines that span the different parts of the reproductive cycle are a key part of supporting care providers in starting and continuing conversations about preconception health with their patients. Guidelines also help inform strategies that are put into place to support health care initiatives.

Canadian Preconception Initiatives and Tools

Preconception health initiatives are becoming a priority within Canada. For example, the Alberta Health Services "Ready or Not" Initiative was launched to provide adults aged 18 to 44 with up-to-date, evidence-based, preconception health information through their ReadyorNotAlberta.ca website. The website was designed to target those who are planning to have a baby within the next 18 months and those who are not. For those who are planning a pregnancy, there is information available for how they can make changes to support their health and the health of their future baby. For those who are not ready, there is information about birth control, safer sex and ways to support their health if they do ever decide to have a child. Nutrition guidance for women who are not ready (i.e. preconception) includes recommendations to consume a daily multivitamin containing folic acid and encouraging alcohol cessation if they try to become pregnant or if they are or think they may be pregnant.

Similarly, the Ontario-based, Best Start program (beststart.org), which is run by Health Nexus (healthnexus.ca) and supports service providers who work in preconception, prenatal health, and early child development, prepared a summary report of research findings[44] on the current status of prenatal education in Ontario and existing gaps and needs in prenatal care. The report itself not only summarizes relevant findings but also includes recommendations for prenatal education in Ontario. From a nutrition perspective, this report highlights that prenatal education has been positively associated with health promoting behaviours such as improved exercise or nutrition, however, it does not provide further details on the education provided or the specific nutrition-related health behaviours promoted. Health Nexus has also prepared several preconception-focused tools in collaboration with other organizations; the tools are all aimed at different populations and have unique purposes. For example, one tool was created to highlight the partners role in conception and the health of their child; this tool, in particular, highlights the fact that alcohol and poor nutritional intake can damage sperm quality and function. Interestingly vitamin C and its importance for individuals who smoke is also mentioned[45]. Another tool summarizes the results of a 2009 survey of Ontario family physicians regarding their preconception health knowledge, needs and practices[46]. A list of the Health Nexus tools can be found at http://en.healthnexus.ca/topics-tools/reproductive-health/preconception

While the importance of preconception health is becoming increasingly recognized and initiatives aimed at this stage of the life course are being normalized, there is still work to be done in providing more in-depth details and guidance around optimizing whole diet before conception, for both women and men.

Existing Preconception Nutrition Research

The impact of parenteral preconception health and nutrition status is a growing area of research. While evidence suggests that optimizing diet, weight, and overall health in the preconception period is linked to positive pregnancy and child health outcomes (highlighted in more detail above), more research is necessary to track how dietary intake and particular patterns are linked to maternal and child outcomes. Particularly, prospective studies assessing the preconception dietary intake of women and men are required. Some key studies that are contributing to this body of work are highlighted below:

Healthy Life Trajectories Initiatives (HeLTI)

Healthy Life Trajectories Initiatives (HeLTI) are longitudinal intervention cohort studies funded by the Canadian Institute of Health and Research (CIHR), the National Natural Science Foundation of China, the Department of Biotechnology of India, and the Medical Research Council of South Africa. Four individual yet inter-linked and collaborative HeLTI studies are currently being conducted and involve researchers based in Canada, China, South Africa and India. While all HeLTI studies are tailored for the country and specific to the population they serve, all have the shared goal of reducing the risk of NCDs via interventions across the life course, starting in preconception and following through to early childhood.

HeLTI-Canada is a randomized controlled trial (RCT), currently underway, which aims to optimize growth and development and limit obesity in children in Canada using a telephone-based intervention with tailored e-health resources for women and their partners, starting in preconception and following through to early childhood[47]. The outcomes of interest include rates of child overweight and obesity, child growth trajectories, cardiometabolic risk factors, sedentary

behaviours, and health behaviours including nutrition and physical activity. Diet will be assessed with a 24-item food frequency tool, called the Diet Screening for Adult Canadians (D-SAC) questionnaire. These initiatives will provide insight into how intervening in the preconception period to optimize dietary intake and other health behaviours may support parental health along with the growth and development of children.

Snart-Gravid

The Snart-Gravid ('Soon Pregnant') study, which launched in 2007, was an online, prospective cohort study of Danish women within reproductive age[48]. Snart-Gravid researchers explored the association of a number of factors related to preconception diet and health outcomes such as fecundability, spontaneous birth, and time to pregnancy. They found that a large proportion of women who are planning for pregnancy were not using folic acid or multivitamin supplements[49]. However, folic acid supplementation was associated with increased fecundability amongst women within the cohort[50]. In one study, Hatch et al (2012) analyzed the association between caffeinated beverage and soda consumption and time to pregnancy; they reported a weak association between fecundability and caffeine intake but reduced fecundability among soda drinkers and increased fecundability among tea drinkers[51].

Snart-Forældre

The 'Snart-Forældre' ('Soon Parents') study was launched in 2011 as an extension of 'Snart-Gravid'. It was an internet-based, prospective cohort study of Danish adult women and men who are planning a pregnancy which aimed to investigate the association between preconception diet and fecundability[52]. Data collection was done using online questionnaires at baseline and bimonthly for 12 months or until pregnancy was recognized. For dietary data collection, a semi-quantitative food frequency questionnaire (FFQ) of more than 220 items was used[52].

The Pregnancy Study Online (PRESTO)

The Pregnancy Study Online (PRESTO) is a web-based, prospective cohort study recruiting Canadian and American women and their partners between the ages of 21-45, who are not yet pregnant, but are thinking about becoming pregnant within the next 6 months[53]. The objective of PRESTO is to identify lifestyle, behavioral, medical, and dietary factors that affect the chances of successful pregnancy. In this study, dietary intake is assessed by the Diet History Questionnaire (DHQ) II, which is a FFQ developed by the National Cancer Institute (NCI). The DHQ II has been validated for use within US and Canadian populations; the questionnaire consists of 134 questions and assesses intake of foods and beverages over the last year[54].

A number of the published manuscripts on the PRESTO study report on findings from both the North American and Danish cohorts. In short, they found little or no association between intake of seafood[55], dairy[56], phytoestrogens[57] and fecundability. However, these studies found positive associations between reduced fecundability amongst women and intake of fried shellfish[55], sodas and energy drinks[58], diets higher in glycemic load, carbohydrate to fiber ratio and added sugar [59],

high intake of trans fatty acids (TFA), low intake of omega-3 fatty acids[60] and caffeine intake[61]. Additionally, intake of omega-3 fatty acid[60] and supplemental iron intake[62] were associated with increased fecundability amongst women. Furthermore, the Danish and Snart-Forældre cohort results suggest a weak association between consumption of 6 or more alcohol servings per week and reduced fecundability amongst men[63].

Central Pennsylvania Women's Health Study Cohort

The Central Pennsylvania Women's Health Study (CePAWHS) was a longitudinal cohort study which included a baseline, population-based survey administered between September 2005 to March of 2005 to 2002 women at different reproductive stages, aged 18-45, living in Central Pennsylvania[64]. One study using the CePAWHS cohort data aimed to "conceptualize the key proximal risks for preterm birth and low birthweight during women's preconceptional and interconceptional periods"[64]. Low intake of fruit and vegetables (<1/day) and non-use of folic acid supplementation, amongst other behaviours, were found to be risk factors for adverse pregnancy outcomes[64]. In response to these findings, a randomized behaviour-change intervention trial was designed to improve women's preconception health and interconceptional health[65]. A total of 362 non-pregnant women aged between 18 and 35 years, living in low-income rural communities in central Pennsylvania were recruited and randomized into an intervention or control group. Those in the intervention group were enabled to improve their health by being given information and supported with their behaviour change skills via six, biweekly, small group Strong Healthy Women intervention sessions[66]. The authors found that women in the intervention group were more likely to report higher self-efficacy for eating healthy food, greater intent to eat healthy foods, consume a daily multivitamin containing folic

acid foods, and to be more physically active as compared to women in the control group who continued to receive standard care[66].

Dietary Assessment

Importance and Challenges of Dietary Assessment

Dietary assessment is the study of food and beverage intake of individuals and populations. It is a critical step in describing food and beverage intake and also in identifying the numerous ways that diet can influence disease risk and health outcomes. In 2016, Labonte et al published an opinion paper highlighting the importance of dietary assessment as a critical element of health research[67]. They note that dietary assessment of individuals is usually measured using self-report, which makes it susceptible to bias. Although the methods that are currently available have their challenges and generate data that has inherent systematic and random error associated with it, self-report is still the most effective way, and in most cases the only way, to collect information on the food and beverages that people consume. This information is required for identifying dietary patterns and food group intake and is therefore essential to furthering our understanding between foods, health and disease.

Some of the difficulties cited as barriers to obtaining accurate and reliable information about dietary intake include the fact that the tools are open to systematic and random measurement errors because they rely on self-report[67,68]. In addition, food and nutrient databases used to estimate macro and micronutrient intake from dietary data may be incomplete in the face of a rapidly changing food supply [67,68], again leading to errors. Finally, social desirability bias may

influence how an individual reports their intake of certain foods, particularly ones that may be considered either desirable or undesirable.

Thus, the important challenge lies in further research to develop, disseminate, and implement high-quality dietary assessment methodologies to improve the quality of this type of data and to provide reliable results. Recognizing the importance of this work and translating that into funding opportunities are key steps needed and will benefit the entire field relying on nutrition-related research.

Dietary Assessment Tools

Many tools exist to help researchers and HCPs assess dietary intake, each with their own benefits and challenges. Choosing the appropriate dietary assessment tool requires reflection on what type of dietary information is required and how it will be used and interpreted. Food records or diaries are less likely to be affected by recall bias as they are be completed in real-time and not from memory[69]. Weighed food records or diaries more precisely measure portion size as compared to ones that estimate portion size, however they put the greatest level of burden on participants[69], may be more time-consuming, and require more resources or be an expensive approach from researchers. Collecting records or diaries over three to seven days is often used to estimate an individual's usual intake[69]. Other common tools include 24-hour recalls or records and FFQs. 24-hour recalls require individuals to recall their dietary intake over the previous day. Unlike food diaries and 24-hour recalls or records, FFQs may be more appropriately used to assess individual typical dietary intake over a specified period, usually the past year[69] and can help capture intake of foods that are often not consumed on a daily basis, such as fish. FFQs have

commonly been used in large epidemiological studies since the 1990's[70]. However, many FFQs designed to assess whole diet are often lengthy in nature and may take the participant up to one hour to complete[54,71]. Researchers who wish to assess diet within a large cohort of participants or those who are measuring diet as one of many other health behaviours often require simple, easy-to-use dietary assessment tools. Thus, the interpretation of FFQ dietary data may differ depending not only on the questionnaire itself, but also by the research question(s) of interest.

Validity and Dietary Assessment Tools

Assessing and understanding the validity and reliability of new dietary assessment tools are important steps in furthering the collection of high-quality dietary data from individuals and populations. In broad terms, there are two different types of validity that provide both information about a questionnaire; these are internal and external validity. External validity refers to the extent to which results can be generalized to populations beyond the sample of people who participated in the study. It is primarily determined by the sampling framework for the study. External validity is of growing importance due to the recognition that factors such as equity, diversity, and inclusion (or lack thereof) of people from different backgrounds in research shapes the interpretation of results and can bias impressions of the outcome of interest, such as dietary intake.

Internal validity is specifically relevant at the development and initial evaluation stages of creating new dietary assessment tools. Internal validity considers whether the tool measures what it is intended to measure, and typically includes constructs of face validity, content validity, and criterion validity. Face validity describes whether or not the tool appears to measure what it is supposed to measure. It can be achieved by having experts review the tool and provide feedback

on the construct and how to measure it. Content validity refers to the degree to which all aspects of the construct has been captured by the tool. In dietary assessment, this could include considering whether the construct of interest is habitual intake or short-term intake, for example. Content validity is often determined by a thorough review of the literature as well as the research question that is being addressed with this new tool. Criterion validity measures the extent to which results from the tool aligns with other tools designed to capture the same or a similar construct. If there is a gold standard tool, it is often important to collect information from both of these tools and compare their outcomes on several dimensions such as absolute and relative intakes or rankings of participants within a study. In the case of dietary assessment, food journals, 3-day records and 24-hour dietary recalls are typically considered standards in the nutrition field. They are not universally considered to be "gold standards" due to the possibility of reporting bias discussed above[67]. Nevertheless, these tools have well-described validity and reliability and can be used to assess relative validity, meaning that new tools can be compared with one or more of them to assess how the new tools compares to a more extensive but perhaps more cumbersome standard tool.

Approaches to Dietary Analysis

Measuring dietary quality is becoming an increasingly popular approach in assessing dietary intake as compared to the investigation of single nutrients. Dietary quality serves as a better predictor of health outcomes[72,73] given the synergetic effects of overall dietary patterns in contrast to single nutrients in influencing overall metabolic health[74,75]. Diet quality indexes are commonly used in research as a tool to score and classify dietary quality. A commonly used index is the Healthy Eating Index (HEI) which measures diet quality and diet alignment with the DGA[76] and has been adapted for use within the Canadian population[77]. However, this index requires data not collected by all FFQs and screening tools such as information on the adequacy

and moderation of intake. Also, statistical methods associated with the HEI have been reported as complex[76] and Kirkpatrick et al (2018) suggest that if researchers plan on using the HEI, they should consult with a statistician early on their research planning process[78]. The Diet Quality Index (DQI) is another commonly used tool. This index has been adapted and validated in other populations. For example, the DQI for Pregnancy (DQI-P) was designed specifically for women of reproductive age and takes into consideration nutrients critical to optimal health in pregnancy. However, concerns about the lack of specificity of the DQI-P have been raised by some researchers[79]. For example, all grains and fats are weighted equally within this index. This is an important factor to consider when using diet quality as a measure of dietary intake.

Dietary patterns analysis (DPA) is an approach used to assess and describe dietary intake and has increasingly gained popularity over time. Dietary pattern analysis allows for the assessment of interactions amongst foods and may capture the complexity of diets as compared to considering individual foods and nutrients in isolation from each other[80]. Mozaffarian et al (2018) reported that single nutrient theories have previously been inadequate in explaining the complex diet effects on non-communicable diseases[74]. Dietary patterns derived from data-driven methods are considered one approach to understanding a person's overall diet quality and their usual intake[81]. Many studies use principal components analysis (PCA) as a method to derive data-driven dietary patterns since the resulting information is based on the relationships and inter-correlations between the foods reported[81]. Dietary patterns yielded via PCA are explained by variations in data. With PCA, participants receive a score in relation to each identified dietary pattern; the higher the score, the more closely the individual's intake aligns with that dietary pattern. Because observed dietary patterns represent individual's food choice patterns and real dietary habits, they may be directly relevant in informing public health messages[82].

Exploring preconception dietary intake of adults who have child-bearing potential is important but under-researched. To date, preconception studies that have considered diet or nutrition, have 1) gathered limited data regarding diet, (generally focused on intake of fruits and vegetables, caffeine, and multivitamins containing folic acid) and 2) focus on women as their target population. Thus, very little is known about women's and men's whole diet during this crucial period of the life course. Studies exploring adult's preconception dietary intake are needed and will play a vital role in informing future research and interventions aimed at supporting adults of child-bearing age during the preconception period in optimizing their dietary intake.

Objectives

The objectives of this thesis are:

1) To assess the reproducibility and comparability of the D-SAC questionnaire in a group of adults in the preconception period in Canada.
2) To describe preconception dietary intake in a group of women and men in the preconception period in Canada using the D-SAC questionnaire. Objective 2 was accomplished by:
    a. Assessing participants' weekly intake of foods and beverages
    b. Examining dietary quality using the D-SAC quality scoring system designed for this study;
    c. Examining the dietary patterns of participants using principal components analysis;
    d. Examining participant and socio-demographic characteristics that are associated with dietary quality and dietary pattern scores;
    e. Determining the extent to which dietary intake differs between those who report planning or not currently planning a pregnancy.

Significance

This research will provide critical information about the reliability and comparability of the D-SAC. This will be important for understanding the dietary information that is generated in the HeLTI-Canada study and ensuring that researchers are confident in interpreting results using this tool. This research will also provide some of the first information from a large group of Canadian women and men about their dietary intake according to whether and when they are planning a pregnancy. This will add a new dimension to the literature describing preconception dietary intake of Canadian adults. Few studies thus far have prospectively examined diet and how it is related to intention to become pregnant. This information is important as it will help inform ways that dietary intake, and subsequent nutritional status, might be optimized in people who are and are not planning pregnancy. By placing priority on this life period (i.e. preconception), there is the possibility of reducing risk of NCDs in offspring and adults in the long-term.

Chapter 2:

The Diet Screening for Adult Canadians (D-SAC): assessing its reproducibility and comparability against 24-hour recalls

Chapter 2 Abstract

Background: Food frequency questionnaires (FFQs) are often used to assess dietary intake in large epidemiological studies, but many of those that assess the entire diet are lengthy and can pose a burden on participants. The HeLTI-Canada study recently developed and implemented the Diet Screening for Adults in Canada (D-SAC), a self-administered, 24-question dietary assessment tool. The objective of this study was to test the reproducibility and comparability of the D-SAC, in a group of adults living in Canada. **Methods:** English-speaking, women and men, between the ages of 18-45, living in Canada who had reliable access to the internet were recruited online. Those who were pregnant were excluded. Participants were asked to complete two D-SAC questionnaires and five 24 hour recalls over the span of one-month. Reproducibility was assessed using Pearson and Intraclass correlation analysis and paired t-tests. Frequency of weekly food and beverage intake and dietary quality assessed via the D-SAC and the 24-hour recalls were compared using weighted kappa and Bland-Altman analysis. **Results:** Dietary quality as assessed via the D-SAC was reproducible over a one-month period. The D-SAC had fair to moderate ability in assessing dietary intake frequency of many food and beverage items compared with diet information collected from 24-hour recalls. Compared with 24-hour recalls, the D-SAC measured the intake of moderate-quality foods well but overestimated intake of high-quality foods and underestimated intake of low-quality foods. **Conclusions:** Intake assessed via the D-SAC is reproducible over a one-month period. Overall, the D-SAC has moderate comparability to repeated 24-hour recalls ability to assess individuals' dietary intake, but should be interpreted with the knowledge that it overestimates intake of high-quality foods and underestimates intake of low-quality foods.

1. Introduction

Food frequency questionnaires (FFQs) have been used to assess habitual dietary intake in epidemiological studies since the 1990's[83]. While FFQs can be limited by recall bias and difficulties with estimating frequencies and portion sizes of foods and beverages consumed, they are particularly useful in assessing dietary patterns and behaviours over time[69]. They are also sometimes favoured over other dietary assessment methods as they can be self-administered, are generally easy to use and cost effective, and may require less time for participants to complete, compared to 24-hour recalls and food records or diaries. Many different FFQs have been created, adapted and validated to assess dietary intake of populations worldwide. Some of the most popular FFQs used in Canadian research studies include the Diet History Questionnaire (DHQ and DHQII), the Block FFQ, and the Willet FFQ[84]. However, these FFQs can take participants up to one hour to complete[85] which can be a significant burden to participants.

A large-scale, Canadian, longitudinal intervention cohort study, called the Healthy Life Trajectories Initiative (HeLTI-Canada)[47], was launched in 2017. The purpose of HeLTI-Canada is to examine the impact of a nurse and e-delivered personalized health intervention initiated in the preconception period on parental and child risk factors for non-communicable diseases (NCDs). Since poor parental dietary intake is a possible risk factor for NCD development and presentation[3-5,10], HeLTI-Canada researchers required a method to repeatedly assess usual dietary intake of adult participants over the ~8 years of the study, from preconception to early childhood of the index child. The research team required a tool that could be completed in 10 – 15 minutes as there was a significant time-burden associated with the large number of questionnaires that participants were asked to complete on an annual basis. The HeLTI-Canada research team also

desired a dietary assessment tool that could be used by HCPs without extensive nutrition training (e.g. nurses) to quickly identify nutrition-related behaviours that could contribute to poor pregnancy outcomes among study participants so that these could be targeted for intervention.

To meet these needs, the research team adapted an 18-item FFQ, called the PrimeScreen. The PrimeScreen FFQ was published in 1999 to be used in primary care settings to help physicians assess nutritional risk for common adult chronic diseases, such as cardiovascular disease[86]. Validity and reliability of the PrimeScreen was completed by Rifas-Shiman et al in a study where they compared PrimeScreen compared to a longer semi-quantitative FFQ and to plasma levels of Vitamin E, β-carotene, and lutein/ zeaxanthin[86]. Rifas-Shiman et al (2000) reported that the PrimeScreen compared well with the longer FFQ in assessing foods and food groups (r=0.61) and nutrients (r=0.60). Correlation coefficients of the selected nutrients measured by the PrimeScreen and plasma levels of the antioxidant micronutrients noted above ranged from 0.33 – 0.43. Authors noted that comparing the PrimeScreen to diet recalls or records was not feasible for their study. This was identified as a limitation of their work[86]. Authors reported that the PrimeScreen had adequate reproducibility as assessed by Spearman correlation coefficients comparing food groups and nutrients across two administrations of the questionnaire.

The objective of the present study was to test the reproducibility and comparability of the adapted version of the PrimeScreen, described below and re-named the Diet Screening for Adults in Canada (D-SAC), in a group of adults living in Canada.

2. Methods

2.1 Study Design & Population

Between July 2020 and March 2021, a convenience sample of participants from across Canada were recruited to a cross-sectional study. Inclusion criteria were: English-speaking, women and men, between the ages of 18-45, living in Canada who had reliable access to the internet. Being pregnant was the only exclusion criteria. Ethics approval was obtained from the University of Alberta Research Ethics Board (Pro00098686).

2.2 Study Process

Recruitment started by sending introductory emails to individuals who were part of an existing participant database of individuals who took part in an undergraduate nutrition research in 2020. Paid, online ads were used on Facebook and Instagram, emails were sent to existing list serves and word-of-mouth was also used. Although there was an intention to recruit in-person, this was not possible due to COVID-19 pandemic-related restrictions. All recruitment materials included a link to the online screening questionnaire (Appendix A) for individuals who indicated they were interested in learning more about the study or enrolling. Upon successfully completing the screening questionnaire, individuals were directed to the online study information letter (Appendix B). Those who wished to enroll completed the online consent form (Appendix B) and were directed to complete the sociodemographic questionnaire (Appendix C) followed by the first D-SAC questionnaire; both were administered through REDCap (University of Alberta).

Once these were complete, participants were sent a "welcome email" (Appendix D) that included instructions on how to complete the five, 24-hour food recalls over the next five weeks using the

Automated Self-Administered 24-hour dietary assessment tool (ASA-24) (https://asa24.nci.nih.gov/). Participants could practice using the ASA-24 system at the website demonstration site, if they chose to do so. They were given a custom login and instructed to complete one to two food recalls every week over the following five weeks until they completed five 24-hour food recalls. Once a participant completed all five food recalls they received a link to the second D-SAC. The study coordinator emailed participants a $25 grocery store gift card who completed all elements of the study protocol.

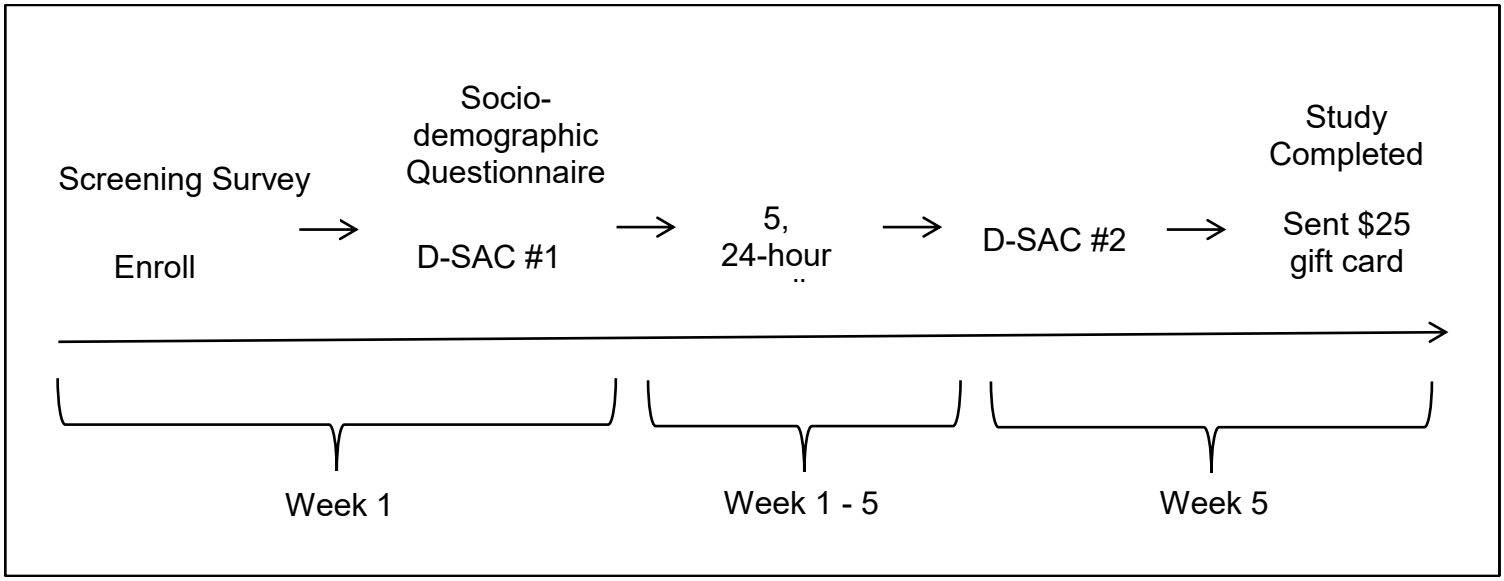


Figure 1. Flow chart highlighting the study activities from enrollment to study completion

2.3 *Adaptation of the Diet Screening for Adult Canadians (D-SAC) Questionnaire*

As noted above, the D-SAC questionnaire (Table 1) was adapted from the PrimeScreen dietary questionnaire (Appendix E). Briefly, food groups in the PrimeScreen were reviewed by three experts (DM, SA, RB) in human nutrition with 5-35 years of practical and research experience in the field. Two of these experts (DM, SA) were also Registered Dietitians. All questions from the PrimeScreen were included in the D-SAC with the exception of the question about intake of stick margarine which was removed in the D-SAC as it is not widely consumed in 2020. Questions about intake of four groups of foods or beverages were added to the D-SAC based on recent changes to Canada's Food Guide as follows: 100% pure fruit juice, nuts and seeds, plant-based unsweetened beverages, and plain water. One question was added about alcohol intake since this questionnaire is targeted at couples who are in the preconception phase of their lifecycle and limiting alcohol intake is recommended for people who are planning a pregnancy. There were subtle but important wording changes to five questions from the PrimeScreen to the D-SAC as follows: dried beans was changed to plant proteins and an expanded list of these foods was

provided to be consistent with CFG 2019; ice cream was removed from the list of examples of whole milk dairy foods and was included in the list of highly processed foods; whole eggs was changed to eggs; refined grains was removed and was considered to be a part of the baked products group; highly processed foods were added (with examples given that include sweet and salty snacks, desserts, chocolate bars and candy, and ice cream); calorie-containing beverages were changed to sugar-sweetened beverages.

There were also changes made to the scoring system originally used by the PrimeScreen. This is discussed in detail below, but briefly, the PrimeScreen had a single score calculated as the sum of scores derived from each question. The D-SAC has three sub-scores representing people's intake of high, moderate and low-quality foods. These are summed to provide a total score. The total score is similar to the single score in the PrimeScreen.

2.4 Diet Screening for Adult Canadians (D-SAC) Questionnaire

The D-SAC (Table 1) is self-administered and asks participants to report their weekly intake of foods and beverages that fall into 24 different categories over the last month. The 24 groups of foods and beverages are shown in Table 3. Intake frequency options were similar to the original PrimeScreen and were: "less than once per week", "once per week"; "2-4 times per week", "nearly daily or daily", "two or more times per day". We did not assess the length of time it took participants to complete the D-SAC, however, Rifas-Shiman et al (2000) found that participants took approximately five minutes to complete the PrimeScreen, and that no one exceeded 10 minutes [86]. The questionnaire format remained the same in the PrimeScreen and D-SAC.

Table 1. Diet Screening for Adult Canadians (D-SAC) Questionnaire
1. Dark green leafy vegetables (spinach, romaine lettuce, mesclun mix, kale, turnip greens, bok choy, swiss chard): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day
2. Broccoli, broccoli rabe, cauliflower, cabbage, brussel sprouts: • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day
3. Orange vegetables (e.g. carrots, orange or yellow pepper, sweet potato, squash) • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day
4. Other vegetables (e.g., peas, corn, green beans, tomatoes - fresh, frozen or canned): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day
5. 100% pure fruit juice (e.g., orange, grapefruit, apple, mango etc.): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day
6. Fruits (e.g. oranges, apples or pears, bananas, berries, grapes, melons - fresh, frozen or canned): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day
7. Whole milk dairy foods (whole milk, hard cheese, butter, yogurt): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day
8. Low-fat milk products (e.g., low-fat/skim milk, yogurt, cottage cheese): • Less than once per week • Once per week

- 2-4 times per week
- Nearly daily or daily
- Twice or more per day

9. Eggs:
   - Less than once per week
   - Once per week
   - 2-4 times per week
   - Nearly daily or daily
   - Twice or more per day
10. Beef, pork, or lamb:
   - Less than once per week
   - Once per week
   - 2-4 times per week
   - Nearly daily or daily
   - Twice or more per day
11. Processed meats (sausages, salami, bologna, hot dogs, bacon):
   - Less than once per week
   - Once per week
   - 2-4 times per week
   - Nearly daily or daily
   - Twice or more per day
12. Turkey or chicken:
   - Less than once per week
   - Once per week
   - 2-4 times per week
   - Nearly daily or daily
   - Twice or more per day
13. Fish/Seafood (not fried, but broiled, baked, poached or canned):
   - Less than once per week
   - Once per week
   - 2-4 times per week
   - Nearly daily or daily
   - Twice or more per day
14. Plant proteins (e.g., dried beans, peas, lentils, tempeh or tofu):
   - Less than once per week
   - Once per week
   - 2-4 times per week
   - Nearly daily or daily
   - Twice or more per day
15. Nuts and seeds (e.g., whole/chopped or spreads made from nuts and seeds):
   - Less than once per week
   - Once per week
   - 2-4 times per week
   - Nearly daily or daily
   - Twice or more per day
16. Plant-based unsweetened beverages or foods (e.g., soy, almond, rice, oat, etc.)
   - Less than once per week
   - Once per week

- 2-4 times per week
- Nearly daily or daily
- Twice or more per day

17. Whole grain breads and cereals (whole wheat, oatmeal, brown rice, barley):
    - Once per week
    - 2-4 times per week
    - Nearly daily or daily
    - Twice or more per day
18. Baked products (e.g., muffins, doughnuts, cookies, cake, pastries, granola bars):
    - Less than once per week
    - Once per week
    - 2-4 times per week
    - Nearly daily or daily
    - Twice or more per day
19. Highly processed foods (e.g., sweet or salty snack foods, desserts, chocolate bars and candy, ice cream, etc.)
    - Less than once per week
    - Once per week
    - 2-4 times per week
    - Nearly daily or daily
    - Twice or more per day
20. Deep fried foods
    - Less than once per week
    - Once per week
    - 2-4 times per week
    - Nearly daily or daily
    - Twice or more per day
21. How often do you add salt to food at the table?
    - Less than once per week
    - Once per week
    - 2-4 times per week
    - Nearly daily or daily
    - Twice or more per day
22. Sugar sweetened beverages (e.g., regular soda, fruit drinks, specialty coffees, energy drinks, ice tea):
    - Less than once per week
    - Once per week
    - 2-4 times per week
    - Nearly daily or daily
    - Twice or more per day
23. How often do you drink plain water:
    - Less than once per week
    - Once per week
    - 2-4 times per week
    - Nearly daily or daily
    - Twice or more per day
24. How often do you drink a beverage containing any alcohol?
    - Less than once per week
    - Once per week

- 2-4 times per week
- Nearly daily or daily
- Twice or more per day

2.5 Automated Self-Administered 24-hour (ASA-24) Assessment Tool

Food recalls were completed using the Canadian version of the Automated Self-Administered 24-hour (ASA-24) Dietary Assessment Tool (2018) [https://epi.grants.cancer.gov/asa24/]. The ASA-24 is a free, web-based tool that allows participants to complete self-administered 24-hour recalls. The Canadian version of the ASA-24 uses the Canadian Nutrient File and a Canadian recipe database to estimate the nutrient content of foods. The decision to collect five recalls over a one-month period was the result of several discussion among the researchers (DM, RB) with additional input from Dr. S. Kirkpatrick at the University of Waterloo. Dr. Kirkpatrick is well-known for her expertise in dietary assessment[87-89] and is very familiar with assessment methods used by nutrition researchers in Canada[67]. Since the D-SAC asks about intake over the last month, we strove to include at least one 24-hour recall per week, to try to capture information about intake over the past month. It is well known that participant burden increases with each 24-hour recall participants are asked to complete, thus the decision for 5 recalls over 4 weeks was attempting to balance improved accuracy describing participants monthly intake and the response burden.

2.6 Calculating Quality Scores

A diet quality food scoring system was devised to assess participants intake of high, moderate, and low-quality foods and beverages as collected by the D-SAC's and the 24-hour recalls. For the food quality scoring system, each food and beverage was categorized as a nutritionally low, moderate, or high-quality item, using Canada's Food Guide for reference. Each quality group

was associated with a different score range. Points were added or subtracted based on the frequency that people reported consuming foods and beverages within each quality group; these points were summed to produce a low, moderate and high-quality score for each participant. A total score was calculated as the sum of the three quality categories (Table 2). The quality scoring system was designed for use with the D-SAC, thus dietary data of food and beverage intake collected via the D-SAC was formatted appropriately for quality analysis (i.e. frequency of food and beverage intake was grouped into one of five frequency categories – Table 2). The dietary data collected using the 24-hour recalls was categorized (described in detail below), to match the D-SAC, and quality scores were compared directly to the quality scores obtained from the D-SAC.

Table 2. D-SAC Quality Scoring System

	Quality Score Groups		
	High	**Moderate**	**Low**
Number of items in the score	**14**	**2**	**8**
	Scores associated with each frequency category		
Less than once per week	0	0	0
Once per week	1	1	-1
2-4 times per week	2	2	-2
Nearly daily or daily	3	-1	-3
2 or more times per day	4	-2	-4
Score Ranges	0 - 56	-4 - 4	-32 - 0
Total Quality Score Range	-36 - 60		

2.8 Variables Used for Comparability Analysis

Five 24-hour recalls were collected from each participant over approximately a one-month period using the ASA-24 tool (Canadian version). Five recalls were collected in an attempt to more accurately collect dietary data representative of the individuals monthly eating habits. Each 24-hour recall was reviewed by a trained research assistant (KS) and each food and beverage reported was categorized into one of the 24 food and beverage groups described in the D-SAC

(Table 3). Items that did not fit any of the D-SAC food and beverage groups, such as condiments and artificially sweetened beverages ("Other Categories" in Table 3) were excluded from further analyses because they were not assessed via the D-SAC. A second researcher (DM) independently categorized a subset of the 24-hour recalls confirming consistency in assigning food and beverage groups, and scores were modified where needed. The frequency of food and beverage consumption was summed across each participant's 24-hour recalls to calculate the number of foods and beverages in each group were consumed in five days. This number was assumed to represent the frequency it would have been consumed in seven days and assigned an intake frequency as follows: consumed 0 times= less than once per week, 1 time=once per week, 2-4 times=2-4 times per week, 5-9=Nearly daily or daily, 10 times= twice or more per day.

Table 3. Examples of foods and beverages reported in 24-hour recalls and their assigned D-SAC food and beverage category.

Examples of foods and beverages reported from the 24-hour recalls	Associated D-SAC food and beverage categories
Spinach, romaine lettuce, mesclun mix, kale, turnip greens, bok choy, swiss chard, etc.	Dark green leafy vegetables
Broccoli, broccoli rabe, cauliflower, cabbage, brussel sprouts, etc.	Cruciferous vegetables
Carrots, orange or yellow pepper, sweet potato, squash, etc.	Orange vegetables
Peas, corn, green beans, tomatoes, etc. (fresh, frozen or canned)	Other vegetables
Orange, grapefruit, apple, mango juice, etc.	100% pure fruit juice
Oranges, apples or pears, bananas, berries, grapes, melons (fresh, frozen or canned)	Fruits
Whole milk, hard cheese, butter, yogurt	Whole milk dairy foods
Low-fat/skim milk, yogurt, cottage cheese	Low-fat milk products
Whole eggs or egg whites	Eggs
Beef, pork or lamb	Red meats
Sausages, salami, bologna, hot dogs, bacon	Processed meats
Turkey or chicken	Lean meats
Any fish/ seafood broiled, baked, poached or canned, but not fried	Fish/Seafood
Dried beans, peas, lentils, tempeh or tofu	Plant proteins
Whole/chopped or spreads made from nuts and seeds	Nuts and seeds

Soy, almond, rice, oat, etc.	Plant-based unsweetened beverages or foods
Whole wheat, oatmeal, brown rice, barley	Whole grain breads and cereals
Muffins, doughnuts, cookies, cake, pastries, granola bars, white breads, etc.	Baked products
Sweet or salty snack foods, desserts, chocolate bars and candy, ice cream, etc.	Highly processed foods
Fries, fried chicken, bacon, etc.	Deep fried foods
Adding salt to any food/meals by the participant	Salt
Regular soda, fruit drinks, specialty coffees, energy drinks, iced tea, etc.	Sugar sweetened beverages
Plain still or sparking water	Plain water
Wine, beer, spirits, etc.	Alcohol-containing beverages
Other examples of foods and beverages reported from the 24-hour recalls	**Other categories**
Mustard, mayo, ketchup, salad dressings, sauces (soy sauce, etc.), margarine, oil, etc.	Condiments/ Add-on's/ Ingredients
Artificially sweetened/ zero calorie beverages, non-caffeinated tea,	Other Beverages
Any sugar added to food/ meals by the participant (i.e., adding sugar to coffee)	Sugar
Any reported supplements	Supplements

See Table 1 for full D-SAC questionnaire

2.8 Statistical Analysis

Reproducibility

i. Intraclass Correlation Analysis

Intraclass correlation coefficients (ICC) were calculated to measure the agreement between quality score categories calculated from the first and second administration of the D-SAC. The following ICC criteria were used to describe the relative agreement: an ICC <0.50=poor agreement, 0.50-0.74=moderate agreement, 0.75-0.90 good agreement, and >0.90=excellent agreement[90].

ii. Correlation Analysis

Pearson correlations coefficients were used to assess the degree of association between the quality scores from the D-SAC at the two time points that this data was collected.

iii. Paired t-test

Paired t-tests were used to assess statistical differences between the low, moderate, high and total quality scores generated from the first and second completion of the D-SAC. A p-value of ≤ 0.05 was a considered a statistically significant difference.

Comparability

i. Weighted Kappa Coefficient

Weighted kappa analysis was used to compare quintiles of participants' frequency of weekly intake over the last month from the D-SACs to their intake as determined from the five, 24-hour recalls. Intake frequency reported by both methods was grouped and coded into one of five categories (quintiles): 0=less than once per week 1=once per week, 2=2-4 times per week, 3=nearly daily or daily, 4=twice or more per day. The following kappa statistic categories were used to describe the level of agreement between the two instruments: <0.00=Poor; 0.00 – 0.20=Slight; 0.21 – 0.40=Fair; 0.41 – 0.60=Moderate; 0.61 – 0.80=Substantial; 0.81 – 1.00 Almost perfect[91].

ii. Bland Altman Plots

Bland Altman plots were used to examine the relationship between low, moderate, high, and total quality scores generated from the information collected by the two D-SAC's and the five

24-hour recalls. Plots were examined visually to determine whether data points lay within the limits of agreement and to assess trends in the quality scores between the two tools

3. Results

A total of 162 people agreed to participate in the study and 131 completed the personal questionnaire and first D-SAC. Of these those who enrolled, nearly half (46%) completed at least one 24-hour recall, and 46 (28%) completed all five, 24-hour food recalls and the second D-SAC (Figure 2). Participants who completed the study responded to at least 23 of the 24 (96%) questions on the DSAC. Two participants formally withdrew from the study.

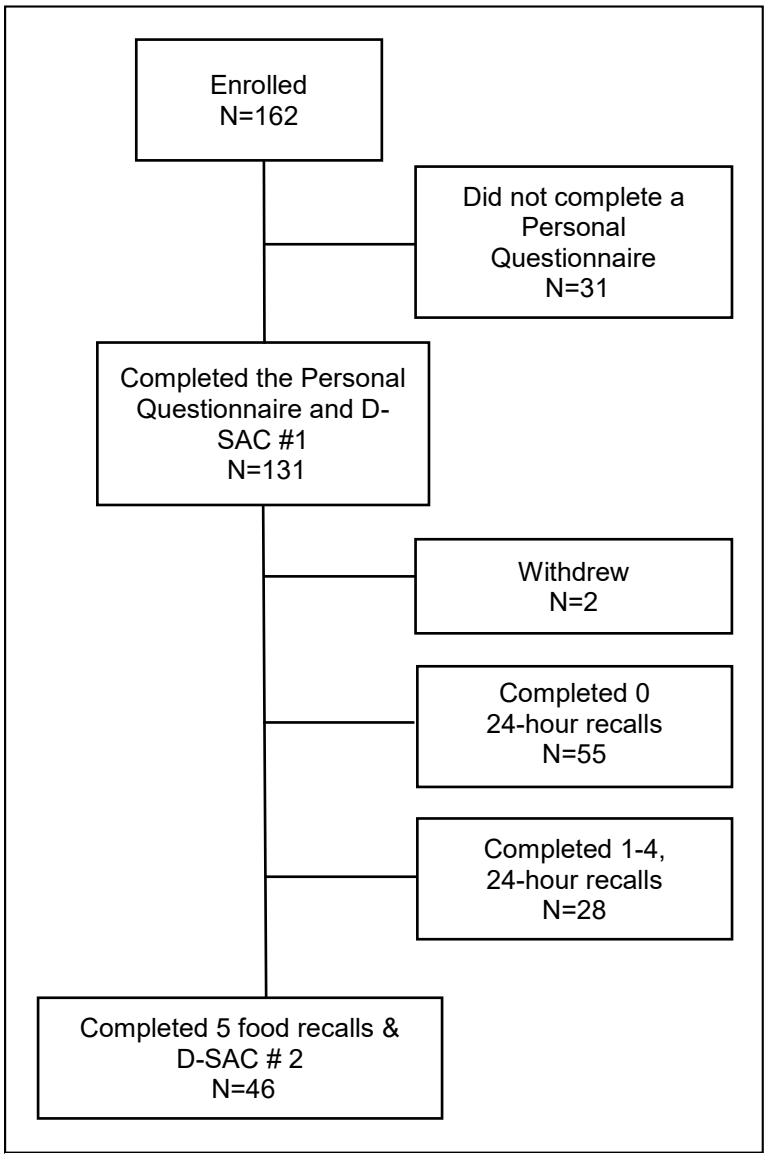


Figure 2. Study process and completion rates flow diagram

3.1 Study Participants

Participants who completed the study were approximately 30 years of age (SD=7.4), mostly female, married or in a common-law relationship, had a college or university education, and an annual household income of CAD$75, 000 or greater (Table 4).

Participant's characteristics of those who did not complete the study were similar to those who did complete the study. Those who completed five 24-hour recalls and two D-SAC questionnaires were more likely to report being moderately active or active compared with those who did not complete all recalls and questionnaires.

Table 4. Participant Characteristics		
	Completed Study	**Completed Sociodemographic Questionnaire, but did not complete the study**
Participant Characteristics	**N=46**	**N=85**
Gender • Female • Male • Other	 37 (81%) 8 (17%) 1 (2%)	 69 (81%) 16 (19%)
Age [Mean (SD)]	30 (7.4)	30 (6.9%)
Province of Residence • Western & Prairie Provinces *(Alberta, British Columbia, Saskatchewan, Manitoba)* • Central Provinces *(Ontario, Quebec)* • Maritime Provinces *(Nova Scotia, New Brunswick, Prince Edward Island, Newfoundland and Labrador)* • *Prefer not to say*	 29 (63%) 14 (31%) 2 (4%) 1 (2%)	 57 (67%) 26 (31%) 2 (2%)
Marital Status • Married/ common-law • Single • Other • Prefer not to say	 23 (50%) 20 (45%) 2 (4%) 1 (1%)	 45 (53%) 34 (40%) 4 (5%) 2 (2%)

Education Level • High School or less • College/ Trade School/ University educated • Prefer not to say	 5 (11%) 40 (87%) 1 (2%)	 11 (13%) 74 (87%)
Annual House Income • < $75, 000 • ≥ $75, 000 • Prefer not to say	 16 (35%) 24 (52%) 6 (13%)	 33 (39%) 43 (50%) 9 (11%)
Ethnicity • European • Asian • Latin American • Other • Prefer not to say	 32 (70%) 6 (13%) 3 (6.5%) 3 (6.5%) 2 (4%)	 56 (66%) 12 (14%) 6 (7%) 10 (12%) 1 (1%)
Born in Canada? • Yes • No • Prefer not to say	 32 (70%) 13 (28%) 1 (2%)	 65 (76%) 20 (24%)
Average BMI [Mean (SD)]	26 (9.9)	26 (6.8)
Proportion of participants in each BMI Category • Underweight (Below 18.5) • Normal (18.5 – 24.9) • Overweight (25 – 29.9) • Obese (30 and above)	 2 (4%) 26 (57%) 7 (15%) 11 (24%)	 3 (4%) 39 (46%) 19 (22%) 24 (28%)
Smokes Cigarettes • No • Yes • Prefer not to say	 45 (98%) 1 (2%)	 78 (92%) 6 (7%) 1 (1%)
Weekly Physical Activity (n=44) ▪ Insufficiently Active ▪ Moderately Active ▪ Active	 4 (9%) 6 (14%) 34 (77%)	 19 (22%) 7 (8%) 59 (69%)

3.2 Reproducibility

Participant's quality scores did not differ significantly between their first and second D-SAC, which were administered approximately one month a part (mean weeks a part: 5; SD=2.4). Mean total quality scores were 20.4 (D-SAC 1) and 19.8 (D-SAC 2) out of a possible 60. Both the Pearson correlation and ICC between the two D-SAC's ranged from 0.53 – 0.85 (Table 5). There were no significant differences between any of the quality score groups when compared paired t-tests (Table 6). Scatter plots highlighting the correlation between the high, moderate, low, and total quality scores from the first and second administration of the D-SAC's can be found in the Appendix (Appendix F).

Table 5. Reproducibility of scores for low, moderate and high and total quality scores between D-SAC questionnaires completed approximately one month a part

Quality Score	Pearson correlation	Intraclass correlation coefficient
Low	0.84	0.85
Moderate	0.53	0.54
High	0.79	0.79
Total	0.84	0.84

Table 6. Reproducibility of scores for low, moderate, high and total quality scores between D-SAC questionnaires completed approximately one month a part

Quality Score	Lowest Possible Score	Highest Possible Score	Mean Score N=46		Difference	P-value*
			D-SAC 1	D-SAC 2		
Low	-32	0	-7.2	-7.0	0.2	0.64
Moderate	-4	4	1.5	1.5	<0.0	0.86
High	0	56	26.1	25.3	0.8	0.23
Total	-36	60	20.4	19.8	0.6	0.31

*P-value from the paired t-test comparing mean low, moderate, high and, total quality scores as calculated by D-SAC's 1 and 2

3.3 Comparability

Weighted kappa values assessing comparability of frequency of weekly intake of the 24 foods and beverage groups measured using the D-SAC and 24-hour recalls are shown in Table 7. Coefficient values ranged from -0.01 (added salt) to 0.51 (other fruit). Values were between 0.21 – 0.40 (i.e. fair to moderate agreement) for cruciferous vegetables, whole dairy products, low-fat milk products, red and processed meats, plant-based proteins foods (dried beans, peas, lentil, tofu, nuts & seeds), whole grains, and plain water. Values were between 0.41 – 0.60 (i.e., moderate agreement) for dark green leafy vegetables, other fruit, eggs, lean meats, and alcohol-containing beverages.

Table 7. Comparability of weekly intake of food and beverage groups assessed by the D-SAC's and 5, 24-hour recalls (n=46)		
Food & Beverage	**Weighted Kappa Coefficient**	**P-Value**
Other Fruit	0.51	<0.001
Lean meats	0.48	<0.001
Alcohol-containing beverages	0.48	<0.001
Eggs	0.47	<0.001
Dark green leafy vegetables	0.42	<0.001
Low-fat milk dairy foods	0.40	<0.001
Dried beans, peas, lentils and tofu	0.35	0.001
Whole grains (excluding pasta)	0.34	0.001
Red meats	0.30	0.002
Whole dairy products	0.26	0.002
Processed meats	0.25	0.002
Cruciferous vegetables	0.24	0.005
Plain water	0.23	0.006
Nuts & seeds	0.23	0.009
Fish and seafood	0.17	0.066
Sugar sweetened beverages	0.17	0.009
Deep fried foods	0.16	0.065
Orange Veg	0.15	0.031
Other vegetables	0.14	0.004
Baked Products	0.02	0.285
100% Fruit Juice	0.01	0.243
Plant based unsweetened beverages	0.01	0.219
Highly processed foods	0.01	0.449
Salt (added to food)	-0.01	0.575

Weighted Kappa Interpretation: <0.00=Poor; 0.00 – 0.20=Slight; 0.21 – 0.40=Fair; 0.41-0.60=Moderate; 0.61-0.80=Substantial; 0.81-1.00=Almost perfect

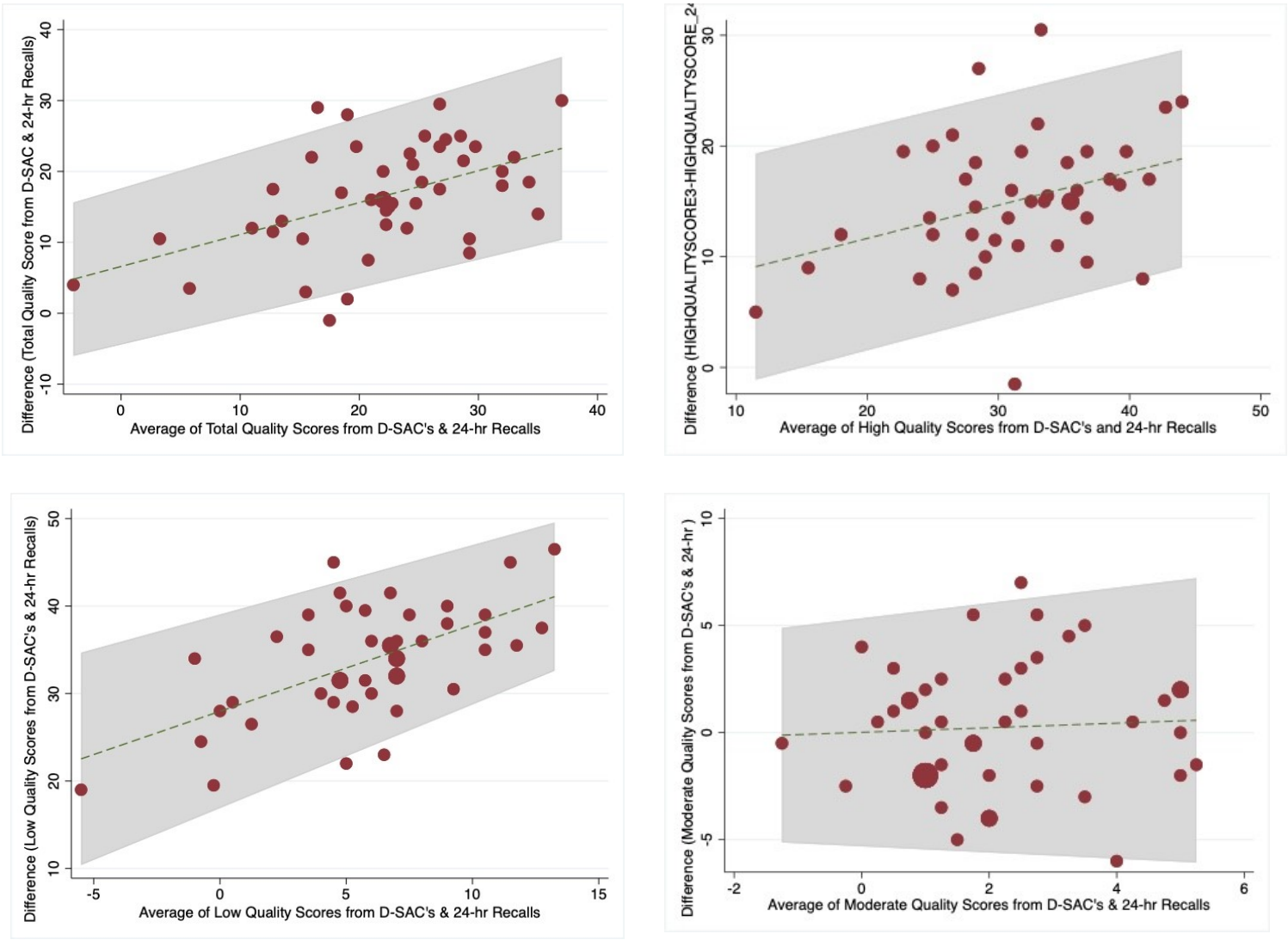


Figure 3. Bland-Altman plots of moderate, high low, and total, quality scores assessed by D-SAC and 24-hour recalls

The Bland-Altman plots (Figure 3) show that the ranges of all quality scores are within acceptable limits of agreement. The plots also show that the D-SAC consistently overestimated high, low, and in turn total quality scores as compared to the 24-hour recalls. Participants who reported higher intake frequencies of high-quality food (i.e., had higher high-quality scores) appeared to overestimate their intake of high-quality foods on the D-SAC compared to what they

reported on the repeated 24-hour recalls. The opposite was true for low-quality scores; thus, the participants with a low-quality food score close to 0 (i.e., reporting less frequent intake of low-quality foods) underestimated their intake of low-quality foods on the D-SAC compared to 24-hour recalls. Intake frequency of moderate quality food scores were reported similarly using the D-SAC and 24-hour recall methods. Finally, the inflated high intake frequencies of high-quality foods and underestimated intake frequencies of the low-quality foods combine to impact the total quality score; the total quality score is ultimately higher when calculated with the D-SAC information than with the information from 24-hour recalls.

4. Discussion

The objectives of the present study were to assess the reproducibility of the D-SAC questionnaire and to compare its assessment of dietary quality and frequency of weekly intake against multiple 24-hr recalls in a group of adults living in Canada. Overall, the D-SAC provides reproducible reports of people's intake frequency of low, moderate, and high-quality foods and this results in reliable assessment of the total quality score over a one-month period. Pearson and ICC correlations assessing reproducibility of quality scores ranged from 0.53 to 0.84, suggesting moderate to good agreement[90] of scores across individual administrations of the D-SAC[90]. A study comparing quality scores, as calculated by the Diet Quality Index Revised (DQI-R) between two administrations of a FFQ, had a Pearson correlation of 0.72, which is comparable to our results[92]. This result may suggest that individual dietary quality does not vary greatly from month-to-month, although intake of specific foods due to preference, season, and food availability may occur. Finally, the quality scores calculated in this study were not statistically different from those calculated in a study in a similar population that used the D-SAC in a group

of over 1200 Canadian women and men [Misita – see Chapter 3]. This provides further evidence that the tool and scoring system produces consistent results within an adult Canadian population.

Interestingly, the Pearson and ICC correlation coefficients were similar or identical to each other. This is likely due to having only a small amount of variance within the dataset. Liu et al (2016) note that when the measurements of interest have the same mean and variance, the ICC and the product-moment correlation, or Pearson correlation coefficient will be the same[93]. Thus, for this study, likely only one of these statistics was needed.

This study also examined the comparability of dietary intake information collected using the D-SAC and repeated 24-hour recalls using the ASA-24. The D-SAC is moderately comparable to repeated 24-hour recalls when both assessment methods are used to assess frequency of food and beverage intake and to calculate total quality scores. According to the Bland-Altman analyses, the D-SAC was at risk of overestimating intake of high-quality foods (i.e., high-quality score) and underestimating intake of low-quality food scores (i.e., low-quality score) compared to 24-hour recalls. This is an important finding and one that needs to be considered when interpreting the D-SAC in this and other studies. Several factors may be contributing to the systematic differences in sub-scores from the D-SAC and repeated 24-hour recalls. For example, social desirability of foods in the high-quality food group and lack of social desirability for foods in the low-quality food group may influence how individuals report their dietary intake. Fruits and vegetables for example, may be subject to overreporting as these foods are often promoted as healthy[94] and are recommended to be consumed regularly[36,41,95]. A large cohort study of several European countries found that participants consistently reported higher fruit intake via FFQ or

diet record compared to 12, 24-hour recalls[94,96]. On the other hand, lower quality foods, such as highly processed foods and sugar sweetened beverages, may be underreported due to the generally negative narrative about their nutritional quality. Similarly, other studies have found trends in underreporting of various "snack foods"[97,98].

Other factors that could be influencing systematic variation in these scores are that the foods in the high-quality food groups maybe easier to recall or identify than those in the some of the low-quality food groups. For example, it might be easier to recall whole foods, such as an apple or piece of fruit, or vegetables in mixed dishes, than to recall consuming a few candies or salty snacks. Some foods may be easier to estimate over the course of a month than others. For example, if fruit is consumed daily (e.g., as part of a regularly eaten meal, such as breakfast or lunch) it may be easier to estimate its intake than for foods that are consumed on an irregular basis, such as could be the case for low-quality foods. Finally, it is not clear how participants may be processing the questions on the D-SAC and what degree of numeracy and literacy skills they could be using to estimate their intake of foods over a one-month period.

Reports on the intake frequency of foods from the different food groups varied between the two dietary assessment tools. Weighted kappa values ranged from as low as -0.01 for added salt to 0.51 for other fruit. However, 15 of the 24 food and beverage groups had weighted kappa coefficients over 0.20 suggesting that comparability for these items was acceptable. Other studies that have compared FFQs to food recalls or records as part of the validation process, have also found a wide range of weighted kappa scores. Barbeiri et al (2014) reported weighted kappa values between 0.12 and 0.46 when using a weighted quadratic kappa to compare classification

of pregnant women into quartiles according to their intake measured by an 85-item FFQ and a 24-hour recall[99]. Another study exploring agreement and classifying people into quartiles based on their food group intake assessed by a self-administered FFQ and diet history interview found that weighted kappa coefficients ranged between 0.15 and 0.59 with most values being between 0.21and 0.60[100]. In the present study, foods and beverages with weighted kappa values ranging between 0.21 and 0.60 (i.e., showed fair to moderate agreement) included food items which were 1) more clearly defined in CFG 2) are foods that may be consumed on a regular basis, or 3) single-food items. For example, categories such as dark green leafy vegetables, other fruit, eggs, lean meats, and alcohol-containing beverages yielded weighted kappa coefficients ranging from 0.42 to 0.51. Food groups that are not clearly defined in CFG, such as 'baked products', 'highly processed foods' and 'deep-fried foods' and therefore may be more difficult for people to identify, yielded weighted kappa coefficients of 0.02, 0.01, and 0.16, respectively. These foods are also generally recommended to be consumed infrequently and may be more susceptible to reporting bias. Also, participants may have had trouble accurately reporting their intake of these food groups via the D-SAC as some food may fit under more than 1 category. Rifas-Shiman (2001) reported similar results in the validation study of the PrimeScreen questionnaire[86]. They found that the PrimeScreen performed better in assessing single-food items, such as eggs and carrots and performed less well for food groups that contain multiple items such as baked products and dark green leafy vegetables, which generally aligns with our findings, excluding our findings for dark green leafy vegetables which yielded a weighted kappa coefficient of 0.42.

Other items that did not measure consistently across both tools included foods that are often not consumed on a daily or weekly basis and therefore may be harder to capture via the food recalls.

For example, fish and seafood, and orange vegetables had a poor weighted kappa coefficient within our analyses (0.17 and 0.15, respectively). Other vegetables (0.14), 100% fruit juice (0.01), plant-based unsweetened beverages (0.01), added salt (-0.01) and sugar sweetened beverages (0.17) also did not measure consistently across both tools. Factors contributing to these results are unclear and deserve further investigation. It is possible that participants reported their intake of all fruit-containing beverages as 100% fruit juice or reported intake of all plant-based beverages as unsweetened even if they consumed a sweetened version of the beverage. Added salt may have been underreported on the food recalls as this detail can be easily forgotten. Also of note is that these results may have also been affected by aspects of social desirability, which must always be considered when participants know that they are taking part in a study assessing dietary intake.

Further assessment of comparability via the Bland-Altman analysis showed that moderate quality scores, made up of intake of whole dairy products and red meats was comparable between the two dietary assessment methods. While dietary guidelines often promote intake of low-fat dairy products and lean meats over whole dairy products and red meats[36,41,95], cultural and societal influences may promote the continued consumption of these foods and lack of consensus on the overall categorization of these foods as "healthy" or "unhealthy" within the general population. Therefore, these foods may be less subject to over or underreporting due to social desirability bias.

5. Study Limitations

The suggested sample size for FFQ validation studies is a minimum of 50 participants, and preferably over 100[101]. Due to limited resources and time, we were only able to have 46

participants complete the full study in a timely manner. While this provides a limitation to the power of our overall analysis, our results are comparable with those of other validation studies conducted with a greater number of participants. While study completion was low (28%), we suspect that this is due to the fact that study enrollment had very few barriers in place, and many individuals enrolled without reviewing full study details, likely being motivated by the $25 incentive. It is possible that the timing of the project affected response rates. The workplace closings during the COVID-19 pandemic meant that many individuals were working from home and may have felt they had spare time; it is possible that individuals were overly optimistic about their time availability to complete the study. Had there been a face-to-face component of the project it is possible that enrollment may have been lower, and completion may have been higher.

6. Study Strengths

Using alternative dietary assessment methods such as food recalls and records as reference for comparison can help avoid bias associated with the use of two similar instruments[86]. It is also recommended that dietary data collected via the reference method, in this case the 24-hour recalls, should be kept for a "sufficient number of days" and that intake should be assessed over the same time interval as the FFQ[102]. For this study, we were able to not only use 24-hour recalls as the reference dietary assessment method but were also able to successfully collect five recalls from all 46 individual participants. Many other validation studies use less than five recalls or records as a reference method for validation[99,103,104]. By encouraging participants to complete one to two food recalls over the span of five weeks we were able to extrapolate their intakes to monthly intake and align more closely with the D-SAC's timeframe of dietary assessment.

7. Conclusion

The D-SAC shows high reproducibility over approximately a one-month period. The D-SAC shows fair to moderate ability to assess frequency of weekly intake of many food and beverage items, however, appears to overestimate intake of high-quality foods and underestimate intake of low-quality foods, as compared to 24-hour recalls. Further research is necessary to assess the relationship between dietary measurements using the D-SAC and health outcomes.

Chapter 3

Assessing the Preconception Dietary Intake of Adults in Canada using a brief, dietary screening tool

Abstract

Background: Little is known about adult preconception diet, despite emerging evidence suggesting both maternal and paternal intake at conception contributes to life-long disease risk of offspring. Further research is also needed to understand preconception dietary intake and whether it is influenced by pregnancy intention, especially considering that nearly half of pregnancies in Canada are unplanned. Thus, the objectives of this study were to 1) describe the dietary intake of women and men in Canada who have childbearing potential and 2) determine whether there are differences in dietary intake of women and men who are planning a pregnancy versus those who are not planning a pregnancy. **Methods:** English-speaking women and men, between the ages of 18-45, living in Canada, who had reliable access to the internet were eligible. Being pregnant was the only exclusion criteria. A cross-sectional survey assessing preconception health behaviours, beliefs, and attitudes was distributed to women and men cross Canada. Dietary intake was assessed using the D-SAC questionnaire. Dietary quality, dietary patterns, and frequency of weekly intake was assessed and compared amongst women and men, and those planning and not planning a pregnancy. **Results:** Women's and men's food and beverage intake did not align with guidelines, particularly considering a generally low intake of higher quality foods, such as fruits and vegetables, whole grains, and plant-based proteins. Pregnancy intention was not associated with differences in dietary intake amongst women or men with few exceptions in alcohol, water, and margarine intake amongst women and calorie containing beverage and low-fat dairy product intake amongst men. **Conclusions:** There appears to be room for improvement in the general preconception dietary intake of Canadian regardless of pregnancy intention.

1. Introduction

The impacts of maternal health and nutrition during pregnancy on their short- and long-term health as well as that of their offspring has received much attention[4,105]. Using the developmental origins of health and disease as a framework, many studies have examined the impact of dietary intake during pregnancy on long-term health outcomes of children. Recent evidence has pointed to the fact that interventions in pregnancy may be too late to produce significant improvements in child health. Stepheson et al (2018) highlights that studies intervening in pregnancy to improve diet have previously had little effect on maternal and infant health outcomes[9]. However, little is known about women's preconception diet and even less is known about men's preconception diet despite emerging evidence suggesting both maternal and paternal nutritional intake at conception contributing to life-long disease risk of offspring[9,10]. Overall, studies suggest that adults living in high income countries often do not meet national guidelines or nutrient recommendations[106-110]. For example, Krebs-Smith et al (2010) found that over 80% of US women and men within the ages of 19 – 50 did not meet national recommendations for intake of fruits, vegetables, and whole grains[109]. Nutrition surveys of women and men living in Western countries suggest that those in the preconception age group may not be meeting many nutrition recommendations. For example, data from the Canadian Community Health Survey of 2004 found that the majority of Canadian adult men and women had consumed intakes of magnesium, calcium, Vitamin A and Vitamin D below recommendations, while more than half of them exceeded their energy needs[110]. A study using data from the National Health and Nutrition Examination Survey (NHANES) from 2013 to 2016 aimed to determine if Americans were meeting nutrient needs through food intake; they found that large proportions of adults did not consume enough calcium (44.5%), vitamin D (94.8%), magnesium (53.3%), vitamin A (45.5%),

vitamin C (48.3%), and Vitamin E (79.0%)[111]. Similarly, Derbyshire (2018) analyzed data from the UK National Diet and Nutrition survey to assess micronutrient intake of UK adults; findings from this study suggested that females and younger adults from the UK are particularly vulnerable to inadequate intake of micronutrients from food sources alone; specifically, 25.3%, 50.3%, and 12% of adult women had iron, selenium and magnesium intakes, respectively, below the lower reference nutrient intake (LRNI). On the other hand, 25.8% and 15% of men had selenium and magnesium intake, respectively, that were below the LRNI[107]. There is clearly room for improving adult diet quality and intake.

The body of evidence reported above describes dietary intake based on age, but little is known about how intakes may change when people are planning a pregnancy. A recent systematic review and meta-analysis of the existing literature found that preconception fruit, vegetable, and caffeine intake was not associated with pregnancy intention[27]; However, it is important to note that analysis was limited in a few ways: a small number of studies were available for meta-analyses; there was heterogeneity of diet measurement across studies which made it difficult to compare diet assessment across studies; and the retrospective study design of a large proportion of studies included for analysis may have introduced important recall bias[27]. Further research is needed to understand preconception dietary intake and whether it is influenced by pregnancy intention, especially considering that nearly half of pregnancies in Canada are unplanned[12].

The primary objective of this study was to describe the dietary intake of a sample of women and men in Canada who are between the ages of 18 to 45. To address this objective, dietary intake was described using 3 approaches: 1) analyzing weekly frequency intake of foods and beverages

using the D-SAC questionnaire; 2) using a dietary quality scoring system based on Canada's Food Guide[112]; and 3) using principal components analysis to describe dietary patterns. The secondary objective of this study was to determine whether there are differences in dietary intake of women and men who are planning a pregnancy versus those who are not planning a pregnancy.

This study provides insight into dietary intake of Canadian adults, and to our knowledge, is the first study to explore preconception diet and consider pregnancy intentions of Canadian adult women and men in a large, multi-province sample using the D-SAC questionnaire.

2. Methods

2.1 Study Design and Population

Between May and July of 2019, participants were recruited to complete an online, cross-sectional study survey. Eligible participants were English speaking, women and men, aged 18-45, living in Canada. Individuals were excluded if they were pregnant or had type 1 diabetes to align with the exclusion criteria of the Healthy Life Trajectories Initiatives (HeLTI). Participants were recruited online; recruitment started by sending electronic flyers (Appendix G) to individuals from existing research study databases. Electronic flyers were also distributed to organizations via social media. Ethics approval was obtained from the University of Toronto (REB#18-309c) and the University of Alberta (Pro00087716).

2.2 Study Process

Upon interacting with the online recruitment flyer and replying to the recruitment email's (Appendix H), women and men were able to access more information about the study via a link which redirected them to the study information letter (Appendix I), an online consent form (Appendix I) and finally the study survey (Appendix J). After providing consent and completing the study survey, participants were sent a $5 Tim Hortons gift card, via email.

2.2.1 Study Survey

The overall study survey aimed to assess individual's preconception beliefs, attitudes, and health behaviours about preparing for pregnancy. In addition to dietary intake, this survey collected information about participants' pregnancy intention, sociodemographic information, self-reported anthropometrics, physical activity, and smoking behaviours, amongst many others.

2.2.2 Dietary Assessment Tool

A 24-item dietary assessment tool was adapted from a FFQ that had been previously designed for use in primary care to screen for dietary risk of non-communicable diseases[86]. The original FFQ was validated against a longer semi-quantitative FFQ and plasma levels of Vitamin E, β-carotene, and lutein/ zeaxanthin[113]. For the present study, the FFQ, was adapted to more closely align with Canada's Food Guide[112] by two nutrition experts (SA, RB), and was subsequently renamed, the Diet Screening for Adult Canadians (D-SAC) questionnaire (Appendix E). The D-SAC asks participants to report their weekly intake foods and beverages from 24 different food and beverage groups over the last month. Intake frequency options are: "less than once per

week", "once per week"; "2-4 times per week", "nearly daily or daily", "two or more per day". The survey generally takes 5-10 mins for people to complete[86].

2.3 Study Variables

Proportions and percentages were calculated for the descriptive analysis of categorical variables. Mean and SD were used to describe continuous data.

2.3.1 Frequency of Food and Beverage Intake

In order to assess frequency of weekly food and beverage intake, the proportion of participants who responded to each frequency option for each food and beverage item on the D-SAC were calculated (e.g., calculated proportion of participants who consumed dark green leafy vegetables less than once per week, once per week, 2-4 times per week, nearly daily or daily, and two or more per day, etc.). The proportion of participants who responded, "nearly daily to daily" and "two or more per day" were also averaged to allow for analysis of what was referred to as "daily intake" of foods.

2.3.2 Dietary Quality Assessment

The D-SAC quality scoring system was developed to assess overall diet quality (Table 7). Each D-SAC food and beverage group was categorized as a nutritionally low, moderate, and high-quality item, using Canada's Food Guide for reference. Each quality group was associated with a different score range (Table 1). Points were added or subtracted based on the frequency that people reported consuming foods and beverages within each quality group; these points were summed to produce a low, moderate and high-quality score for each participant. A total score

was calculated as the sum of the 3 food quality categories. Foods that were part of the high-quality category were: dark green leafy vegetables, cruciferous vegetables, carrots, other vegetables, dried beans, peas lentils or tofu, citrus fruits, other fruits, low-fat milk products, whole eggs, lean meat (turkey or chicken), fish and seafood (broiled, baked, poached or canned), nuts and seeds, whole grain breads, and plain water; the medium-quality category included: whole milk dairy foods and red meat (beef, pork, or lamb); and the low-quality category included: processed meats, stick margarine, refined grains, baked products, salt (added to food), calorie-containing beverages, and alcohol-containing beverages. Scores for each quality category ranged as follows: high-quality: 0 to 56; moderate-quality: -4 to 4; and low-quality: -32 to 0. Total quality scores ranged from -36 to 60.

2.3.3 Dietary Patterns Assessment

Principal components analysis was used to explore existing dietary patterns of participants based on their reported weekly intakes of the 24 different food and beverage groups. The five weekly intake frequencies were converted into daily frequencies for ease of interpretation as follows: Less than once per week=0.5/day, once per week=1/day, 2-4 times per week=3/day, nearly daily or daily=7/day, two or more per day=14/day. Principal components analysis was run and a screeplot (Figure 4) was generated to determine the variation explained by each component. Initially the first 4 components were retained. Components one and two were retained due to their nutritional interpretability while components three and four were nutritionally uninterpretable and therefore not explored. Foods, food groups, and beverages with a coefficient $\geq$0.2 were used to describe components 1 and 2 (Table 7). The coefficient indicates the strength of the relationship between each food item and the component in question and describes the

covariance between the food or beverage item and the component[114]. A coefficient of ≥0.2 was chosen based on both statistical and nutritional relevance. Other research studies exploring dietary patterns via principal components analysis have used a coefficient 0.15 or greater[115,116]. Finally, in order to determine participants' adherence to the components, and thus to generate dietary patterns scores, the frequency of consumption of the foods and beverage was multiplied by the coefficient and summed for each component.

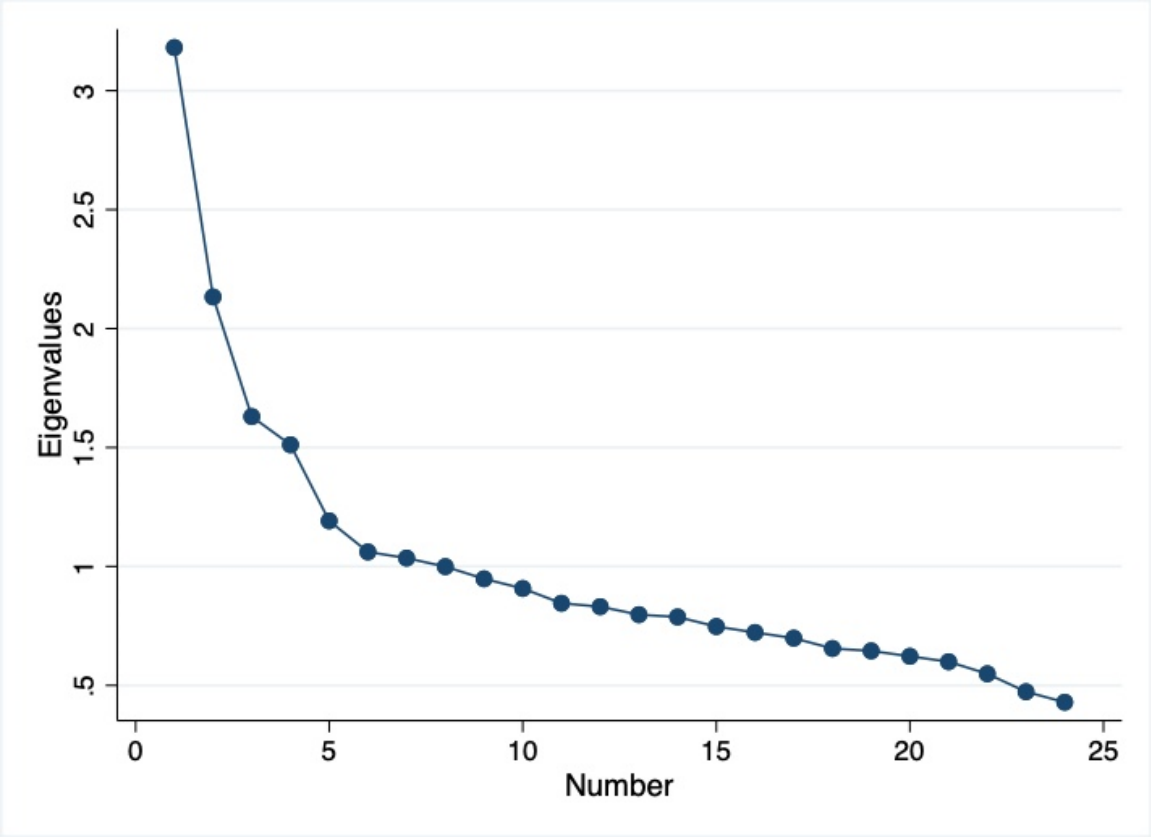


Figure 4. Scree plot of eigenvalues from principal component analysis (PCA)

Participants were divided into thirds based on tertiles of each dietary pattern score; average weekly intake of food items was compared between those whose scores fell within the lowest and highest tertiles.

2.3.4 Participant and Socio-Demographic Characteristics

Participants reported their personal and socio-demographic information as part of the overall study survey. They reported their sex as either female or male. Weight and height were self-reported, and this information was used to calculate BMI and classify participants into one of four BMI categories: <18.5=Underweight, 18.5 – 24.9=Normal, 25 – 29.9=Overweight, and ≥30=Obese. Participants reported their highest level of education achieved as either elementary/grade school, high school, college/ trade school, university (undergraduate degree) or university (graduate degree). For the purposes of our analysis, we collapsed these into two groups (college or university educated and high school or lower) for ease of interpretation and analysis. Annual household income was reported into one of nine categories but was collapsed into two groups (<CAD$75, 000 and ≥CAD$75,000) for ease of interpretation and analysis. Groups were also collapsed because there is evidence to suggest that higher education [117] and income are associated with healthier eating habits[118]. Participants reported how many cigarettes they smoke on a typical day and had the option of reporting that they did not smoke. We categorized smoking cigarettes as "yes" and "no" for ease of analysis and interpretation. Physical activity was assessed via the Global Physical Activity Questionnaire (GPAQ) and analysis was guided by the GPAQ Analysis Guide [https://www.who.int/ncds/surveillance/steps/resources/GPAQ_Analysis_Guide.pdf]. Participants' physical activity was grouped into one of two group: "met recommendations" or "did not meet recommendations". Participants reported if they had 0, 1, 2, or 3 or more children; these groups being collapsed into 0 children or ≥1 child. Participants reported whether or not they were born in Canada as "yes" or "no". Finally, to assess pregnancy intention, participants were asked "Are you currently thinking about or planning to have a child?" and they were able

report they and/ or their partner 1) have no plans for pregnancy at this time, 2) are currently trying to get pregnant 3) are considering a pregnancy in the next 1 to 2 years or 4) are considering a pregnancy in the next 3 to 5 years; these responses were not collapsed and were analyzed individually.

2.4 Statistical Analysis

All statistical analysis was completed using Stata (StataCorp 2021. *Stata Statistical Software: Release 17*. College StataCorp Station, TX: StataCorp LLC).

2.4.1 Statistical Analysis of Frequency of Weekly Intake and Pregnancy Intention

Descriptive statistics reporting the proportion of people within the five different intake frequency categories were calculated. Chi-square was used to compare differences in proportions of daily and less than weekly food and beverage intake between participants who were currently intending a pregnancy (i.e., responded "I am currently trying to get pregnant") and those who were not (i.e. responded "I have no plans for pregnancy at this time"). Intake of food items that were significantly different ($P \leq 0.05$) between those two intention groups were then further analyzed to assess how far in advance participants may be making dietary changes prior to pregnancy. Then, Chi-square analysis was used to compare differences in proportions of weekly intake of those food and beverage items between participants who were not considering a pregnancy (i.e. responded "I have no plans for pregnancy at this time") and those who were considering one within the next 1-2 years (i.e. responded "I am considering a pregnancy in the next 1-2 years") and 3-5 years (i.e. responded "I am considering a pregnancy in the next 3-5

years"). This was done to assess 1) differences between intention groups and 2) how early participants may be changing dietary behaviours when considering a pregnancy.

2.4.2 Statistical Analysis of Dietary Quality Scores and Dietary Pattern Scores

i. Unpaired T-test Analysis Comparing Dietary Quality Scores between Subgroups

Unpaired t-tests were used to compare low, moderate, high and total quality scores amongst participant subgroups (sex: female vs male; BMI: underweight, normal, overweight, obese; physical activity level: meet recommendations vs do not meet recommendations; education: university/ college vs high school or less; annual household income: ≥CAD $75,000 vs < CAD $75,000; parity: nulliparous vs primi/multiparous, smoking status: smoke vs do not smoke, pregnancy intention: no intention, currently planning, considering in 1-2 years, considering in 3-5 years, born in Canada: yes vs no).

ii. Correlation Analysis of Dietary Quality Scores and Dietary Pattern Scores

Pearson correlations were used to identify if participants' characteristics (sex, age, BMI, physical activity level, education, annual household income, parity, smoking status, pregnancy intention, and whether they were born in Canada or not) were closely correlated. (Appendix K) These variables were all considered for regression analysis.

iii. Regression of Diet Quality Scores

To determine which participant characteristics were associated with quality scores (low, moderate, high, and total-quality scores), associations between participant's socio-demographic

characteristics and each diet quality score were assessed with univariable regression analysis. Characteristics that were statistically significant ($P \leq 0.05$) were retained for further multivariable regression analysis.

iv. Regression of Dietary Pattern Scores

To determine which participant characteristics were associated with participants Mediterranean and Western dietary pattern scores. Associations between participant's socio-demographic characteristics and their Mediterranean and Western dietary pattern scores were assessed with univariable regression analysis. Characteristics that were statistically significant ($P \leq 0.05$) were retained for further multivariable regression analysis.

3. Results

3.1 Study Participants

Of the 1,324 participants who were recruited, 1,227 completed the D-SAC, resulting in a 93% response rate. Participants were generally in their 30's (mean=34; SD=4.9), female, and married or in a common-law relationship (Table 8.) Most were born in Canada, were highly educated, and had an annual household income of CAD$75, 000 or greater.

Table 8. Characteristics of participants in the national preconception health behaviour study.	
Participant Characteristics	**N (%)** **N=1,227**
Sex • Female • Male	 1,021 (83%) 206 (17%)
Age [Mean (SD)]	34 (4.9)
Province of Residence • Western & Prairie Provinces *(Alberta, British Columbia, Saskatchewan, Manitoba)* • Central Provinces *(Ontario, Quebec)* • Maritime Provinces *(Nova Scotia, New Brunswick, Prince Edward Island, Newfoundland and Labrador)* • Territories *(Nunavut, Northwest Territories, Yukon)*	 313 (26%) 852 (69%) 61 (5%) (<1%)
Marital Status • Married/ common-law • Single • Divorced/ separated/ widowed	 1169 (95%) 37 (3%) 19 (2%)
Education Level • High School or less • College/ Trade School • University educated	 82 (7%) 206 (17%) 939 (76%)
Annual House Income • < $75, 000 • ≥ $75, 000	 353 (29%) 874 (71%)
Born in Canada? • Yes • No	 1017 (83%) 210 (17%)
Mean length of time living in Canada [yrs (mean (SD)] (n=210)	18 (10.34)

Average BMI [Mean(SD)]	26 (6.9)
BMI Category • Underweight (Below 18.5) • Normal (18.5 – 24.9) • Overweight (25 – 29.9) • Obese (30 and above)	 63 (5%) 523 (43%) 376 (31%) 265 (22%)
Smokes Cigarettes • Yes • No	 59 (5%) 1168 (95%)
Meets Weekly Physical Activity (n=1173) • Yes • No	 666 (57%) 507 (43%)
Parity • ≥1 • 0	 1192 (97%) 35 (3%)

3.2 Proportion of Participants and Frequency of Weekly Intake

On average, only 20% of participants reported consuming vegetables "nearly daily or daily" and even fewer (4%) consumed them "twice or more per day". Of the four vegetable categories assessed via the D-SAC, participants reported the highest weekly intake of "other vegetables" with 34% and 11% consuming them "daily or nearly daily" and "twice or more per day" respectively. Less than half (41%; 32% "nearly daily or daily" and 9% "twice or more per day") of participants reported consuming whole grains on a daily basis, and their weekly intake of protein containing foods (plant-based proteins, whole dairy products, low fat dairy products, whole eggs, lean meats, red meats, fish and seafood) was widely distributed across the five frequency intake categories. Less than half (ranged from 3% to 38%) of participants reported consuming any protein containing foods on a daily basis. However anywhere from 28% to 79%

of participants consumed protein containing foods at least two to four times per week. Overall, less than half (42%) of participants reported consuming plant-based proteins two to four times per week or more often. A 51% and 79% of participants reported consuming low-fat milk products and whole milk dairy products two to four times per week, respectively. More than half of participants consumed whole eggs (52%), red meats (64%), and dried beans peas and lentils (72%) once per week or less often. Table 9 provides an overview of participants' weekly intake as per the D-SAC.

Table 9. Assessing frequency of weekly intake by reporting the proportion of participant responses to the D-SAC questionnaire					
Foods and Beverages	**Frequency of intake per week over the last month**				
	< Weekly	**Weekly**		**Daily**	
	< 1/ week	**1 x/ week**	**2-4x/ week**	**5-7x/ Week†**	**≥2x/ day**
	Proportion (%) N=1227				
Dark green leafy vegetables	16	21	38	21	4
Cruciferous vegetables	18	28	42	11	1
Carrots	23	30	34	12	1
Other vegetables	4	13	38	34	11
Vegetables	15	23	38	20	4
Citrus fruit	36	25	25	12	2
Other fruit	5	7	28	41	19
Fruit	20	16	27	27	10
Dried beans, peas, lentils, and tofu	45	27	21	6	1
Nuts & Seeds	20	22	31	21	6
Plant-Based Proteins	33	25	26	13	3
Whole grains breads and cereals	12	14	33	32	9
Plain water	1	3	9	12	75
Low-fat milk products	35	14	31	18	2
Whole eggs	17	35	29	17	2
Lean meats	10	18	70	3	0
Fish/seafood‡	26	16	26	26	6
Whole dairy products	6	15	41	33	5
Red meats	21	43	28	7	1
Processed Meat	51	27	19	3	<1
Stick margarine	82	7	8	3	<1
Refined grains	31	20	27	19	3
Baked products	24	28	34	13	1
Deep fried foods	55	31	13	1	<1
Salt (added to food)	63	12	14	9	2
Calorie containing beverages	66	14	14	4	2
Alcohol-containing beverages	57	18	20	4	1

†5-7 days/ week= "Nearly daily or daily" on the D-SAC questionnaire

‡Monthly intake assessed for fish/seafood

See Appendix E for the version of the D-SAC that was used as well as the response categories available to participants

Women's and men's frequency of intake was similar across most food and beverage groups, with few noted, consistent differences. While daily intake of processed meats was low amongst women and men, in general, a greater proportion of men consumed processed meat on a weekly

basis (one to four times per week) compared to women (Once per week: women=26%, men=35%, P=0.006; two to four times per week: women=16%, men=29%, P=0.000) and significantly more women reported consuming processed meats on a less than weekly basis as compared to men (less than once per week: women=55% men=34%, P=0.000). A greater proportion of women also reported consuming water twice per day or more often as compared to men (women = 77%; men = 60%, respectively, P=0.000). A greater proportion of women reported consuming alcohol (less than once per week: women=60%, men=40%, P=0.000) and calorie containing beverages (less than once per week: women=68%; men= 54%, P=0.000) less often on a weekly basis, as compared to men. Finally, while men's and women's weekly intake of deep-fried foods is relatively low, a greater proportion of women consumed them less often on a weekly basis as compared to men (less than once per week: women=57%; men=47%, P=0.006). Table 10 describes the differences of weekly food and beverage intake between women and men.

Table 10. Comparing the frequency of weekly intake of food and beverage items between women and men by reporting the proportion of participant responses to the D-SAC

	Frequency of intake per week over the last month				
	< Weekly	**Weekly**		**Daily**	
Foods and Beverages	**< 1/ week**	**1 x/ week**	**2-4/ week**	**5-7x/ Week†**	**2x/ day**
	Proportion (%)				
Dark green leafy vegetables					
• Female (n=1021)	17*	20	38	21	4
• Male (n=206)	11	26	41	19	3
Cruciferous vegetables					
• Female (n=1021)	18	28	42	11	1
• Male (n=206)	18	28	44	9	1
Carrots					
• Female (n=1021)	23	30	34	12	1
• Male (n=206)	19	34	33	13	1
Other vegetables					

• Female (n=1021) • Male (n=206)	4 4	13 15	37 41	35 33	11 7
Citrus fruit • Female (n=1021) • Male (n=206)	37 33	24 27	25 26	12 12	2 2
Other fruit • Female (n=1021) • Male (n=206)	4* 8	6* 11	28 29	42 35	20 17
Dried beans, peas, lentils, and tofu • Female (n=1021) • Male (n=206)	45 45	27 28	21 20	6 6	1 1
Nuts & Seeds • Female (n=1021) • Male (n=206)	21 15	21 25	31 32	21 20	5 8
Whole grains breads and cereals • Female (n=1021) • Male (n=206)	12 12	14 13	32 36	33 32	9 7
Plain water • Female (n=1021) • Male (n=206)	1 0	2** 8	9* 15	11* 17	77** 60
Low-fat milk dairy products • Female (n=1021) • Male (n=206)	35 37	14 15	30 34	19* 13	2 1
Whole eggs • Female (n=1021) • Male (n=206)	17 17	35 35	30 29	17 16	1 3
Lean meats • Female (n=1021) • Male (n=206)	9 11	18 18	70 69	3 2	0 0
Fish/seafood‡ • Female (n=1021) • Male (n=206)	26 26	16 19	26 29	27 21	5 5
Whole dairy products • Female (n=1021) • Male (n=206)	7 4	15 14	41 43	32 35	5 4
Red meats • Female (n=1021) • Male (n=206)	22 17	44 37	26* 36	7 8	1 2
Processed Meat • Female (n=1021) • Male (n=206)	55** 34	26* 35	16** 29	3 1	<1* 1
Stick margarine • Female (n=1021) • Male (n=206)	82 81	7 7	8 7	3 4	<1 1

Refined grains • Female (n=1021) • Male (n=206)	32 27	19 20	26 31	20 19	3 3
Baked products • Female (n=1021) • Male (n=206)	25 19	27 33	33 39	14* 8	1 1
Deep fried foods • Female (n=1021) • Male (n=206)	57* 47	29* 37	13 16	1 <1	<1 <1
Salt (added to food) • Female (n=1021) • Male (n=206)	62 64	12 11	14 14	9 9	3 2
Calorie containing beverages • Female (n=1021) • Male (n=206)	68** 54	14 16	12* 20	4* 8	2 2
Alcohol-containing beverages • Female (n=1021) • Male (n=206)	60** 40	18 21	18* 29	4* 8	<1* 2

Proportions of weekly intake were compared between women and men using chi-square tests
*P-value≤0.05
**P-value≤0.001
†5-7 days/ week= "Nearly daily or daily" on the D-SAC questionnaire
‡Monthly intake assessed for fish/seafood
See Appendix E for the version of the D-SAC that was used as well as the response categories available to participants

3.3 Pregnancy Intention Among Participants

Only 16% (n=195) of participants reported that they were currently trying to become pregnant and 52% (n=644) had no current intentions of conceiving a child. The remaining 32% of participants reported that they were either considering a pregnancy within the next one to two (25%; n=306) or three to five years (7%; n=82). (Appendix L)

3.4 Weekly Intake and Pregnancy Intention

There were few noted differences in intake between those who were not planning a pregnancy and those who were currently intending to conceive. Significant differences between the two intention groups were noted within beverage categories (plain water, alcohol-containing

beverages, calorie-containing beverages), low-fat dairy products and stick margarine. More women who reported that they were currently planning to become pregnant had greater daily consumption of plain water compared to those who had no plans of becoming pregnant, and significantly fewer consumed stick margarine on a daily basis; however, daily intake of stick margarine was low in both groups.

A greater proportion of men who were planning to have a child with their partner reported daily intake of low-fat dairy products compared to those who had no plans of having a child. Also, fewer men who were planning to have a child reported daily consumption of calorie-containing beverages.

Table 11. Comparing daily intake ("nearly daily or daily" + "twice or more per day") of food and beverage groups amongst women and men who are currently planning a pregnancy versus those who are not.

	Women		**Men**	
	Planning	**Not Planning**	**Planning**	**Not Planning**
	(N=157)	**(N=524)**	**(N=38)**	**(N=120)**
	N (%)			
Dark green leafy vegetables	41 (26)	142 (27)	9 (24)	29 (24)
Cruciferous vegetables	18 (11)	61 (12)	4 (11)	11 (9)
Carrots	16 (10)	78 (15)	5 (13)	16 (13)
Other vegetables	71 (45)	254 (48)	17 (45)	48 (40)
Dried beans, peas, lentils and tofu	18 (11)	41 (8)	3 (8)	7 (6)
Citrus Fruits	30 (19)	70 (13)	4 (11)	18 (15)
Other Fruit	104 (66)	321 (61)	16 (42)	64 (53)
Whole grain breads and cereals	63 (40)	226 (43)	13 (34)	48 (40)
Plain water	148 (94)*	456 (87)	26 (68)	88 (73)
Low-fat milk dairy foods	37 (24)	98 (19)	10 (26)*	11 (9)
Whole eggs	33 (21)	100 (19)	8 (21)	22 (18)
Lean meats	5 (3)	12 (2)	0 (0)	2 (2)
Fish/seafood‡	45 (29)	185 (35)	13 (34)	32 (27)
Whole dairy products	62 (39)	187 (36)	18 (47)	50 (42)
Red meats	15 (10)	37 (7)	4 (11)	9 (8)
Processed meats	4 (3)	18 (3)	0 (0)	4 (3)

Stick margarine	1 (<1)	24 (5)*	3 (8)	5 (4)
Refined grains	33 (21)	120 (23)	5 (13)	30 (25)
Nuts & seeds	49 (31)	145 (28)	10 (26)	33 (28)
Baked products	24 (15)	77 (15)	4 (11)	10 (8)
Deep fried foods	1 (1)	2 (<1)	1 (3)	1 (<1)
Salt (added to food)	15 (10)	62 (12)	3 (8)	10 (8)
Calorie containing beverages	12 (8)	23 (4)	0 (0)	15 (13)*
Alcohol-containing beverages	2 (1)	22 (4)	6 (16)	8 (7)

Proportions of weekly intake were compared between intention groups using chi-square tests
*P-values≤ 0.05
‡Monthly intake assessed for fish/seafood
See Appendix E for the version of the D-SAC that was used as well as the response categories available to participants

A greater proportion of women who were currently planning to become pregnant reported consuming alcohol containing beverages "less than once per week" compared to those who had no plans of becoming pregnant (Table 12). There were no significant differences in "less than weekly intake" of any foods or beverages amongst within the two intention groups amongst men.

Table 12. Comparing "less than one per week" intake" of women and men who are currently planning a pregnancy versus those who are not.

	Women		**Men**	
	Planning	**Not Planning**	**Planning**	**Not Planning**
	(N=157)	**(N=524)**	**(N=38)**	**(N=120)**
	N (%)			
Dark green leafy vegetables	24 (15)	88 (17)	5 (13)	12 (10)
Cruciferous vegetables	26 (17)	98 (19)	7 (18)	22 (18)
Carrots	37 (24)	115 (22)	6 (16)	21 (18)
Other vegetables	9 (6)	16 (3)	1 (3)	4 (3)
Citrus Fruits	55 (35)	190 (36)	15 (39)	36 (30)
Other Fruit	5 (3)	22 (4)	3 (8)	9 (8)
Dried beans, peas, lentils and tofu	66 (42)	231 (44)	17 (45)	57 (48)
Nuts & seeds	31 (20)	107 (20)	6 (16)	17 (14)
Whole grain breads and cereals	19 (12)	57 (11)	1 (3)	17 (14)
Plain water	0 (0)	9 (2)	0 (0)	0 (0)
Low-fat milk dairy foods	49 (31)	187 (36)	10 (26)	50 (42)
Whole eggs	26 (17)	81 (15)	5 (13)	20 (17)
Lean meats	19 (12)	44 (8)	4 (11)	13 (11)
Fish/seafood‡	43 (27)	125 (24)	6 (16)	28 (23)
Whole dairy products	13 (8)	34 (6)	1 (3)	2 (2)

Red meats	43 (27)	116 (22)	3 (8)	22 (18)
Processed meats	92 (59)	279 (53)	11 (29)	40 (33)
Stick margarine	136 (87)	437 (84)	26 (68)	98 (82)
Refined grains	59 (38)	164 (31)	8 (21)	31 (26)
Baked products	38 (24)	128 (24)	3 (8)	26 (22)
Deep fried foods	94 (60)	298 (57)	19 (50)	51 (43)
Salt (added to food)	100 (64)	328 (63)	23 (61)	82 (68)
Calorie containing beverages	106(68)	380 (73)	21 (55)	62 (52)
Alcohol-containing beverages	123 (79)**	287 (55)	10 (26)	51 (43)

Proportions of weekly intake were compared between intention groups using chi-square tests
*P-value≤ 0.05
**P-value≤ 0.001
‡Monthly intake assessed for fish/seafood
See Appendix E for the version of the D-SAC that was used as well as the response categories available to participants

We then compared weekly intake of alcohol containing beverages, plain water, stick margarine, low-fat dairy products, and calorie containing beverages between individuals who reported no intention of conceiving and those who were considering a pregnancy in one to two years and then those who were considering a pregnancy in three to five years; the differences in intake did not remain significant for any of the food or beverage groups.

3.5 Participant Dietary Quality

Figure 5 shows the distribution of low, moderate, high and total-quality scores, in the study population. Total and high-quality scores were normally distributed while moderate and low-quality scores were slightly, negatively skewed. Total-quality scores (TQSs) ranged from -15 to 54 with a mean of 20.1 (SD=8.0). High-quality scores (HQSs) ranged from 5 to 53 with a mean of 25.3 (SD=6.6). Moderate-quality scores (MQSs) ranged from -4 to 4 and with mean of 1.4 (SD=1.7). Low-quality scores (LQSs) ranged from -24 to 0 with a mean of -6.6 (SD=3.7). (Table 13)

Table 13. Average of participants low, moderate, high, and total quality scores using the D-SAC Quality Scoring System							
Quality Score Group (N=1227)	**Mean**	**Median**	**SD**	**Min**	**Max**	**Lowest Possible**	**Highest Possible**
Low	-6.6	-6.0	3.7	-24	0	-32	0
Moderate	1.4	1.0	1.7	-4	4	-4	4
High	25.3	25.0	6.6	5	53	0	56
Total	20.1	20.0	8.0	-15	54	-36	60

SD=Standard Deviation

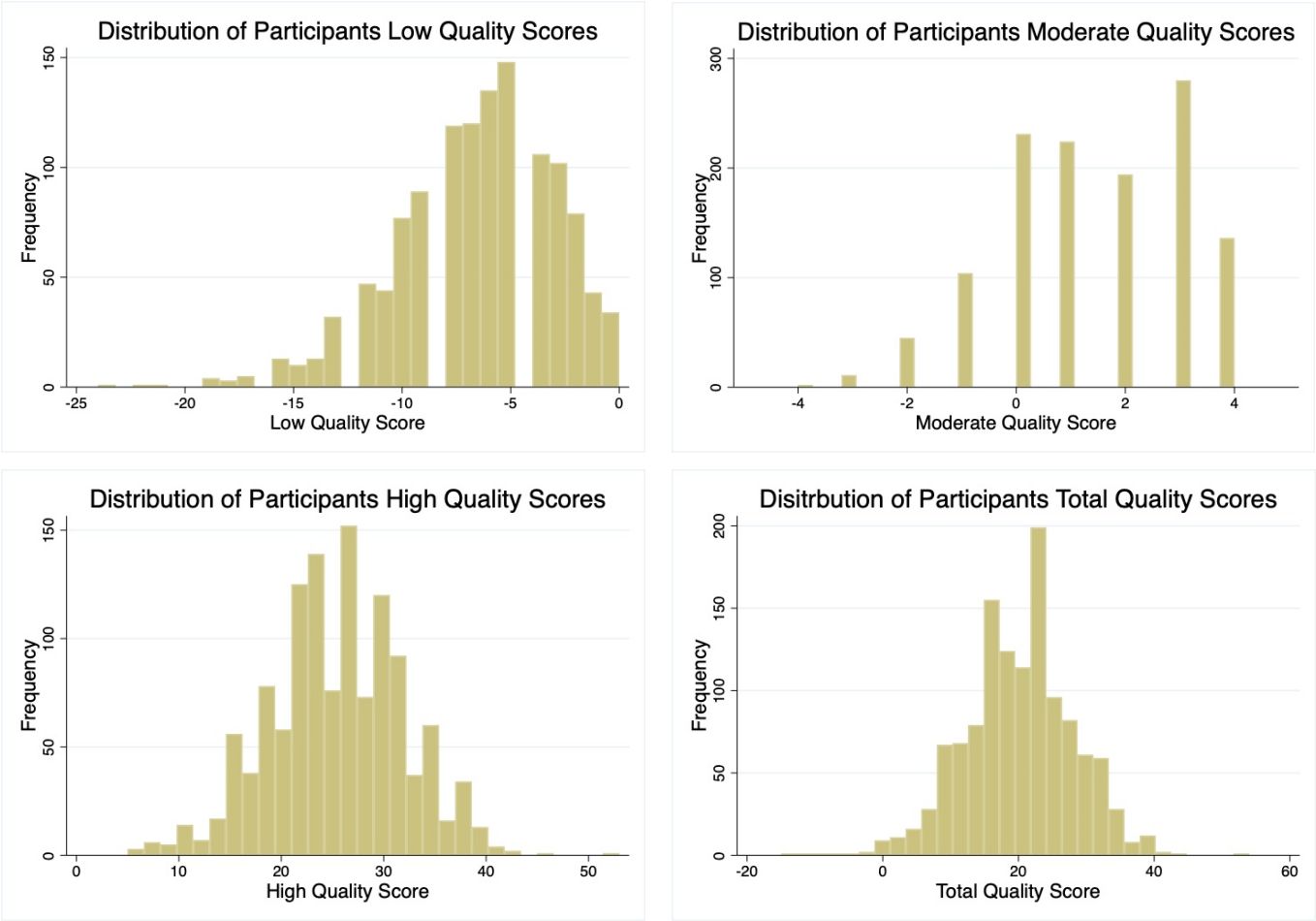


Figure 5. Bar graphs of total, high, moderate, and low-quality score distributions amongst study participants.

Unpaired t-tests were used to examine and compare quality scores amongst participant subgroups. This was done to analyze how the quality scoring system and low, moderate, high and total scores presented within particular groups. (Table 14).

Table 14. Average quality scores according to participant characteristics								
		Quality Scores Mean (SD)						
Participant Characteristic	**N**	**High**		**Moderate**		**Low**		**Total**	
Sex									
• Women	1021	25.4 (6.5)		1.4 (1.8)		-6.4 (3.7)	**	20.4 (0.2)	**
• Men †	206	24.6 (6.6)		1.5 (1.7)		-7.7 (3.8)		18.5 (0.6)	
Meet Physical Activity Requirements									
• Yes	666	26.7 (6.3)	**	1.3 (1.7))	*	-6.2 (3.5)	**	21.8 (7.6)	**
• No †	507	23.5 (6.3)		1.6 (1.7)		-7.0 (3.9)		18.1 (7.7)	
Education									
• College/ University	1145	25.5 (6.4)	**	1.5 (1.7)		-6.5 (3.7)	**	20.5 (0.2)	**
• High School or less †	82	22.0 (7.3)		1.2 (2.0)		-8.0 (4.4)		15.2 (1.0)	
Annual Household Income									
• ≥ $75, 000	874	25.7 (6.3)	**	1.5 (1.7)	*	-6.5 (3.6)		20.7 (0.3)	**
• < $75, 000 †	353	24.3 (7.0)		1.3 (1.8)		-6.9 (4.1)		18.6 (0.5)	
BMI Categories									
• Underweight	63	24.8 (6.6)		1.6 (1.6)		-7.6 (4.3)	*	18.8 (7.6)	*
• Normal †	523	26.3 (6.4)		1.3 (1.7)		-6.2 (3.6)		21.4 (7.8)	
• Overweight	376	25.1 (6.6)	*	1.5 (1.8)		-6.8 (3.7)	*	19.7 (8.0)	*
• Obese	266	23.9 (6.4)	**	1.7 (1.6)	*	-7.0 (3.8)	*	18.4	**
Smoke									
• Yes	59	22.5 (6.1)	**	1.5 (1.7)		-7.8 (4.4)	*	16.2 (7.9)	**
• No †	1169	25.5 (6.5)		1.4 (1.7)		-6.6 (3.7)		20.3 (8.0)	

Born in Canada?					
• Yes	1017	25.4 (6.6)	1.4 (1.7) *	-6.7 (3.7)	20.1 (8.1)
• No †	210	24.9 (6.1)	1.6 (1.8)	-6.3 (3.7)	20.2 (7.4)
Pregnancy Intention					
• Not Planning †	644	25.5 (6.4)	1.5 (1.7)	-6.7 (3.7)	20.3 (7.8)
• Currently Planning	195	25.9 (6.9)	1.3 (1.8)	-6.2 (3.6)	21.0 (8.3)
• Considering w/n 1-2 yrs	306	24.9 (6.3)	1.4 (1.7)	-6.8 (3.8)	19.5 (8.0)
• Considering w/n 2-5 yrs	82	23.8* (7.0)	1.5 (1.7)	-6.7 (4,1)	18.7 (8.8)
Parity					
• 0 Children †	1192	25.2 (6.5) *	1.4 (1.7)	-6.7 (3.7) *	20.0 (8.0) *
• ≥1 Children	35	28.1 (6.7)	1.5 (1.5)	-5.3 (3.5)	24.3 (8.1)

Scores were compared between subgroups groups using unpaired t-tests
†Reference group
*P-value≤0.05
**P-value≤0.001

3.5.1 Associations between Participant Characteristics and Diet Quality Scores

Associations between participant characteristics and diet quality scores from univariable and multivariable regression are displayed in Table 15 and Tables 16, 17, 18, respectively. Univariable and multivariable regressions were run to explore which participant characteristics determined TQS.

Results of the univariable regression analysis showed that TQS were associated with identifying as female, being older, meeting physical activity recommendations, having completed college or university education, and having an annual household income equal to or greater than CAD$75,000. Univariable regression analysis also showed that having a lower TQS associated with smoking, considering a pregnancy within 3-5 years and having a BMI in the overweight or obese category. However, being born in Canada and pregnancy intent were not associated with differences in the TQS.

In the multivariable regression, identifying as female, being older, meeting physical activity recommendations, and having completed college or university remained significantly associated with a higher TQS, though income was no longer significant. Having had children, smoking, and having a BMI in the obese category were inversely associated with TQS in multivariable analyses though having an annual household equal to or greater than CAD$75,000 and having a BMI in the overweight category were no longer significant.

Table 15. Beta coefficients (β) from univariable linear regressions examining the association between socio-demographic characteristics and diet quality scores				
Characteristic	**Total QS**	**High QS**	**Moderate QS**	**Low QS**
Sex				
• Women	2.0**	0.8	-0.1	1.3**
• Men†				
Meet Weekly Physical Activity				
• Yes	3.8**	3.3**	-0.2*	0.7**
• No †				
Education				
• College/ University†	5.3**	3.6**	0.3	1.4**
• High School or less				
Annual Household Income				
• ≥ $75, 000†	2.1**	1.4**	0.2*	0.4
• < $75, 000				
BMI Categories				
• Underweight	-2.5*	-1.4	0.3	-1.4*
• Normal †	-	-	-	-
• Overweight	-1.6*	-1.2*	0.2	-0.6*
• Obese	-2.9**	-2.4**	0.4*	-0.8*
Smoke				
• Yes	-4.0**	-2.9**	0.1	-1.2*
• No†				
Born in Canada?				
• Yes†	-0.1	0.5	-0.3	-0.4
• No				
Planning Intention				
• Not Planning†	0.7	0.4	-0.2	0.5
• Currently Planning				
• Considering w/n 1-2 yrs	-0.8	-0.6	-0.1	-0.1
• Considering w/n 2-5 yrs	-1.7	-1.7*	0.04	-0.1
Parity				
• 0 †	-4.3*	-2.9*	-0.8	1.4*
• ≥1				
Age	0.1*	0.1	0.02*	0.04

*P-value≤0.05
**P-value≤ 0.001
† Reference category

Table 16. Beta coefficients (β) from multivariable linear regressions of socio-demographic characteristics associated with high-quality scores		
Characteristic	**β Coefficient**	**95% Confidence Interval**
Sex • Women • Men †	NS	-
Meet Weekly Physical Activity • Yes • No †	3.0**	2.2, 3.7
Education • College/ University • High School or less †	2.5**	1.0, 4.1
Annual Household Income • ≥ $75, 000 • < $75, 000 †	0.5	-0.3, 1.3
BMI Categories • Underweight • Normal † • Overweight • Obese	NS - -0.8 -1.5**	- - -1.7, 0.0 -2.5, -0.6
Smoke • Yes • No †	-2.0*	-3.8, -0.3
Pregnancy Intention • Not Planning † • Currently Planning • Considering w/n1-2 yrs • Considering w/n 2-5 yrs	- NS NS -1.5	- - - -2.9, 0.0
Parity • 0 † • ≥1	-2.2	-4.3, -0.0
Age (years)	NS	-

NS = Non-significant (P-value≤0.05) in univariable analysis
*P-value≤ 0.05
**P-value≤0.01
† Reference category

Table 17. Beta coefficients (β) from multivariable linear regressions of socio-demographic characteristics associated with moderate-quality scores		
Characteristic	**β Coefficient**	**95% Confidence Interval**
Sex • Women • Men †	NS	-
Meet Weekly Physical Activity • Yes • No †	-0.2*	-0.4,-0.0
Education • College/ University • High School or less †	NS	-
Annual Household Income • ≥ $75, 000 • < $75, 000 †	0.26*	0.0, 0.5
BMI Categories • Underweight • Normal † • Overweight • Obese	NS - NS 0.4*	- - - 0.1, 0.6
Smoke • Yes • No †	NS	-
Pregnancy Intention • Not Planning † • Currently Planning • Considering w/n 1-2 yrs • Considering w/n 2-5 yrs	- NS NS NS	- - - -
Parity • 0 † • ≥1	NS	-
Age	0.01	-0.007, 0.034

NS = Non-significant (P-value≤0.05) in univariable analysis
*P-value≤ 0.05
**P-value≤0.01
† Reference category

Table 18. Beta coefficients (β) from multivariable linear regressions of socio-demographic characteristics associated with low-quality scores		
Characteristic	**β Coefficient**	**95% Confidence Interval**
Sex • Women • Men †	1.2**	0.6, 1.8
Meet Weekly Physical Activity • Yes • No †	0.7*	0.2, 1.0
Education • College/ University • High School or less †	1.1*	0.3, 2.0
Annual Household Income • ≥ $75, 000 • < $75, 000 †	NS	-
BMI Categories • Underweight • Normal † • Overweight • Obese	-1.2* - -0.3 -0.6*	-2.1, -0.2 - -0.8, 0.2 -1.2, -0.02
Smoke • Yes • No †	-0.5	-1.6, 0.5
Pregnancy Intention • Not Planning † • Currently Planning • Considering w/n1-2 yrs • Considering w/n 2-5 yrs	- NS NS NS	- - - -
Parity • 0 † • ≥1	1.3*	-2.5, -0.1
Age	NS	-

NS = Non-significant (P-value≤0.05) in univariable analysis
*P-value≤ 0.05
**P-value≤0.01
† Reference category

Table 19. Beta coefficients (β) from multivariable linear regressions of socio-demographic characteristics associated with total quality scores		
Characteristic	**β Coefficient**	**95% Confidence Interval**
Sex • Women • Men †	2.1**	0.9, 3.3
Meet Weekly Physical Activity • Yes • No †	3.5**	2.7, 4.3
Education • College/ University • High School or less†	3.4**	1.6, 5.2
Annual Household Income • ≥ $75, 000 • < $75, 000†	0.8	-0.2, 1.8
BMI Categories • Underweight • Normal † • Overweight • Obese	-1.2 - -0.7 -1.8*	-3.2, 0.8 - -1.7, 0.3 -2.9, -0.6
Smoke • Yes • No†	-2.4*	-4.5, -0.3
Pregnancy Intention • Not Planning † • Currently Planning • Considering w/n 1-2 yrs • Considering w/n 2-5 yrs	- NS NS NS	- - - -
Parity • 0 † • ≥1	-4.1*	-6.8, -1.5
Age	0.1*	0.05, 0.2

NS = Non-significant (P-value<0.05) in univariable analysis
*P-value ≤ 0.05
**P-value ≤0.01
† Reference category

3.6 Dietary Patterns Analyses

Two clear dietary patterns (i.e., components) emerged from the dataset. These two components explained 13% and 9% of the variation in the data. A coefficient of ≥0.2 was used as a cut off to describe both components (Table 20).

Table 20. Components derived from principal component analysis and their corresponding coefficients

Food and Beverage Item	Component 1	Component 2
Dark green leafy vegetables	**0.3470**	0.0578
Cruciferous vegetables	**0.2981**	0.1533
Carrots	**0.2608**	0.1431
Other vegetables	**0.3493**	0.0819
Dried beans, peas, lentils and tofu	**0.2700**	0.0533
Nuts and seeds	**0.3186**	0.0348
Whole grain breads and cereals	**0.2227**	0.0833
Plain water	**0.2285**	-0.1234
Citrus fruits	**0.2206**	0.1391
Other fruits	**0.3260**	0.0167
Low-fat milk dairy foods	0.0817	0.0790
Whole eggs	0.1657	0.1668
Lean meats	-0.0118	**0.2173**
Fish/ Seafood	0.1997	0.0613
Whole milk dairy foods	0.0337	**0.2418**
Red meats	-0.0249	**0.3189**
Processed meats	-0.1078	**0.3996**
Stick margarine	-0.0448	**0.2147**
Refined grains	-0.0966	**0.3231**
Baked products	-0.1016	**0.3497**
Deep fried foods	-0.1570	**0.3507**
Salt (added to food)	-0.0027	0.1450
Calorie containing beverages	-0.1885	**0.2801**
Alcohol-containing beverages	0.0164	0.0083

Bolded text highlights food groups and beverages which have a coefficient ≥ 0.2 and characterize the pattern

Component 1, named the "Mediterranean Dietary Pattern" (MDP), was characterized by more frequent consumption of fruits, vegetables, whole grains, plant-protein foods, and water. Component 2, named the "Western Dietary Pattern" (WDP), was characterized by more frequent

consumption of meat, whole milk dairy products, calorie containing beverages, and "other foods" such as deep-fried foods, processed meat, and stick margarine (Table 21).

Table 21. Characterization of components from principal components analysis (PCA)			
Component 1 (13%) "Mediterranean Dietary Pattern"		**Component 2 (9%) "Western Dietary Pattern"**	
Characterized by more frequent consumption of:	**Coefficient†**	**Characterized by more frequent consumption of:**	**Coefficient**
Fruit • Citrus fruits • Other fruits	 0.22 0.33	**Meat** • Red meats • Lean meats	 0.32 0.22
Vegetables • Cruciferous vegetables • Dark green leafy vegetables • Carrots • Other vegetables	 0.30 0.35 0.26 0.35	**Other Foods** • Stick margarine • Deep fried foods • Processed Meats	 0.22 0.35 0.40
Whole grains	0.22	**Whole milk dairy foods**	0.24
Plant proteins • Dried beans peas, lentil & tofu • Nuts and seeds	 0.27 0.32		
Plain water	0.23	**Calorie containing beverages**	0.28

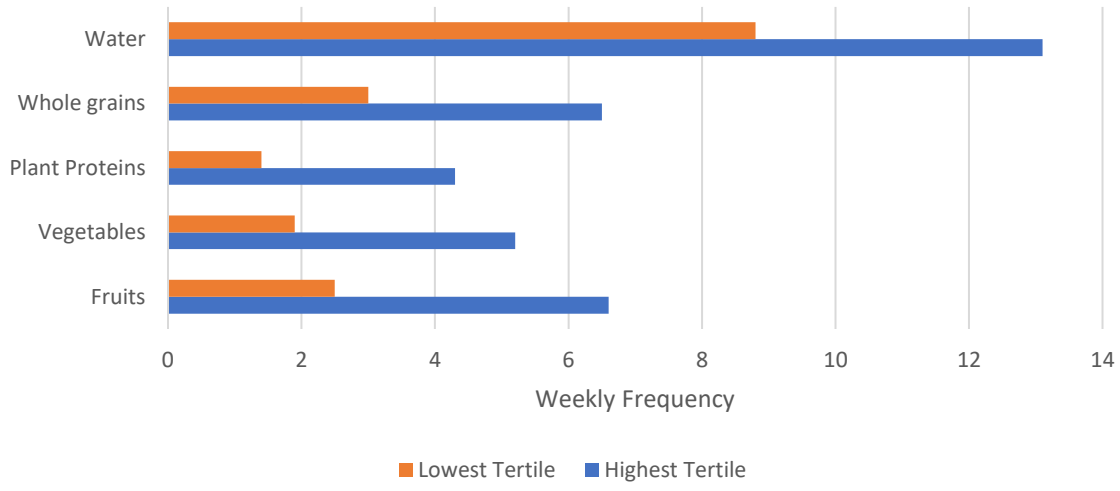
†Coefficients represent covariance between the foods and the overall component

Mediterranean Dietary Pattern (MDP)

Participants who's MDP score fell within the highest tertile were consuming fruit, vegetables, plant proteins, whole grains and water more often than those who's score fell within the lowest tertile (Table 22 and Figure 6).

Table 22. Weekly frequency of intake in lowest and highest tertile score groups for the Mediterranean Dietary Pattern (MDP)		
	Weekly frequency of intake amongst lowest tertile (N=409)	**Weekly frequency of intake amongst highest tertile (N=408)**
Citrus fruits	1.4	3.4
Other fruits	3.6	9.8
Fruits	2.5	6.6
Cruciferous vegetables	1.6	3.5
Dark green leafy vegetables	1.8	5.6
Other vegetables	2.8	8.0
Carrots	1.5	3.5
Vegetables	1.9	5.2
Dried beans, peas, lentil, and tofu	1.0	2.7
Nuts & seeds	1.7	6.0
Plant proteins	1.4	4.3
Whole grains	3.0	6.5
Plain water	8.8	13.3

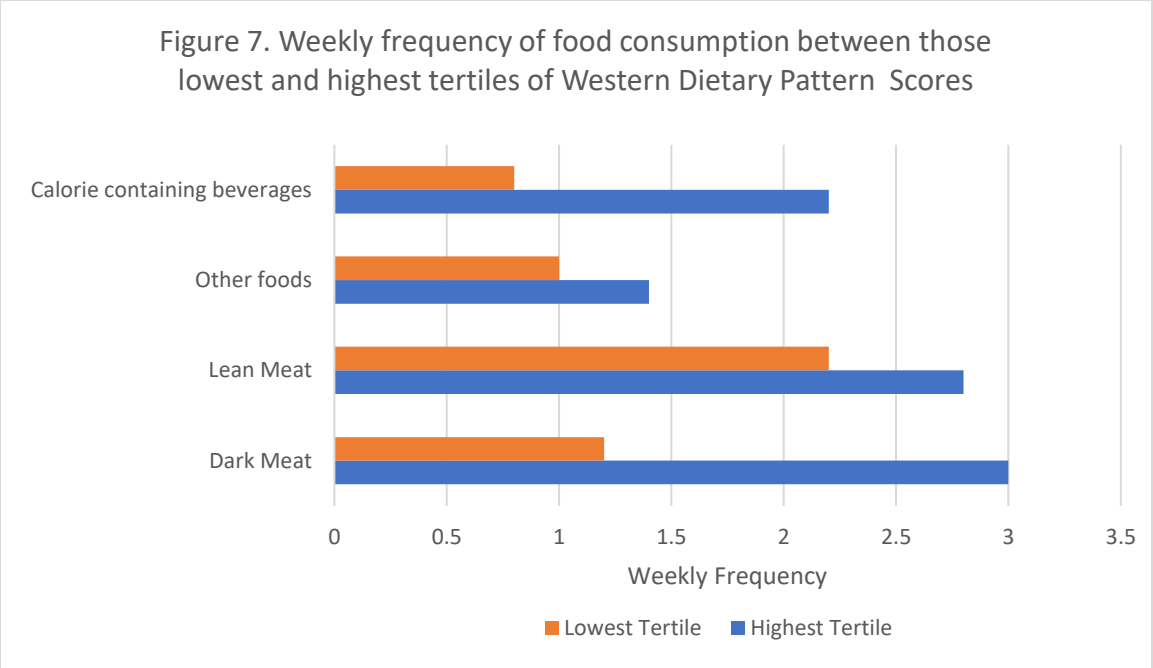
Figure 6. Weekly frequency of food consumption between those in the lowest and highest tertiles of Meditteranean Dietary Pattern Scores



Western Dietary Pattern (WDP)

Participants whose WDP score fell within the highest tertile were consuming red meat, lean meat, processed meat, whole fat dairy foods, calorie containing beverages, and deep-fried foods more often than those who's score fell within the lowest tertile. (Table 23 & Figure 7).

Table 23. Weekly frequency of intake in lowest and highest tertile score groups for the Western Dietary Pattern (WDP)		
	Weekly frequency of intake amongst lowest tertile (N=409)	**Weekly frequency of intake amongst highest tertile N=408**
Lean meats	2.2	2.8
Whole milk dairy foods	2.8	6.1
Red meats	1.2	3.0
Processed meats	0.7	2.1
Calorie containing beverages	0.8	2.2
Deep fried foods	0.8	1.5
Stick margarine	1.4	0.7



3.6.1 Participant Characteristics Associated with Dietary Patterns

Associations between participant characteristic and dietary pattern scores following univariable and multivariable regression are displayed in Table 24 and Table 25.

Those who identified as female, met physical activity requirements, and had a college or university education tended to have a higher MDP score. In addition, participants who were in the overweight or obese category tended to have a lower MDP score as compared to individuals within a normal BMI range. Participants who identified as female and had an annual household income of CAD$75,000 or more tended to have a lower WDP score.

Table 24. Beta coefficients (β) from univariable linear regressions of socio-demographic characteristics associated with the dietary pattern scores				
	Mediterranean Dietary Pattern		Western Dietary Pattern	
Characteristic	**β**	**(95% CI)**	**β**	**(95% CI)**
Sex				
• Female	1.2*	(0.3, 2.0)	-0.6*	(-1.0, -0.1)
• Male †				
Meet Weekly Physical Activity				
• Yes	3.2**	(2.6, 3.8)	-0.3	(-0.6, 0.1)
• No †				
Education				
• College/ University	2.6**	(1.4, 3.9)	-0.8*	(-1.5, -0.02)
• High school or less †				
Annual Household Income				
• ≥ CAD75,000	0.9*	(0.2, 1.6)	-0.6	(-1.0, -0.2)
• <CAD75,000 †				
BMI				
• Underweight	-1.9*	(-3.3, -0.4)	1.0*	(0.1, 1.8)
• Normal †	-	-	-	-
• Overweight BMI	-1.3**	(-2.0, -0.6)	0.3	(-0.1, 0.7)
• Obese BMI	-2.3**	(-3.2, -1.5)	0.1	(-0.4, 0.6)
Smokes Cigarettes?				
• Yes	-2.6**	(-4.1, -1.1)	0.7	(-0,2, 1.5)
• No †				
Pregnancy Intention				
• Not currently planning †	-	-	-	-
• Currently trying	0.5	(-0.4, 1.4)	0.004	(-0.5, 0.5)
• Within 1-2 years	-0.3	(-1.1, 0.4)	-0.02	(-0.5, -0.7)
• Within 3-5 years	-1.4*	(-2.6, -0.1)	-0.004	(-0.7, 0.7)
Parity				
• 0	3.2**	(1.3, 5.1)	-0.9	(-2.0, 0.1)
• ≥1†				

*P-value ≤ 0.05
**P-value ≤0.01
† Reference category

Table 25. Beta coefficients (β) from multivariable linear regressions of socio-demographic characteristics associated with the dietary pattern scores				
	Mediterranean Dietary Pattern		Western Dietary Pattern	
Characteristic	**β**	**(95% CI)**	**β**	**(95% CI)**
Sex				
• Female	1.3*	(0.5, 2.2)	-0.6*	(-1.0, -0.1)
• Male †				
Weekly Physical Activity				
• Meet PA recc	3.0**	(2.4, 3.7)	NS	-
• Don't meet PA recc †				
Education				
• College/ University	1.9**	(0.6, 3.2)	-0.5	(-1.3, 0.2)
• High school or less †				
Annual Household Income				
• ≥ CAD75,000	0.1	(-0.6, 0.8)	-0.5*	(-0.9, -0.1)
• <CAD75,000 †				
BMI				
• Underweight	-1.0	(-2.3, 05)	0.8	(-0.1, 1.6)
• Normal †	-		-	
• Overweight BMI	-0.7*	(-1.5, 0.0)	0.2	(-0.2, 0.6)
• Obese BMI	-1.5*	(-2.3, -0.7)	0.01	(-0.5, 0.5)
Smokes Cigarettes?				
• Yes	-1.5*	(-3.0, -0.0)	NS	-
• No †				
Pregnancy Intention				
• Not currently planning †	-		-	
• Currently trying	NS	-	NS	-
• Within 1-2 years	NS	-	NS	
• Within 3-5 years	-1.2	(-2.5, 0.0)	NS	
Parity				
• 0	-2.4*	(0.6, 4.2)	NS	-
• ≥1†				

NS = Non-significant (P-value<0.05) in univariable analysis
*P-value ≤ 0.05
**P-value ≤0.01
† Reference category

Total and high-quality scores were positively correlated with the MDP scores, while the LQSs were positively correlated with the WDP scores (Table 26).

Table 26. Pearson correlation analysis comparing diet quality scores and dietary patterns scores

	Mediterranean Dietary Pattern	Western Dietary Pattern
Total Quality Score	0.83	-0.14
High Quality Score	0.88	0.29
Moderate Quality Score	-0.19	-0.32
Low Quality Score	0.32	-0.67

4. Discussion

The primary objective of this study was to describe the dietary intake of a sample of women and men in Canada who are of childbearing age (Government of Canada, 2021). The secondary objective of this study was to determine whether there were differences in dietary intake of women and men who are planning a pregnancy versus those who are not planning a pregnancy. Generally, participants weekly intake of higher quality foods did not align with CFG recommendations. Also, intention to conceive a child was generally not associated with differences in dietary intake, with few noted exceptions.

We first investigated participants preconception diet by analysing their weekly intake of foods and beverages. More than half of participants reported consuming vegetables (63%) and fruits (76%) on a less than daily basis. Results from Central Pennsylvania Women's Health Study (CePAWHS) highlight that low intake of fruits and vegetables (<1/day) is a risk factor for adverse pregnancy outcomes[119]. Similarly, a study of adult Americans across diverse geographic areas found that mean daily intake of fruits and vegetables was only 3.6 servings[120]. These

findings may suggest that the dietary intake North American adults may not align with guidelines, and in turn, may be insufficient in important nutritional qualities important for conception.

Within this cross-sectional study, pregnancy intention was not a determinant of any participants diet quality or dietary pattern. However, our results may suggest that women and men make few, dietary-related changes when they are actively planning to conceive in the near future. Women in this study consumed alcohol less often on a weekly basis if they were currently planning a pregnancy as compared to those who reported not having any intention to conceive. However, this difference in alcohol intake was not seen amongst women considering a pregnancy within the next one to five years, suggesting that women may adjust this behaviour only if they are actively trying to become pregnant. Similarly, a study using data from the Southampton Women's Survey, which examined changes in diet and lifestyle recommendations before and during pregnancy, found a significant reduction in alcohol consumption amongst women between these two phases of the life course[121]. Given that the dietary-related recommendations of numerous guidelines suggest that women reduce or stop their alcohol intake in preparation for pregnancy, these findings are not surprising. There is some evidence to suggest that certain food group intake is associated with adverse pregnancy outcomes. For example, a case-control study of Iranian women found that those who had GDM had a significantly higher preconception and pregnancy intake of high-fat dairy products, fried foods and a significantly lower intake of fruit, as compared to a control group[122]. Another study of Australian women found that those who had gestational hypertension, compared to those without, had lower preconception and pregnancy intake of vegetables, fruit, grains, and plant-based proteins such as nuts, beans, and soya[123].

Within the present study, a greater proportion of women currently planning a pregnancy, versus those who were not, consumed more water on a daily basis. Men, on the other hand, had a lower daily intake of calorie-containing beverages and a greater intake of low-fat dairy products if they were planning to conceive. Cumulatively these findings may suggest that women and men both make few and varied dietary-related changes when pregnancy planning. While the differences between intention groups are promising in that they suggest a decrease in lower quality food items and an increase in higher quality ones, the lack of difference in most high-quality food groups such as fruits, vegetables, whole grains, and plant-based proteins is concerning and requires further investigation.

Women, those who met weekly physical activity requirements, those who had a post-secondary education and were older tended to have a higher total quality score as assessed by the D-SAC. However, participants who smoked, already had children, and those who had an obese BMI tended to have a lower total quality score. These associations between participant characteristics and dietary quality are consistent with the literature. For example, a greater dietary quality has been associated with a lower BMI[124] and poorer dietary quality has been associated with overweight and obesity[125]. In addition, adequate physical activity[126] and higher education[127] are also all associated with healthy dietary intake. The consistence between our findings and those in the literature suggests that the D-SAC quality scoring system is able to detect associations that have been previously reported. Furthermore, MDP scores were strongly correlated with total (0.83) and high (0.88) quality food scores, supporting the idea that the total and high-quality food scores are consistent. There was also a strong, negative correlation between WDP scores and low-quality scores (-0.67). The presence and strength of these correlations suggests that the

results obtained using the D-SAC quality scoring system aligns with other dietary assessment methods.

5. Study Strengths

While DOHaD research is increasingly recognizing and emphasizing the importance of optimizing health and particularly dietary intake prior to conception, this area of research is still under explored. This study will not only provide important insights into the general preconception dietary intake of Canadian adults, but it will also help provide important insights around the relationship between pregnancy intention and associated dietary changes. To our knowledge, this study is the first to explore preconception diet and consider pregnancy intentions among Canadian adult women and men in a large, multi-province sample. We also believe that this is the first human study to describe preconception dietary intake of men and to assess how it is associated with their intention to conceive a child with their partner. Finally, we were able to assess prospective pregnancy intention at 4 separate levels and explore how these levels determined (or did not, in this case) dietary quality and patterns.

6. Study Limitations

This studied attracted high-income, highly educated, and Canadian-born individuals; the study sample limits the generalizability of our results to more diverse populations. However, inadequacies in intake as highlighted within this sample may be further exacerbated in populations experiencing socio-economic and other social barriers. In addition, the majority of participants in this study were already parents and results associated with parity should be interpreted with caution. We cannot accurately or confidently describe the preconception dietary intake of nulliparous individuals. Finally, we did not collect data on supplement or caffeine consumption. This is an important limitation to note as most studies published to date that explore the association between pregnancy intention and dietary intake assess both of these dietary factors.

7. Study Biases

It is important to consider biases that may influence the study findings. Since all study activities were completed online, study participation was limited to individuals who had reliable access to a computer and excluded those who did not. Individuals who are of lower socioeconomic status may be less likely to have reliable access to the internet[128]. However, online recruitment and study completion did make it possible for us to reach a wider geographic distribution of people from (i.e., from across Canada) than would have been possible using in-person recruitment methods. The fact that the study was only open to English-speaking individuals introduces further sampling bias and may limit assessment of preconception diet amongst newcomers or others whose English language skills did not match those needed for this study. Finally, nutrition

research, in general, may attract individuals who are already interested in health and wellness, and therefore our results likely reflects a subgroup of Canada's diverse population.

8. Implications & Next Steps

This research will help provide important insight into the dietary intake of Canadian women and men and into the health behaviours they may or may not be prioritizing when pregnancy planning. These findings are crucial in informing future research and public health strategies focused on optimizing preconception dietary intake of Canadian adults, including the Canadian Healthy Life Trajectories Initiative (HeLTI-Canada). HeLTI-Canada will also be using the D-SAC for their own dietary data collection and analysis; findings from this study will provide insights into how the D-SAC can be interpreted by HeLTI staff and researchers; particularly those who do not have specific nutrition training. The quality scoring system shows promise for easy and reliable use and interpretation of dietary data in a large cross-sectional study.

Conclusions

Within our study, pregnancy intention is not associated with differences in dietary intake amongst women or men, with few noted exceptions. There appears to be room for improvement in the general preconception dietary intake of Canadian adults to more closely align with national and global guidelines, regardless of their pregnancy intent.

Chapter 4:

Thesis Conclusions

Discussion

This set of research studies assessed the reproducibility of the D-SAC and compared diet quality scores and frequency of intake determined using the D-SAC and repeated 24-hour recalls. It also used the D-SAC to describe the preconception dietary intake of women and men in Canada and compared the frequency of intake and diet quality between those who are planning and those who are not planning a pregnancy.

Dietary quality assessed via the D-SAC was reproducible over the course of one month. It aligned well with dietary intake assessed by five, 24-hour recalls, although the D-SAC overestimated people's intake of high-quality foods and underestimated intake of low-quality foods. Results from the national cross-sectional survey of women and men that used the D-SAC to assess their dietary intake suggest that there is room for improvement in the preconception dietary intake of adults in Canada, and that, pregnancy intention was not associated with higher diet quality but was associated with less frequent intake of alcohol in women and calorie-containing beverages in men, and more frequent intake of low-fat dairy beverages in men and water in women. The noted differences between those planning and not planning a pregnancy are important but not sufficient to raise the overall diet quality to a level considered optimal to support a healthy pregnancy. An important aspect of this work is that it is one of the first studies to report dietary intake among men in a preconception part of their life.

While FFQs are often the dietary assessment tool of choice for large-scale epidemiological studies[83], there is a need for tools that are short, easily interpreted, and pose a low level of burden on participants while still providing reliable estimates of dietary intake. Thus, the D-SAC and its

subsequent comparison against 24-hour recalls within this thesis project brings tangible value to researchers for their dietary assessment needs. Findings from this study suggest that dietary quality as assessed via the D-SAC is reproducible over about a one-month period and provides fair to moderate assessments of the weekly intake of many foods and beverages, particularly, ones that are easily grouped and interpreted. Findings also suggest that the D-SAC reliably measures individual's intake of moderate quality foods, overestimates intake of higher quality foods, and underestimate intake of lower quality foods as compared to 24-hour recalls. Social desirability and reporting biases may play a role in these results; these biases must be considered when interpreting dietary data collected via the D-SAC. However, general overestimation of dietary intake is not uncommon amongst FFQs when they are compared to other dietary assessment methods[129-132]. While our study findings suggest that the D-SAC may be appropriately used to assess intake of various food and beverage groups, rather than the collection of detailed dietary data and nutrient intake, future research is necessary to better understand how dietary intake assessed by the D-SAC compares to nutritional status assessed by biological samples.

To date, studies on nutrition prior to conception have largely focused on women and have assessed intake of few food and beverage groups or specific nutrients[133-135]. Many nutrition experts are advocating for a holistic view of diet, understanding that people consume whole foods in combination[74,75,116] and that habitual food intake patterns make a large contribution to people's risk of NCDs over the long term. Thus, assessing whole diet quality and multiple food and beverage groups, amongst women and men, as is done in this study, is particularly novel.

This approach allows for a more complete exploration of diet and contributes to future research exploring preconception intake of women and men.

Findings in the present study suggest that dietary intake of participants does not align with the 2019 CFG[112]. For example, less than half of participants reported consuming fruits, vegetables, whole grains, and plant-based proteins on a daily basis. Regular consumption of these food groups characterizes healthy dietary patterns which have been associated with a reduced risk of pregnancy complications[136-138] and chronic disease development general[139-141]. Given the lack of alignment between intake and recommendations, Canadian adults' diets may be at risk for inadequate intake of a number of nutrients that are important for overall health and wellbeing such as fibre, iron, and Vitamins A and D, to name a few. Participants in this study were generally well-educated and of a high socio-economic status. These characteristics have previously been associated with overall better dietary intake amongst individuals[117,142]. Therefore, lower intake, or less frequent intake, of high-quality foods may be observed in some groups and contribute to widening health inequalities. Women of reproductive age, living in other high-income countries, such as the UK and Australia were also falling short of nutritional recommendations[9,106,107,109]. This cumulative evidence, while not encouraging, strengthens the argument that more attention is necessary on promoting the overall dietary intake of adults who are within childbearing age. Public health measures need to focus not only on general education and appropriate support of overall dietary optimization prior to conception, but also consider the implications that preconception diet has on short and long-term health trajectories.

To address objective 2 (i.e., to describe preconception dietary intake in a group of women and men in the preconception period in Canada using the D-SAC questionnaire) dietary data was analysed using three different approaches, one of which was PCA. PCA has been used to identify patterns of food intake using a data-driven method and in this study served as a way to examine the relationship between a pre-determined method to classify data quality (i.e. the D-SAC scoring methods, based on CFG) and data-driving analyses of intake. The strong agreement between these two approaches gives additional evidence that D-SAC quality scoring system produces results consistent with an independent approach to measure diet quality. Information from the PCA approach also provides insights into the combinations of foods consumed by people in this study. Information from these analyses could be used in the future to identify possible areas of intervention among similar populations.

Research assessing the associations between pregnancy intention and preconception diet is limited[27]. This study provides valuable insight into this association considering both women and men, which is particularly novel. Study findings suggest that both women and men make few dietary changes when planning a pregnancy. The observed changes, however, appear to align with nutrition recommendations, which suggests that individuals may make some positive changes to their dietary intake prior to conception. Women in the present study, who were currently intending to become pregnant had significantly lower alcohol and greater water intake compared to women who had no intentions to conceive. Other studies have found similar results regarding alcohol intake[121,143], however, to our knowledge increased water consumption has not previously been reported among women who are planning a pregnancy. Current preconception guidelines largely focus on recommendations related to caffeine, alcohol, and folic acid intake.

Unfortunately, we were not able to assess caffeine or supplement intake, in the current study, but the observed differences in alcohol intake among women in this study align with recommendations. This suggests some specific aspects of dietary guidelines positively influence optimization of intake of well-educated women. Additional research is needed among more diverse groups of women to understand the impact in different populations.

Within the present study, men who were currently intending to conceive a child with their partner had a significantly greater daily intake of low-fat dairy products and lower daily intake of calorie-containing beverages compared to those who had no intention of conceiving. While these results require further investigation, there is evidence that low-fat dairy intake is associated with greater sperm concentration and motility[144] which may appear desirable for men who are trying to conceive and particularly amongst men who are facing challenges trying to conceive with their partner. It is unclear whether men are aware of this evidence and are consciously making the decision to adjust their low-fat dairy intake when planning a pregnancy with their partner. More research is needed to explore this association and to better understand the validity of this finding. Dietary guidelines and associated messaging may influence how women prioritize dietary changes when pregnancy planning. Future guidelines related to preconception and pregnancy may need to consider how to frame and promote overall dietary intake for women and men.

Evidence from large cohort studies suggests that dietary patterns that are high in fruit, vegetables, fish, and plant-based protein and are low in red and processed meat up to three years before pregnancy are associated with reduced risk of adverse pregnancy outcomes[9,136-138]. Thus, pregnancy planning occurring at least three years prior to conception may be important in optimizing pregnancy health and therefore child health outcomes. Understanding how far in

advance individuals should make dietary changes with the intention of optimizing their health for future conception is critical to provide support during this phase of the life course. This research provides some context about the potential timing of dietary-related pregnancy plans among men and women. Ultimately, these findings suggest that dietary changes that women and men make when planning a pregnancy occur amongst those who have current intentions to conceive compared to those who are planning on having a child within the next one to five years. Given that half of pregnancies in Canada are unplanned[12] all adults of childbearing potential may be considered as being within the "preconception" period regardless of their intention to conceive. Therefore, public health initiatives, population level interventions, and diverse intervention strategies targeting all adults are required to promote optimal preconception diet.

Thesis Strengths

To my knowledge, this is the largest study to date that describes whole dietary intake in the preconception period and that includes men. These results lay the groundwork for understanding preconception dietary intake and could be a starting point for identifying supports for people to improve or optimize their diet during this phase of the life course. While more research is needed to confirm these findings, this study provides an important early step in this work.

Another strength of this study is that dietary data and pregnancy intention was collected prospectively. Many studies exploring these factors to date have collected data retrospectively, often when the woman is already pregnant[18,29]. Retrospective dietary recall may be influenced by reporting and memory bias, and therefore may be prone to measurement error. Studies with this study design also do not include women who did not end up becoming pregnant. There could be

important lessons to learn in the future by ensuring that women who eventually become pregnant and those who do not become pregnant are included.

This study also provides a new, short, method that can be used to assess intake of food and beverage groups that align with CFG and that can also be used to examine the quality of the whole diet. Habitual dietary intake, in contrast to intake of specific nutrients or single dietary components of diet is important because dietary patterns appear to be closely linked to health outcomes in parents and their offspring. This approach allows for a holistic exploration of diet and will shed light into the many areas in which individuals need support in optimizing their diet prior to conception. This information will help inform future research exploring preconception parental intake.

Finally, the dietary quality scoring system that was developed for the D-SAC is amongst the first to consider the 2019 CFG. While the nutritional value of some foods and beverages may be controversial, the proposed quality scoring system and its alignment with the 2019 CFG, helps keep nutrition messaging for the public and within research consistent.

Thesis Limitations

While this research provides valuable insights into preconception dietary intake, it is missing important details regarding individual supplement and caffeine intake prior to conception. Given that nutrition-related preconception guidelines largely focus on alcohol, caffeine, and dietary supplements, is it likely that women are prioritizing and changing these dietary behaviours above others.

Overall, participants in this study had high educational attainment and socio-economic status. Because these characteristics have been associated with an overall better dietary quality[117,142], our results may not be generalizable to more diverse population groups.

Another limitation of this work is the lack of available data on nulliparous individuals; most study participants already had at least one child, and therefore, we cannot accurately or confidently describe the preconception dietary intake of individuals who would be first-time parents which may in fact differ.

It is also important to note that within study 1 (Chapter 2) data for individuals who completed one to four recalls was not included for analysis, and only individuals who completed all five recalls were included. This was done to manage consistency of data used for validation purposes. By only using individuals who had complete datasets, analysis was made more straightforward, clean, and consistent, and gave us more confidence in comparing the data derived from the recalls to the D-SAC's.

Finally, the order in which the two studies described within this thesis were conducted was a limitation of the study design. Study 1, which assessed the comparability and reproducibility of the D-SAC was conducted after study 2 in which the D-SAC was used to assess preconception dietary intake within a sample of Canadian women and men. Slightly different versions of the D-SAC were used in studies 1 and 2. This ordering was the result of logistical aspects of the formative HeLTI-Canada study and other forces, such as the COVID-19 pandemic. Ideally, we would have used the same version for both studies, and study 2 would have been conducted with

the updated version of the D-SAC. However, because changes made to the D-SAC between the two studies were minimal, we are confident that the results of studies 1 and 2 would be largely consistent.

Other Considerations

It is important to consider that a large portion of this thesis project was conducted during the global COVID-19 pandemic. Specifically, study 1 was conducted during peak pandemic conditions and restrictions. These circumstances influenced the progress of this study in various ways. For example, recruitment was done solely online due to COVID-19 restrictions; there was no face-to-face interaction with potential participants and enrolled participants for the duration of the study. While online recruitment allowed for a broad reach to individuals across Canada, it also made enrollment more accessible to a larger group of people, resulting in large numbers of individuals enrolling in the study. As highlighted previously, study 1 had an overall low completion rate of 28% from all who agreed to participate, and 46% for those who completed at least one 24-hour recall. The pandemic may have also played a roll in how successful participants were in participating in research and completing the study requirements. Individuals and different geographic locations were affected differently and at different times by the pandemic. As such, we cannot be sure what barriers to participation and study completion were incurred by participants, particularly those who did not complete all aspects of the study. Hughes et al (2017) noted that about 20% of the adolescents in their study experienced significant problems with internet connections and computer issues using the ASA-24[145]. If participants in our study also experienced similar situations, it may have contributed to reduced completion rates, over and above those experienced due to the pandemic per se.

In addition, because of the COVID-19 restrictions, I was not able to meet face-to-face or as regularly with my committee and other researchers as I would have under normal conditions. Having less interaction and collaboration with others during the planning stages of the project lead to inconsistencies in data collection and analysis, in spite of our regular meetings using virtual meeting programs (such as zoom). For example, despite the fact that questionnaires were shared and reviewed by multiple individuals no one identified that caffeine containing beverages were missing from the questionnaire. This was an important oversight and is a limitation of the study. It would be important to include this in future studies. Finally, the living and working circumstances that all of us experienced, including me and my supervisors, adversely affected us in subtle ways that are difficult to describe, but must be considered. For example, "pandemic fatigue" likely affected members of our group's mental health and ability to focus for extended period of time. While the ways in which the COVID-19 pandemic may have affected this and all research studies is not yet clear, it is still vital that the circumstances are known to have happened and considered.

Thesis Implications

Optimal preconception dietary intake of both women and men is an integral part of a healthy pregnancy and the future health trajectory for the child. Understanding individual food choices influenced by pregnancy intention may help inform future research supporting dietary intake optimization in the preconception period. These findings may also contribute to a body of literature to inform future preconception dietary guidelines. While successfully identifying individuals, who may wish to conceive now or in the future allows for more timely and

appropriate support implementation, it is as equally important to optimize intake of all individuals who have childbearing potential as unexpected pregnancies are common.

Making sustainable dietary changes is a complex task. Interventions and support must be implemented with consideration to an individual's context and begin early enough to allow time for sustainable behaviour change. Recognizing preconception as an important part of life course health, that goes beyond two to three months prior to pregnancy is the next big step in the future of DOHaD research and clinical care. Optimizing the preconception diet of adults who have childbearing potential will enhance the health of Canadians, now and across generations.

Future Research

Preconception nutrition care is continuing to evolve. With more research continuing to focus on this phase of the life course, we will be better equipped and informed to find ways to best support women and men in optimizing dietary intake prior to conception. Preconception research focused on assessing whole diet is limited; therefore, more work is needed to fill these knowledge gaps. Assessing the relationship between preconception intake and various maternal and child health outcomes will have a key role in future research studies, such as the HeLTI-Canada study. This work will strengthen our understanding of the short and long-term influence of dietary intake, quality, and patterns on individual health. Future research should aim to explore both women and men's motivations for making dietary changes prior to conception. Finally, a better understanding of the various facilitators and barriers individuals face when planning a pregnancy would provide much needed context and help in shaping future interventions that meet the needs of Canada's diverse population. An important question that

researchers and clinicians need to ask is, “how do we make preconception dietary intake a priority for all Canadians?”

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Appendix

A. PREP'D Study Information & Eligibility Screening Questionnaire (Chapter 2)

Thank you for your interest in The Preconception Dietary (PREP'D) Study! This research is possible because of the generosity of volunteers like you! What is this research study about? Researchers at the University of Alberta are interested in learning more about what foods and beverages women and men between the ages of 18 and 45 are eating and drinking. Particularly we would like to compare how two different dietary tools assess food and beverage intake. Why are we interested in this? Women and men between the ages of 18-45 are of child-bearing age. This means that they may have children now or in the future. What women AND men eat before pregnancy is an important part of not only their overall health and well-being, but also the health and well-being of their future children. By comparing two different dietary tools we can better understand how each tool measures food and beverage intake. What would I have to do if I chose to take part in this study? Fill out one online questionnaire telling us about yourself, two online food frequency questionnaires (time to complete: ~10-15 minutes each), and five online 24-hour dietary recalls (time to complete: 15 to 30 minutes each). What benefit would I get from taking part? If you complete all study questionnaires, you will recieve a $25 grocery store gift card. We hope this study will provide you with an opportunity to reflect on what you are currently eating and drinking and help you identify whether you want to make dietary changes!

If you are interested in being a part of our study please answer the questions below so that we can make sure you are eligible to participate:

Do you live in Canada?
- Yes
- No

Are you between the ages of 18-45?
- Yes
- No

Do you understand written and spoken English?
- Yes
- No

Do you feel comfortable writing in and speaking in English?
- Yes
- No

Do you have reliable access to the internet?
- Yes
- No

What gender identity do you most identify with?
- Female
- Male
- Other
- Prefer not to say

Are you currently pregnant?

- Yes
- No

If you have any questions please contact our research team directly at prepdstudy@ualberta.ca

B. PREP'D Study Information Letter and Implied Consent Form (Chapter 2)

Title of the study: Preconception Dietary (PREP'D) Study

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Why am I being asked to take part in this research study? You are being asked to participate in The PREP'D Study because you are an adult of childbearing age (between the ages of 18 to 45) living in Canada. As part of this study, the research team will collect information about what adults between the ages of 18 to 45 eat and drink on a regular basis. Study participants will be asked to fill out food and drink questionnaires online to collect this information. The questionnaires being used are the "PrimeScreen Food Frequency Questionnaire" and the "ASA-24 Hour Recall". You will also be asked to fill out a questionnaire telling us about yourself.

What is the reason for doing this study? Women and men between the ages of 18-45 are of child-bearing age. This means that they may have children now or in the future. What women AND men eat before pregnancy is an important part of not only their overall health and well-being, but also the health and well-being of their future children. By comparing two different dietary tools we can better understand how each tool measures food and beverage intake. We want to 1) better understand what foods and beverages adults (ages 18-45) are consuming and 2) to explore how the two different questionnaires describe someone's food and beverage consumption compared to one another.

What will you be asked to do? If you wish to participate in this study, you will be asked to complete a online questionnaires: one telling us a little bit about yourself, two PrimeScreen Food Frequency Questionnaires, and five 24 hour food recalls. You will be asked to complete one PrimeScreen questionnaire at the beginning of the study, the five
24 hour recalls throughout the middle of the study, and the other PrimeScreeen questionnaire at the very end. The PrimeScreen questionnaire includes 24 questions and should take you approximately 10 – 15 minutes to complete. You do not have to answer any questions that you do not want to answer. For the 24 hour food recalls, you will be asked to report everything you ate and drank on five separate days. These days should not be consecutive and should not be completed in one week; we ask that you complete 1-2 food recalls per week for 4 weeks, until 5 food recalls have been completed. We ask that you record your intake for 2 weekend days and 3 different week days. Once you complete the questionnaires online and submit them, your information will be put directly into the database.

What are the benefits to me? Once you complete all study questionnaires, you will receive a $25 grocery store gift card. We hope participating in this study will provide you with an opportunity to reflect on what you are currently eating and drinking, and help you identify whether you want to make changes to improve your eating habits.

What are the risks to me? As far as we know, there are no known risks associated with participating in this study.

How will my information be kept private? We will do everything we can to make sure that the data we collect from you is kept private. Only the researchers in this study and the University of Alberta Research Ethics Committee, if needed, will have access to the information that you provide. No data relating to this study that includes your name will be released outside of the researchers' office or published by the researchers. Any personal information you provide us with, and your responses to the PrimeScreen food questionnaires will be collected via and stored on a secure data collection system at the University of Alberta. Any personal information that is exported from this system will be stored on a password-protected document, on a password-protected computer. The 24-hour recall data will be collected via another secure data collection system and will also be stored on a password-protected document on a password-protected computer. After the study is done, we will keep and securely your data that was collected for this study and will keep it for up to 1 year after the end of the study.

In order to minimize the risk of security breaches and to help ensure your confidentiality we recommend that you use standard safety measures such as signing out of your email account, closing your browser and locking your screen or device when you are no longer using them / when you have completed any of the questionnaires.

Your responses to the survey questions will be looked at in a pooled (aggregate) format; no one will know what answers you gave.

Do I have to take part in this study? Being in this study is your choice. You can refuse to answer questions that you do not want to answer. If you choose to withdraw from the study you

can do so by emailing the study coordinator at prepdstudy@ualberta.ca. Once you have withdrawn from the study, none of the data you have submitted will be used. You will have up to two weeks after completing the study to withdraw your data.

Will you tell me about the results? Yes! We will send a summary document or report to all study participants after the study is complete.

Contact Information: If you have any questions or require more information about the study itself, you may contact the researchers at the numbers or email addresses mentioned above.

If you have any questions regarding your rights as a research participant, you may contact the Health Research Ethics Board at 780-492-2615. This office has no affiliation with the study investigators.

Please keep a copy of this form for your records. Make sure you have reviewed this form thoroughly.

By clicking "submit" below means you consent to participate in the study. If you do not wish to proceed, simply close this window.

C. PREP'D Sociodemographic Questionnaire (Chapter 2)

First, we would like to learn a little bit more about you. Please answer the questions below: Congratulations! You are officially enrolled in The PREP'D Study! If you have any questions please contact our study team at prepdstudy@ualberta.ca

How did you hear about this study?

- Facebook
- Instagram
- Twitter Email
- A friend
- Other
    - Please specify: _____

Your Name:

- My name is _____
- Prefer not to say (First, Last) _____

What e-mail address can we reach you at? _____

To which gender identity do you most identify?

- Female
- Male
- Other
- Prefer not to say
    - Please specify: _____

How old are you?

- I am _____ years old
- Prefer not to say I am ____ years old

How would you describe your ethnic origin?

- Eastern European (Polish, Russian, Croatian, etc.)
- Western European (English, French, Portuguese, etc.)
- Middle Eastern East Asian (Chinese)
- East Asian (Korean)
- East Asian (Japanese)
- South Asian (East Indian, Pakistani, Sri Lankan, etc.)
- Southeast Asian (Vietnamese, Malaysian, Filipino, etc.)
- West Asian (Iranian, Afghan, Palestinian, etc.)
- East African (Ethiopian, Kenyan, Somali, etc.)
- Middle African (Cameroonian, Chadian, Congolese, etc.)
- Northern African (Moroccan, Algerian, Egyptian, etc.)
- Southern African (Botswana, South African, etc.)

- Western African (Ghanaian, Nigerianm Guinean, etc.)
- Latin American (Argentinean, Costa Rican, Mexican, etc.)
- Caribbean Region (Jamaican, Trinidadian/ Tobagonian, etc.)
- Indian Caribbean (Guyana with origins in India)
- North American Aboriginal (Inuit, Metis, First Nations, etc.)
- Oceania (Samoan, Fijan, etc.)
- Australian or New Zealander
- Other
    - Please specify: _____
- Unknown
- Prefer not to say

What province or territory do you live in?

- Alberta
- British Columbia
- Manitoba
- New Brunswick
- Newfoundland and Labrador
- Northwest Territories
- Nova Scotia
- Nunavut
- Ontario
- Prince Edward Island
- Quebec
- Saskatchewan
- Yukon

Were you born in Canada?

- Yes
- No
- Prefer not to say

What country were you born in?

How long have you lived in Canada?

- Less than 1 year
- 1 to 5 years
- 5 to 10 years
- Longer than 10 years
- Prefer not to say

What is your current marital status?

- Married/ Common-Law
- Single

- Divorced/ Separated
- Widowed
- Other
    - Please specify: _____
- Prefer not to say

What is the highest level of education you have completed?

- Elementary / Grade School
- High School College/ Trade School
- University (Undergraduate Degree)
- University (Graduate Degree)
- Prefer not to say

Approximately, what was your total combined family income before taxes last year?

- Less than $25,000
- $25,000 to $49,000
- $50,000 to $74,999
- $75,000 to $99,999
- More than $100,000
- Prefer not to say

How many children do you have?

- No children
- 1 child
- 2 children
- 3 or more children
- Prefer not to say

(for women) Are you currently thinking about or planning to have a child?

- I have no plans for a pregnancy at this time
- I am currently trying to get pregnant
- I am considering a pregnancy within the next 1 to 2 years
- I am considering a pregnancy within the next 3 to 5 years
- Prefer not to say

(for guys) Are you currently thinking about or planning to have a child?

- My partner and I have no plans for a pregnancy at this time
- My partner and I are currently trying to get pregnant
- My partner and I are considering a pregnancy within the next 1 to 2 years
- My partner and I are considering a pregnancy within the next 3 to 5 years
- Prefer not to say

The next few questions will be related to your health and well-being:

How would you rate your overall health?

- Very healthy
- Healthy
- Ok
- Unhealthy
- Very unhealthy
- Prefer not to say

How much do you weigh?

- I weight_____ lbs
- Prefer not to say

How tall are you?

- I am ___ foot ___inches tall
- Prefer not to say

On a typical day, how many cigarettes do you smoke?

- I do not smoke
- I do not smoke daily - only occasionally
- 1 to 3 cigarettes a day
- 4 to 6 cigarettes a day
- 7 to 10 cigarettes a day
- More than 10 cigarettes a day
- Prefer not to say

In the past 12 months, have you used cannabis (marijuana) for medical reasons?

- Yes
- No
- Prefer not to say

In the past 12 months, have you used cannabis (marijuana) for non-medical/ recreational reasons?

- Yes
- No
- Prefer not to say

(if yes) How often have you used cannabis (marijuana) for medical reasons?

- Daily
- Weekly
- Monthly
- Every couple of months
- Once or twice a year
- Prefer not to say

How often have you used cannabis (marijuana) for non-medical/ recreational reasons?

- Daily

- Weekly
- Monthly
- Every couple of months
- Once or twice a year
- Prefer not to say

Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like carrying or lifting heavy loads, digging or construction work for at least 10 minutes continuously?

- Yes
- No
- Prefer not to say

In a typical week, on how many days do you do vigorous- intensity activities as part of your work?

- 0 days
- 1 to 2 days
- 3 to 4 days
- More than 4
- Prefer not to say

In a typical week, on how many days do you do moderate- intensity activities as part of your work?

- 0 days
- 1 to 2 days
- 3 to 4 days
- More than 4
- Prefer not to say

Has a doctor or other health professional ever told you that you have any of the following conditions? Please mark all that apply.

- Type 1 Diabetes
- Type 2 Diabetes
- Hypertension
- Inflammatory bowel disease
- Renal disease Overweight/Obesity
- None of the above
- Prefer not to say

The next few questions will be related to your general food and beverage intake:

Which ingredients, foods or beverages do you avoid (or never eat or drink)?

- Peanuts
- Tree Nuts
- Eggs

- Milk
- Fish
- Shellfish
- Meat
- Wheat
- Soy
- Alcohol
- Other
    - Please specify: _____
- None of the above
- Prefer not to say

How would you classify your typical dietary intake?

- Semi-vegetarian (may include small amounts of fish, meat or poultry)
- Lacto-ovo vegetarian (includes eggs, milk/ milk products)
- Lacto vegetarian (includes milk/ milk products) Vegan Gluten free
- Other
    - Please specify: _____
- Prefer not to say

What supplements and/or vitamins are you currently taking, if any?

- I am not currently taking any supplements or vitamins
- Prenatal vitamin (E.g., Materna, One A Day, PregVit, etc.)
- Multivitamin (E.g. Centrum, Jamieson, etc.)
- Supplement containing only Calcium
- Supplement containing only Vitamin D
- Supplement containing only Folic Acid
- Supplement containing only Iron
- Other
- Prefer not to say

How often do you take a prenatal vitamin (E.g. Materna, One A Day, PregVit, etc.)?

- Less than 1 day per month
- 1-3 days per month
- 1-3 days per week
- 4-6 days per week
- Every day
- Prefer not to say

When did you start taking a prenatal vitamin (E.g. Materna, One A Day, PregVit, etc.)?

- Within the last month
- Within the last 6 months
- Within the last year
- Over a year ago

- Don't remember
- Prefer not to say

How often do you take a multivitamin (E.g., Centrum, Jamieson, etc.)?
- Less than 1 day per month
- 1-3 days per month
- 1-3 days per week
- 4-6 days per week
- Every day
- Prefer not to say

When did you start taking a multivitamin (E.g., Centrum, Jamieson, etc.)?
- Within the last month
- Within the last 6 months
- Within the last year
- Over a year ago
- Don't remember
- Prefer not to say

How often do you take a supplement that contains ONLY calcium?
- Less than 1 day per month
- 1-3 days per month
- 1-3 days per week
- 4-6 days per week
- Every day
- Prefer not to say

When did you start taking a supplement that contains ONLY calcium?
- Within the last month
- Within the last 6 months
- Within the last year
- Over a year ago
- Don't remember
- Prefer not to say

How often do you take a supplement that contains ONLY Vitamin D?
- Less than 1 day per month
- 1-3 days per month
- 1-3 days per week
- 4-6 days per week
- Every day
- Prefer not to say

When did you start taking a supplement that contains ONLY Vitamin D?

- Within the last month
- Within the last 6 months
- Within the last year
- Over a year ago
- Don't remember
- Prefer not to say

How often do you take a supplement that contains ONLY Folic Acid?

- Less than 1 day per month
- 1-3 days per month
- 1-3 days per week
- 4-6 days per week
- Every day
- Prefer not to say

When did you start taking a supplement that contains ONLY Folic Acid?

- Within the last month
- Within the last 6 months
- Within the last year
- Over a year ago
- Don't remember
- Prefer not to say

How often do you take a supplement that contains ONLY Iron?

- Less than 1 day per month
- 1-3 days per month
- 1-3 days per week
- 4-6 days per week
- Every day
- Prefer not to say

When did you start taking a supplement that contains ONLY Iron?

- Within the last month
- Within the last 6 months
- Within the last year
- Over a year ago
- Don't remember
- Prefer not to say

Please specify what other supplements you're taking, how often you are taking them, and when you stated taking them:

Which of the following statements best describes the food eaten in your household in the past 12 months?

- You and other household members always had enough of the kinds of foods you wanted to eat
- You and other household members had enough to eat, but not always the kinds of food you wanted
- Sometimes you and other household members did not have enough to eat
- Often you and other household members didn't have enough to eat
- Don't know/ refuse to answer
- Prefer not to say

In the past 12 months, have you and/ or other household members been worried that food would run out before you got money to buy more?

- Often true
- Sometimes true
- Never true
- Don't know/ refuse to answer
- Prefer not to say

The next two questions will be related to pregnancy health and knowledge:

What a woman eats during pregnancy affects her baby's risk of becoming obese as an adult?

- True
- False
- Don't Know
- Prefer not to say

What a pregnant woman eats during pregnancy affects her grandchildren's risk of becoming obese?

- True
- False
- Don't Know
- Prefer not to say

A healthy weight gain in pregnancy is:

- 10-20 pounds
- 20-30 pounds I
- t depends on your weight before pregnancy and your height
- Don't know
- Prefer not to say

Thank you! You're almost done this questionnaire.

The next few questions will help us communicate with you more easily throughout the duration of this study: After you finish one of the 24 hour recalls, a member of our study

team will review it. If we require any more information from you, we will request to have a short meeting with you via an online communication method.

Please check off which of the following communication methods you would prefer to use to meet with a member of the research team:

- Phone call
    - The phone number we can reach you at (with area code):
      _____
- Skype video meeting
- Zoom video meeting
- Google video meeting
- Google hangouts chat

What times are typically most convenient for you to chat during the work week? Choose all that apply

- 7:00 - 9:00
- 9:00 - 12:00
- 12:00 - 15:00
- 15:00 - 17:00
- After 17:00
- Custom preferred time
    - Please specify what specific time/ day is most convenient for you to chat:
- Not sure
-

May we contact you in the future when we are recruiting participants for other research studies?

- Yes
- No

D. PREP'D Study Welcome Email

Hello!

Thank you for participating in The PREP'D Study, and for completing the first few online questionnaires. The next step will be to complete five 24-hour food recalls. These will be completed on the ASA24 online platform. This is an easy to use, secure dietary assessment tool. Before you access your ASA24 account to complete your first recall, you can practice using the ASA24 system on the demo website here: https://asa24.nci.nih.gov/demo/ - click on the "Launch Demo ASA24-Canada-2018" option.

IMPORTANT: Please complete 1-2 food recalls per week. Do not complete all food recalls in one week. We ask that you record your intake for 2 weekend days and 3 different weekdays.

If you have any questions about completing your food recalls using the ASA24 system please email us so that we can set up a one-on-one virtual meeting with you.

Once you feel comfortable using the ASA24 system, you can access the website here: https://asa24.nci.nih.gov/

Log in to your account using the sign in data below:
User login: ENTER
Password: ENTER

You will be using the same user login and password for all five 24 hour food recalls; note that you can only login to the ASA-24 website once every 24 hours. Once you log on you will be taken through a brief tutorial. After completing your first 24 hour food recall, a member of our study team will review it to make sure that you have reported your intake in enough detail. Should we need more information, we will email you and ask you to connect briefly (~15 minutes) to discuss these details.

When filling out the food recalls please member to:

- Report what you ate over the last 24 hours for each recall
- Include as many details about the foods and beverages you consume as you can remember. Give estimates if you cannot remember exactly.
- Complete all of the recalls over the next 2 weeks. They do not have to be done in consecutive order.
- Include 2 week days and 1 weekend day for the recalls

Should you have any questions, please contact our study team at prepdstudy@ualberta.ca

Thank you,

PREP'D Study Team

E. Differences between the PrimeScreen and the D-SAC's

Original PrimeScreen	HeLTI Formative Study Diet Questionnaire Ref: DM Thesis	D-SAC for Validation Study Ref: DM Thesis	Notes
How often do you eat….	How often do you eat…..	How often do you eat….	
Dark green leafy vegetables (spinach, romaine lettuce, mesclun mix, kale, turnip greens, bok choy, swiss chard): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Dark green leafy vegetables (spinach, romaine lettuce, mesclun mix, kale, turnip greens, bok choy, swiss chard): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Dark green leafy vegetables (spinach, romaine lettuce, mesclun mix, kale, turnip greens, bok choy, swiss chard): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Did not differ.
Broccoli, broccoli rabe, cauliflower, cabbage, brussels sprouts: • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Broccoli, broccoli rabe, cauliflower, cabbage, brussels sprouts: • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Broccoli, broccoli rabe, cauliflower, cabbage, brussels sprouts • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Did not differ.
Carrots: • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Carrots: • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Orange Vegetables (carrots, orange or yellow pepper, sweet potato, squash): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Section expanded to include other orange vegetables.
Other vegetables (e.g. peas, corn, green beans, tomatoes, squash): • Less than once per week • Once per week • 2-4 times per week	Other vegetables (e.g. peas, corn, green beans, tomatoes, squash): • Less than once per week • Once per week • 2-4 times per week	Other vegetables (e.g. peas, corn, green beans, tomatoes – fresh, frozen or canned): • Less than once per week • Once per week • 2-4 times per week	Green beans and "fresh, frozen, or canned" was added.

• Nearly daily or daily • Twice or more per day	• Nearly daily or daily • Twice or more per day	• Nearly daily or daily • Twice or more per day	
		100% pure fruit juice (e.g. orange, grapefruit, apple, mango, etc) (negative) • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	100% pure fruit juice was added.
Dried beans, split peas, lentils: • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Dried beans, peas, lentils or tofu: • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Plant proteins (e.g. dried beans, peas, lentils, tempeh, tofu): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Food group renamed "Plant proteins" and examples were listed. Tempeh, tofu, and peas were added.
Citrus fruits (e.g. oranges, grapefruits): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Citrus fruits (e.g. oranges, grapefruits): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Citrus fruits (e.g. oranges, grapefruits): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Did not differ,
Other fruits (e.g. fresh apples, pears, bananas, berries, grapes, melons): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Other fruits (e.g. fresh apples, pears, bananas, berries, grapes, melons): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Fruits (e.g. apples, pears, bananas, berries, grapes, melons – fresh, frozen or canned): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Group renamed "Fruits". "Fresh, frozen, or canned" was added.
Whole milk dairy foods (whole milk, hard cheese, butter, ice cream):	Whole milk dairy foods (whole milk, hard cheese, butter, ice cream):	Whole milk dairy foods (whole milk, hard cheese, butter, yogurt):	Ice cream was removed.

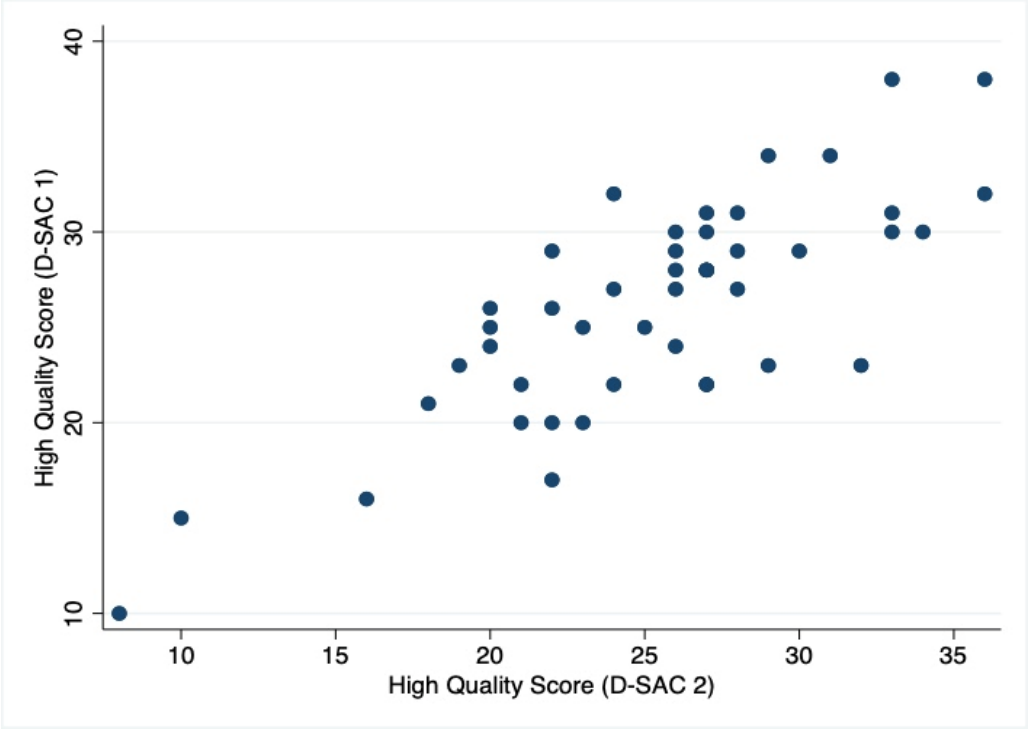
• Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice daily or more	• Never • Once per week or less • 2-4 times per week • Twice per day • 4 to 5 times per day	• Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	
Low-fat milk products (e.g., low-fat/skim milk, yogurt, cottage cheese): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Low-fat milk products (e.g., low -fat/skim milk, yogurt, cottage cheese): • Less than once per week • Once per week • 2-4 times per week • Twice per day • 4 to 5 times per day	Low-fat milk products (e.g., low-fat/skim milk, yogurt, cottage cheese): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Did not differ.
Whole eggs: • Less than once per week • 1-2 per week • 3-4 times per week • Daily • Twice or more per day	Whole eggs: • Less than once per week • 1-2 per week • 3-4 times per week • Daily • Twice or more per day	Eggs: • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Group renamed "Eggs".
Beef, pork or lamb: • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Beef, pork or lamb: • Less than once per week • 1-2 per week • 3-4 times per week • Daily • Twice or more per day	Beef, pork or lamb: • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Did not differ.
Processed meats (sausages, salami, bologna, hot dogs, bacon): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Processed meats (sausages, salami, bologna, hot dogs, bacon): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Processed meats (sausages, salami, bologna, hot dogs, bacon): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Did not differ.
Turkey or chicken: • Less than once per week	Turkey or chicken: • Less than once per week	Turkey or chicken: • Less than once per week	Did not differ.

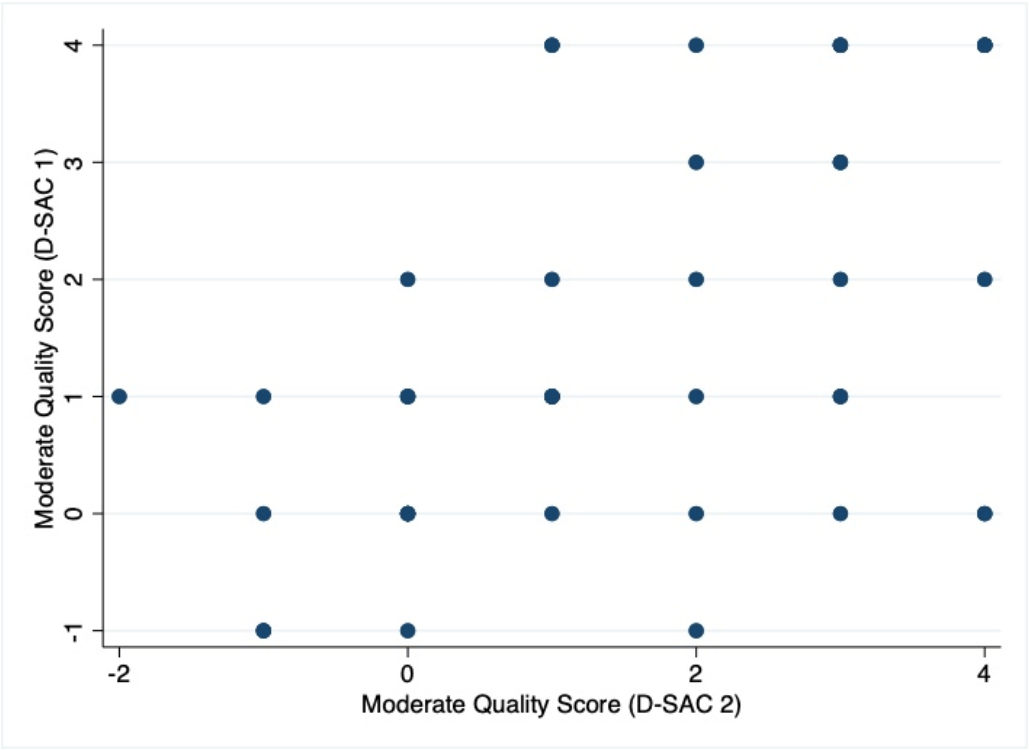
• Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	• Once per week • 2-4 times per week • Twice or more per day	• Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	
Fish/Seafood (not fried, but broiled, baked, poached or canned): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Fish/Seafood (not fried, but broiled, baked, poached or canned): • Less than once per month • Once per month • 2-3 times per month • Nearly Weekly • Twice or more per week	Fish/Seafood (not fried, but broiled, baked, poached or canned): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Did not differ.
	Plant-based protein foods such as nuts and seeds • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Nuts and seeds (e.g. whole/chopped or spreads made form nuts and/or seeds): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Group renamed "Nuts and seeds" and examples listed.
		Plant-based unsweetened beverages or foods (e.g. soy, almond, rice, oat, etc). • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	"Plant-based unsweetened beverages or foods" was added.
Stick margarine: • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Stick margarine: • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day		Group removed.
Whole grain breads and cereals (whole wheat, oatmeal, brown rice, barley):	Whole grain breads and cereals (whole wheat, oatmeal, brown rice, barley):	Whole grain breads and cereals (whole wheat, oatmeal, brown rice, barley):	Did not differ.

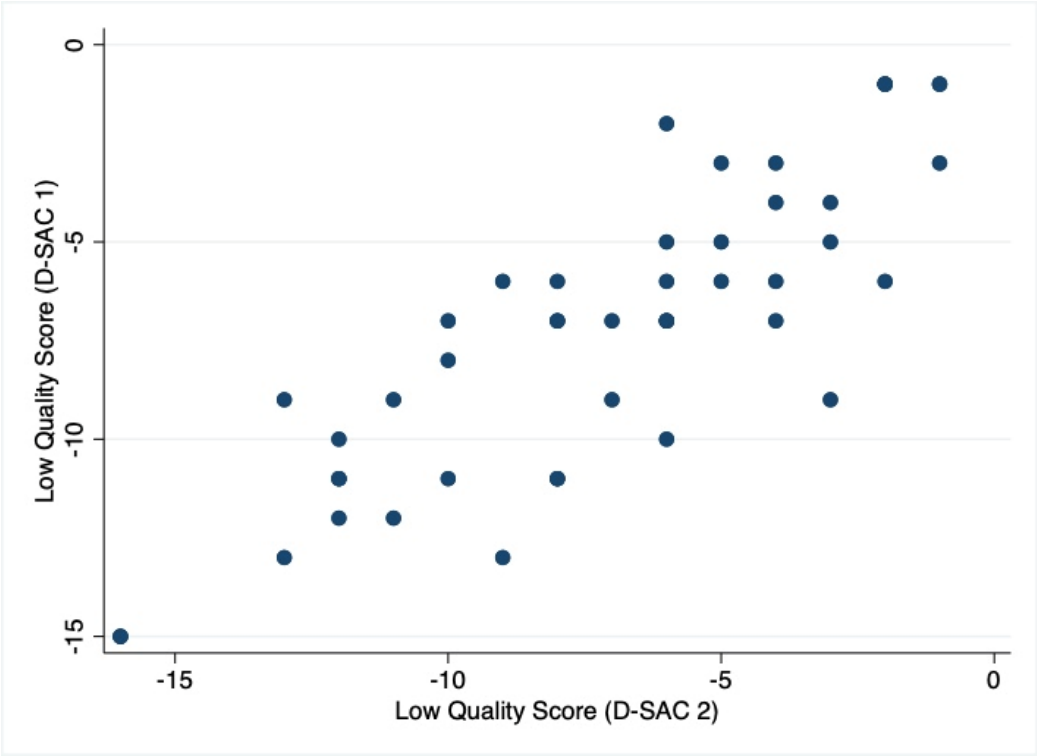
• Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	• Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	• Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	
Baked products (muffins, doughnuts, cookies, cake, pastries): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Baked products (muffins, doughnuts, cookies, cake, pastries): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Baked products (muffins, doughnuts, cookies, cake, pastries): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Did not differ.
Refined grains (white bread, white rice): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Refined grains (white bread, white rice): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day		Group removed
		Highly processed foods (e.g. sweet or salty snack foods, desserts, chocolate bars, candy, ice cream, etc) • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	"Highly process foods" were added.
Deep fried foods: • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Deep fried foods: • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Deep fried foods: • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Did not differ.

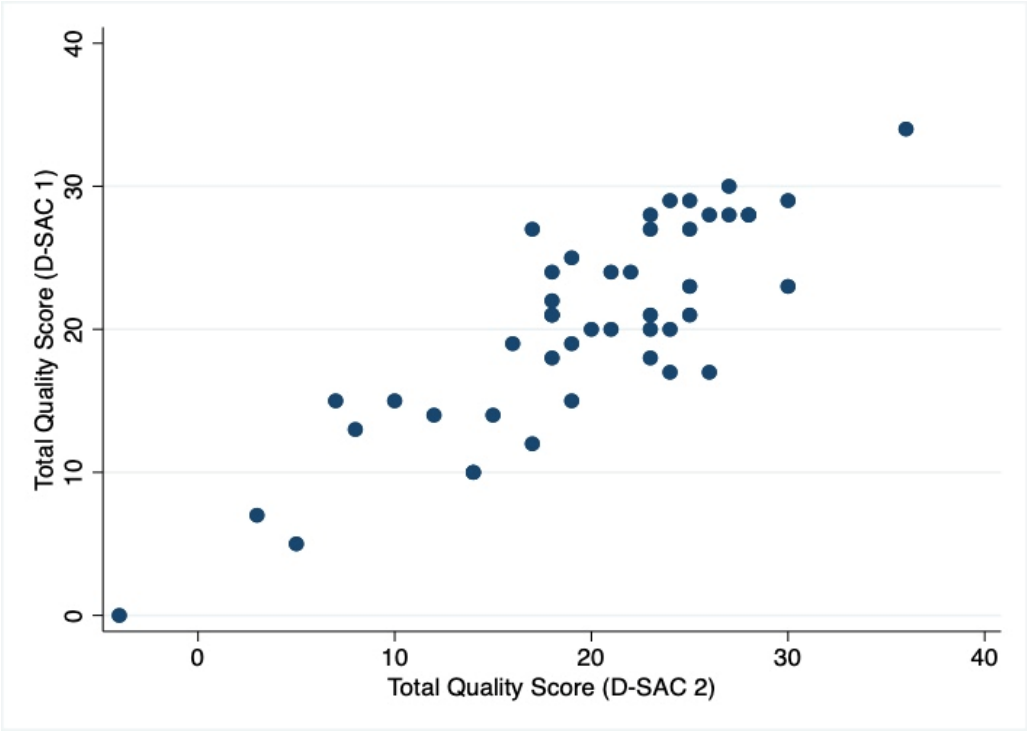
How often do you add salt to food at the table? • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	How often do you add salt to food at the table? • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	How often do you add salt to food at the table? • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Did not differ.
Calorie-containing beverages (e.g. Regular soda, Snapple, Nestea, Gatorade)? • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Calorie-containing beverages (e.g. Regular soda, fruit drinks, Nestea, Gatorade)? • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Sugar-sweetened beverages (regular soda, fruit drinks, specialty coffees, energy drinks, iced tea): • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Group renamed "Sugar-sweetned beverages."
	How often do you drink plain water? • Once per week or less often • 2-4 times per week • Nearly daily or daily • Twice per day • More than 3 times/day	How often do you drink plain water? • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	Group added.
	How often do you drink a beverage containing any alcohol? • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	How often do you drink a beverage containing any alcohol (wine, beer or spirits)? • Less than once per week • Once per week • 2-4 times per week • Nearly daily or daily • Twice or more per day	"Beverages containing alcohol" were added and examples listed.

F. Scatter plots comparing low, moderate, high, and total quality scores between the first and second administration of the D-SAC questionnaire in study 1.






Low Quality Score (D-SAC 1)
0
-5
-10
-15
-15
-10
-5
0
Low Quality Score (D-SAC 2)


Total Quality Score (D-SAC 1)
40
30
20
10
0
0
10
20
30
40
Total Quality Score (D-SAC 2)

G. Electronic recruitment electronic flyers sent to individuals from research study databases (Chapter 3)

Do you plan on having a child in the future?

Are you expecting a child?

Have you recently had a child?

If you answered "YES" to ANY of these,
you may be eligible for this new, innovative study!

Researchers at St. Michael's Hospital are conducting a new study to examine your beliefs and attitudes related to pregnancy and family planning.

We are looking for:

* Both females and males
* Canadian residents
* Individuals or couples who (1) have had a child recently, (2) are planning a future pregnancy, or (3) are currently expecting a child

If you would like to participate, all that you have to do is complete an easy, online 35-minute survey.

As a token of our appreciation you will receive a **$5 Tim Hortons® gift card** upon completion.

St. Michael's
Inspired Care.
Inspiring Science.

For additional information, please contact:

Email: HeLTICanada@smh.ca
or
Toll free number: 1-877-344-0464

Mothering Transitions RESEARCH

H. Participant Recruitment Emails from research study database (Chapter 3)

Recruitment Email

Thank you for your interest in participating in this research study. This is Alvaro Ferreira from Dr. Cindy-Lee Denis' research team at St. Michael's Hospital and we are currently conducting a new research study that involves one quick online questionnaire exploring the preconception care beliefs and attitudes regarding pregnancy and family planning among men and women.

Your involvement and overall input will work to inform family care practices and future research studies that are focused on targeting expecting parents.

The Exploring the Preconception Care Attitudes and Beliefs of Men and Women in Canada: A Formative Research Study is being conducted by Dr. Cindy-Lee Dennis and her research team at the St. Michael's Hospital. We are looking to enroll participants who are planning to have a child within the next three years and/or parents who currently have a child under the age of 5.

Study Purpose.
The study is aimed at examining the preconception care attitudes, beliefs and intervention preferences of current and future parents. Your input on preconception care will inform future health research studies that are focused on targeting parents to- be through the preconception period; which will provide valuable information in assisting healthcare professionals in providing better, informed care to future families.

Your Participation
If you agree to participate, you will be asked to sign a consent form and complete a short questionnaire that will explore your preconception care attitudes, beliefs and study participation preferences. You can either complete these questions online or over the telephone with a research assistant. If you choose to complete the questionnaire online, an online link will be provided for you to access the secure and encrypted data forms. If you choose to complete questions by telephone with a research assistant, you will be called at a scheduled date and time, depending on your availability.

When asked about personal attitudes and beliefs during your participation in this study, this may, in rare instances, cause some emotional distress. As such, it is suggested that you answer interview questions alone in a private space, whether the questions are completed online or by telephone with a research assistant. This will also enhance privacy and ensure confidentiality, and that you answer the questions on your own as best as you can without any help or input from your partner or anyone else.

The questionnaire should take up to 30 minutes of your time and as a token of our appreciation, a $5 Tim Hortons e-gift card will be emailed to you upon questionnaire completion.

If you are interested in participating in this study using the online secure link please directly REPLY to this email. We will send you a follow-up email with the secure link to the consent form and survey.

If you are interested in participating in this study over the phone, please directly REPLY to this email. With your preferred phone number for contact, how you heard about the study, and a good time for one of our research assistants to call you and your partner to enroll/further assess your eligibility. If you prefer not to provide your contact information via email, please contact our research assistants toll free at 1-877-344-0464.

Should you have any questions or concerns, you may always e-mail us at HeLTICanada@smh.ca and someone from our team will respond within 3 business days.

We wish you and your family the very best and I hope to hear from you soon!
U. Alberta REB ID Pro00087716

Email with Survey Link

Hello Participant NAME,

Thank you for your response interest in the Exploring the Preconception Care Attitudes and Beliefs of Men and Women in Canada: A Formative study.

We will now provide you with a link to the consent form and short questionnaire. Once the consent form has been reviewed, signed and submitted, the questionnaire will appear for your completion.

LINK HERE

Once you have completed and submitted the questionnaire, you will receive a $5 e-gift card emailed to the provided email address. Should you have any questions or concerns, you may always e-mail us at HeLTICanada@smh.ca or call toll free at 1-877-344-0464 and a member of our research team will respond within 2-3 business
days.

If you do not want to be contacted any further, please reply to this email with ‘No Thanks’,

Thank you for your interest in this study. We wish you and your family the very best!
Warm regards,

Alvaro Ferreira
Project Manager

I. Study Information Letter & Consent Form (Chapter 3)

Exploring the Preconception Care Attitudes and Beliefs of Men and Women in Canada:

Participant Consent Form Study Title
Exploring the Preconception Care Attitudes and Beliefs of Men and Women in Canada: A Formative Research Study

Principal Investigator
Dr. Cindy-Lee Dennis, Li Ka Shing Knowledge Institute, St. Michael's Hospital

Funding Agency
Canadian Institutes of Health Research (CIHR)

You are being asked to participate in a research study. Please read this explanation about the study and its risks and benefits carefully before deciding if you would like to participate. Please take as much time as you need to make your decision. You should ask study personnel to explain anything you do not understand. Participation in this study is voluntary, and you can choose to stop participating at any time, for any reason. Your decision not to participate or to withdraw from the study will not have any impact on the quality of care and services to which you are otherwise entitled.

Why am I being asked to take part in this study?
You are being asked to be in this study because you have had a child within the last 5 years or are planning to have a child. We aim to explore preconception health attitudes, beliefs, and intervention preferences of parents and couples who are planning on having children in the next 3 years.

What is the reason for doing this study?
We want to better understand preconception health attitudes, beliefs and intervention preferences of current and future parents. Your input around preconception care will help inform future research studies that are focused on preconception care for parents who pare planning on having a child, which will in turn provide valuable information to assist health professionals in providing better care to families in the future. Our goal is to enroll 500 participants to participate in this research study.

What will I be asked to do?
If you agree to participate, you will be asked to fill out a questionnaire that will explore your preconception care attitudes, beliefs and study participation preferences. You will be given the option of answering these questions online (e.g. on a computer at home) or over the telephone with a research assistant. If you choose to complete questionnaires online, you will be e-mailed a unique temporary login username and password to access the secure and encrypted data forms. If you choose to complete the questionnaires by telephone with a research assistant, you will be confidentially called at scheduled interview dates and times based on your availability. It is anticipated that the questionnaire could take up to 30 minutes to complete. As a token of

appreciation, a $5 Tim Hortons e-gift card will be emailed to you after you have completed the study questionnaire.

What are the risks and discomforts?
When asked about personal attitudes and beliefs during your participation in this study, this may, in rare instances, cause some emotional distress. As such, you will be required to answer interview questions alone in a private space, whether the questions are completed online or by telephone with a research assistant. This will also enhance privacy and ensure confidentiality, and that you answer the questions on your own as best as you can without any help or input from your partner or anyone else.

What are the benefits to me?
While you may not directly benefit from participating in this study, you will be providing valuable information which may assist future families to receive better care. This study will help inform future research studies focused on the preconception phase, with the long-term goal of positively influencing preconception care in Canada.
Do I have to take part in the study?
Your participation in this study is voluntary. You may choose not to respond to any of the questions that you do not feel comfortable in answering or questions that are not applicable to you. You may choose not to participate, or you may withdraw for any reason at anytime leading up to submission of your survey and up to one week after submission of the survey. If you have any questions or concerns while answering these questions, please talk to our study staff.

Will I be paid to be in the research?
Participation in this study is completely voluntary. As a token of appreciation, a $5 Tim Hortons e-gift card will be e-mailed to you after you have completed the study questionnaire.

Will my information be kept private?
If you agree to participate in this study, the research team will have access to some of your personal health information and collect only the information they need for the study. Personal health information is any information that could be used to identify you, including your name, email address, date of birth, and telephone number.
The study personnel will make every effort to keep your personal health information private and confidential in accordance with all applicable privacy legislation, including the Personal Health Information Protection Act (PHIPA) of Ontario.
Any personal identifying information (such as your name) will be “de-identified” by replacing your personal identifying information with a “unique code/number”. The principal investigator is in control of the study unique code key, which is needed to connect the study data to you. The link between the study number and your personal identity will be safeguarded by the principal investigator at St. Michael’s Hospital. No information identifying you will be allowed off site in any form. Your name will not appear on any of your paper or password-protected, encrypted online data forms. Your participation in this study will be kept completely confidential, and any data that is collected for the study will be destroyed after 5 years upon study completion. Only the study team or the people or groups listed below will have access to your records.

All information collected, including your personal health information, will be kept confidential and will not be shared with anyone outside the study unless required by law. You will not be named in any reports, publications, or presentations that may come from this study.

Please note that the online survey is hosted by RedCap, which stores de-identified study data on servers located at the University of Alberta.

If you decide to leave the study, the information about you that was collected before you left the study will still be used in the study analysis. However, no new information will be collected without your permission.

It is important to understand that despite the protections described in this section being in place, there continues to be the risk of an unintentional release of information. The chance that personal information or study data will be accidentally released or accessed without authorization is small.

A summary of the study findings will be made available to you at the end of the project if you request it.

What if I have questions?
If you have any questions about the research now or in future, please contact: Research/Study Coordinator: Alvaro Ferreira
Email: FerreiraAlv@smh.ca Phone: 416-864-6060 ext. 77057

If you have any questions regarding your rights as a research participant, you may contact Unity Health Toronto Research Ethics Board (REB), at 416-864-6060 ext. 2557 during regular business hours.Should you want to participate in this study, please fill out the consent form enclosed.

Study Title: Exploring the Preconception Care Attitudes and Beliefs of Men and Women in Canada: A Formative Research Study

Principal Investigator: Dr. Cindy-Lee Dennis

By signing this consent form, I acknowledge that:
● The research study has been explained to me, and my questions have been answered to my satisfaction.
● I have been informed of the alternatives to participation in this study.
● I know that I have the right not to participate and the right to withdraw without affecting the quality of medical care at Unity Health Toronto or elsewhere in any province in Canada for me and for other members of my family.
● The potential harms and benefits (if any) of participating in this research study have been explained to me.
● I have been told that I have not waived my legal rights nor released the investigator, sponsor, or involved institutions from their legal and professional responsibilities.
● I know that I may ask now, or in the future, any questions I have about the study.

● I have been told that records relating to me and my care will be kept confidential and that no personal information will be disclosed without my permission unless required by law.
● I have been given sufficient time to read the above information.
● I will be given a copy of the signed and dated consent form.

Signature of Participant:
Printed Name:
Date (DD MM YYYY):

For Staff Use Only:
Yes No
I believe that the person signing this form understands what is involved in the study and voluntarily agrees to participate.
Yes No
Research Staff Signature:
Date (DD MM YYYY):

J. Formative Preconception Study Survey

Thank you for agreeing to participate in our study. To begin, we would like to ask you some questions about yourself.

What is your sex?
Female
Male
Other:

What is your age? years old

What is your current marital status?
o Married / common-law
o Single
o Divorced / separated
o Widowed

What is the highest level of education you have youcompleted?
o Elementary / Grade School
o High School
o College / Trade School
o University (Undergraduate Degree)
o University (Graduate Degree)

Are you currently employed?
o Yes, working full-time
o Yes, working part-time

o Yes, but currently on maternity/ parental leave
o No, unemployed
o No, student
o Other (please explain):

What is your current occupation?
If Employed
o Management (e.g. legislators, managers in health/engineering/communication/sales/food services)
o Business, finance, and administration (e.g. auditors, accountants, investment professionals, human resources professionals)
o Natural and applied sciences (e.g. actuaries, statisticians, computer and information systems professionals, architects, engineers, inspectors and regulatory officers)
o Health (e.g. nurses, medical technologists, dieticians, chiropractors, dental assistants)
o Education, Law, and Social, community, and government services (e.g. paralegals, professors, police officers, psychologists, policy researchers)
o Art, Culture, Recreation, and Sport (e.g. librarians, photographers, coaches, designers, journalists)
o Sales and service (e.g. realtors, cashiers, salespersons, cleaners, cooks, insurance brokers)
o Trades, transport and equipment operators (e.g. plumbers, contractors, construction labourers, repairers, longshore workers)
o Natural resources, agriculture and related production (e.g. landscaping labourers, forestry operations supervisor)
o Manufacturing and utilities (e.g. embroidery supervisor, aircraft assembly inspectors, processing
labourers)
o Other (please specify): _____

Approximately, what was your total combined annual household income before taxes lastyear?
o Less than $25,000
o $25,000 to $49,999
o $50,000 to $74,999
o $75,000 to $99,999
o $100,000 to $149,999
o $150,000 to $199,999
o $200,000 to $299,999
o $300,000 to $449,999
o $450,000 or more

What Canadian province or territory do you currently live in?
o Alberta
o British Columbia
o Manitoba
o New Brunswick
o Newfoundland and Labrador
o Northwest Territories

o Nova Scotia
o Nunavut
o Ontario
o Prince Edward Island
o Quebec
o Saskatchewan
o Yukon

What is your postal code?

Were you born in Canada?
Yes
No

If no, what country were you born in?

If no, for how many years have you lived in Canada? years

What language do you speak most often at home?
¦ English
¦ French
¦ Other (please specify): _____

What are the ethnic or cultural origins of your ancestors?
Biological Mother
¦ Eastern European (Polish, Russian, Croatian, etc.)
¦ Western European (English, French, Portuguese, etc.)
¦ Middle Eastern
¦ East Asian (Chinese)
¦ East Asian (Korean)
¦ East Asian (Japanese)
¦ South Asian (East Indian, Pakistani, Sri Lankan, etc.)
¦ Southeast Asian (Vietnamese, Malaysian, Filipino, etc.)
¦ West Asian (Iranian, Afghan, Palestinian, etc.)
¦ East African (Ethiopian, Kenyan, Somali, etc.)
¦ Middle African (Cameroonian, Chadian, Congolese, etc.)
¦ Northern African (Moroccan, Algerian, Egyptian, etc.)
¦ Southern African (Botswana, South

African, etc.)
¦ Western African (Ghanaian, Nigerian, Guinean, etc.)
¦ Latin American (Argentinean, Costa Rican, Mexican, etc.)
¦ Caribbean Region (Jamaican, Trinidadian/Tobagonian, etc.)
¦ Indian Caribbean (Guyana with origins in India)
¦ North American Aboriginal (Inuit, Métis, First Nations, etc.)
¦ Oceania (Samoan, Fijian, etc.)
¦ Australian or New Zealander
¦ Other (please specify):
_____
¦ Unknown

Biological Father
¦ Eastern European (Polish, Russian, Croatian, etc.)
¦ Western European (English, French, Portuguese, etc.)
¦ Middle Eastern
¦ East Asian (Chinese)
¦ East Asian (Korean)
¦ East Asian (Japanese)
¦ South Asian (East Indian, Pakistani, Sri Lankan, etc.)
¦ Southeast Asian (Vietnamese, Malaysian, Filipino, etc.)
¦ West Asian (Iranian, Afghan, Palestinian, etc.)
¦ East African (Ethiopian, Kenyan, Somali, etc.)
¦ Middle African (Cameroonian, Chadian, Congolese, etc.)
¦ Northern African (Moroccan, Algerian, Egyptian, etc.)
¦ Southern African (Botswana, South African, etc.)
¦ Western African (Ghanaian, Nigerian, Guinean, etc.)
¦ Latin American (Argentinean, Costa Rican, Mexican, etc.)
¦ Caribbean Region (Jamaican, Trinidadian/Tobagonian, etc.)
¦ Indian Caribbean (Guyana with origins in India)
¦ North American Aboriginal (Inuit, Métis, First

Nations, etc.)
¦ Oceania (Samoan, Fijian, etc.)
¦ Australian or New Zealander
¦ Other (please
specify):_____
¦ Unknown

How would you describe your household?
¦ Single, no children
¦ Male / Female couple, no children
¦ Same sex couple, no children
¦ Mother, father, child(ren)
¦ Same sex couple, child(ren)
¦ Single parent family (mother head)
¦ Single parent family (father head)

If couple: How long have you and your partner been together? □□ years

In this section we would like to ask you some questions about your reproductive health.
Have you or your partner ever been pregnant?
o Yes
o No
How many children do youhave?
o No children
o One child
o Two children
o Three or more children
First Child
When was your child born? Please enter their date of birth below
(yy/mm/dd)
Was this pregnancy planned?
o Yes
o No

How much weight did you gain during your pregnancy?
kg / lbs or I don't know

Second Child
How old is your child? Date of birth: (yy/mm/dd)
Was this pregnancy planned?
o Yes
o No
How much weight did you gain during your pregnancy?

kg / lbs or I don’t know

Third Child
How old is your child? Date of birth: (yy/mm/dd)
Was this pregnancy planned?
o Yes
o No
How much weight did you gain during your pregnancy?
kg / lbs or I don’t know

Fourth Child
How old is your child? Date of birth: (yy/mm/dd)
Was this pregnancy planned?
o Yes
o No
How much weight did you gain during your pregnancy?
kg / lbs or I don’t know

Fifth Child
How old is your child? Date of birth: (yy/mm/dd)
Was this pregnancy planned?
o Yes
o No
How much weight did you gain during your pregnancy?
kg / lbs or I don’t know

Have you or your partner ever experienced any of the following with a pregnancy? (Select ALL that
apply)
If “have you or your partner ever been pregnant” = yes
o Miscarriage
o Stillbirth
o Assisted reproductive technology (e.g., in vitro fertilization)
o Preterm birth (born before 37 weeks gestation)
o Low birth weight (baby weighed below 2500g or 5 ½ lbs)
o High birth weight (baby weighted more than 4000g or 8lbs 13oz)
o Planned caesarean section
o Unplanned caesarean section
o Diabetes that developed during pregnancy
o High blood pressure that developed during
pregnancy (also known as preeclampsia)
o Birth defects
o Uterine anomalies
o Other medical issues:
o None

Are you currently thinking about or planning to have a child?

IF SEX=FEMALE
o I have no plans for a pregnancy at thistime
o I am currently trying to get pregnant
o I am considering a pregnancy in the next 1 to 2years
o I am considering a pregnancy in the next 3 to 5years

IF SEX=MALE
o My partner and I have no plans for a pregnancy at thistime
o My partner and I are currently trying to get pregnant
o My partner and I are considering a pregnancy in the next 1 to 2years
o My partner and I are considering a pregnancy in the next 3 to 5years

What type of contraception are you (and your partner) currently using?
o Birth control pills
o Intrauterine device (IUD)
o Condoms
o Diaphragm
o Cervical Cap / Femcap
o Contraceptive Implant
o Contraceptive Sponge
o Contraceptive Injections
o Vaginal Ring
o Contraceptive Patch
o Sterilization (tubal ligation, coil, vasectomy)
o Natural methods
o None

In this section we would like to ask you about your current health status and medical history.

What is your current weight?
__ lbs or __ kg

What is your current height?
__ ft __ in or __ m

Have you ever been diagnosed with any of the following conditions? Please mark all that apply.
o Asthma
o Cancer
o Diabetes
o HIV
o Hypertension
o Inflammatory bowel disease
o Phenylketonuria

o Renal disease
o Seizure disorder
o Systemic Lupus Erythematosus, Rheumatoid Arthritis, and other Autoimmune Diseases
o Thromboembolic Disease
o Thyroid disease
o HIV
o Parvovirus
o Hepatitis B
o Hepatitis C
o Tuberculosis
o Cytomegalovirus
o Toxoplasmosis

Have you ever tested positive for any of the following in the past year? Please mark all that apply.
o Chlamydia
o Gonorrhea
o Syphilis
o Genital herpes
o Trichomoniasis

Do you currently use any of the following? Mark all that apply.
o Prescribed medications
o Over-the-counter medications
o Herbal medications
o Natural medications
o Weight-loss medications or supplements
o Athletic products of supplements
On a typical day, how many cigarettes do you smoke?
o None, I do not smoke
o I do not smoke daily – only occasionally
o 1 to 3 cigarettes a day
o 4 to 6 cigarettes a day
o 7 to 10 cigarettes a day
o More than 10 cigarettes a day

In the past 12 months, have you used cannabis (marijuana) for medical reasons?
o Yes
o No

In the past 12 months, have you used cannabis (marijuana) for non-medical reasons?
o Yes - how often?
o Daily, Weekly, monthly, every couple of months, once or twice a year
o No

What types of cannabis (marijuana) products have you regularly used in the past 12 months?
o None
o Dried flower/leaf
o Hashish/kief
o Edibles
o Oil cartridges
o Vape pens
o Liquids

How would you rate your overall health?
1. Very healthy
2. Healthy
3. Ok
4. Unhealthy
5. Very unhealthy

Over the last 2 weeks, how often have you been bothered by any of the following problems?
(0=Not at all, 1=Several days, 2=More than half the days, 3=Nearly every day)

1. Little interest or pleasure in doing things 0 1 2 3
2. Feeling down, depressed, or hopeless 0 1 2 3
3. Trouble falling or staying asleep, or sleeping too much 0 1 2 3
4. Feeling tired or having little energy 0 1 2 3
5. Poor appetite or overeating 0 1 2 3
6. Feeling bad about yourself – or that you are a failure or
have let yourself or your family down 0 1 2 3
7. Trouble concentrating on things, such as reading the
newspaper or watching television 0 1 2 3
8. Moving or speaking so slowly that other people could have
noticed? Or the opposite–being so fidgety or restless that you
have been moving around a lot more than usual 0 1 2 3
9. Thoughts that you would be better off dead or of hurting
yourself in some way 0 1 2 3

If “several days” or “more than half the days” or “nearly every day” was checked:
How difficult have these problems made it for you to do yourwork, take care of things at home, or get along with other
people?
Not difficult at all
Somewhat difficult
Very difficult
Extremely difficult

In this section we would like to ask you some questions about your eating behaviours and food choices. There are no right or wrong answers.
Directions: Please check the box that best describes your eating habits over the LAST MONTH.

How often do you eat…
Dark green leafy vegetables (spinach, romaine lettuce, mesclun mix, kale, turnip greens, bok choy, swiss chard):
Less than once per week
Once per week
2-4 times per week
Nearly daily or daily
Twice or more per day

Broccoli, broccoli rabe, cauliflower, cabbage, brussel sprouts:
Less than once per week
Once per week
2-4 times per week
Nearly daily or daily
Twice or more per day

Carrots:
Less than once per week
Once per week
2-4 times per week
Nearly daily or daily
Twice or more per day

Other vegetables (e.g. peas, corn, green beans, tomatoes, squash):
Less than once per week
Once per week
2-4 times per week
Nearly daily or daily
Twice or more per day

Dried beans, peas, lentils or tofu:
Less than once per week
Once per week
2-4 times per week
Nearly daily or daily
Twice or more per day

Citrus fruits (e.g. oranges, grapefruits):
Less than once per week
Once per week
2-4 times per week
Nearly daily or daily

Twice or more per day

Other fruits (e.g. fresh apples or pears, bananas, berries, grapes, melons):
Less than once per week
Once per week
2-4 times per week
Nearly daily or daily
Twice or more per day

Whole milk dairy foods (whole milk, hard cheese, butter, ice cream):
Never
Once per week or less
2-4 times per week
Twice per day
4 to 5 times per day

Low-fat milk products (e.g., low
-fat/skim milk, yogurt, cottage cheese):
Less than once per week
Once per week
2-4 times per week
Twice per day
4 to 5 times per day

Whole eggs:
Less than once per week
1-2 per week
3-4 times per week
Daily
Twice or more per day

Beef, pork or lamb:
Less than once per week
1-2 per week
3-4 times per week
Daily Twice or more per day

Processed meats (sausages, salami, bologna, hot dogs, bacon):
Less than once per week
Once per week
2-4 times per week
Nearly daily or daily
Twice or more per day
-
Turkey or chicken:
Less than once per week

Once per week
2-4 times per week
Twice or more per day

Fish/Seafood (not fried, but broiled, baked, poached or canned):
Less than once per month
Once per month
2-3 times per month
Nearly Weekly
Twice or more per week

Stick margarine:
Less than once per week
Once per week 2-4 times per week
Nearly daily or daily
Twice or more per day

Refined grains (white bread, white rice):
Less than once per week
Once per week
2-4 times per week
Nearly daily or daily
Twice or more per day

Plant-based protein foods such as nuts and seeds
Less than once per week
Once per week
2-4 times per week
Nearly daily or daily
Twice or more per day

Whole grain breads and cereals (whole wheat, oatmeal, brown rice, barley):
Less than once per week
Once per week
2-4 times per week
Nearly daily or daily
Twice or more per day

Baked products (muffins, doughnuts, cookies, cake, pastries):
Less than once per week
Once per week
2-4 times per week
Nearly daily or daily
Twice or more per day

Deep fried foods:

Less than once per week
Once per week
2-4 times per week
Nearly daily or daily
Twice or more per day

How often do you add salt to food at the table?
Less than once per week
Once per week
2-4 times per week
Nearly daily or daily
Twice or more per day

How often do you drink calorie-containing beverages (i.e. Regular soda, fruit drinks, Nestea, Gatorade)?
Less than once per week
Once per week
2-4 times per week
Nearly daily or daily
Twice or more per day

How often do you drink plain water?
Once per week or less often
2-4 times per week
Nearly daily or daily
Twice per day .
More than 3 times/day

How often do you drink a beverage containing any alcohol?
Less than once per week
Once per week
2-4 times per week
Nearly daily or daily
Twice or more per day

Adapted from the PrimeScreen Questionnaire, President and Fellows of Harvard College, Harvard School of Public Health,
and modified for pregnancy by SA Atkinson, McMaster University 2013 and 2019.
Copyright 1999
Source: Rifas-Shiman, SL, Willett, WC et a.l PrimeScreen, a brief dietary screening tool reproducibility and comparability with
both a longer food frequency questionnaire and biomarkers. PubHealNut.1999:4 (2), 249-254

In this section we would like to ask you about your time doing different types of physical activity in a typical week.

Please answer these questions even if you do not consider yourself to be a physically active person.

Think first about the time you spend doing work. Think of work as the things that you have to do such as paid or unpaid work, study/training, household chores, harvesting food/crops, fishing or hunting for food, seeking employment. [Insert other examples if needed]. In answering the following questions 'vigorous-intensity activities' are
activities that require hard physical effort and cause large increases in breathing or heart rate, 'moderate-intensity activities' are activities that require moderate physical effort and cause small increases in breathing or heart rate.

Activities at Work
GPAQ1. Does your work involve vigorous-intensity activity that causes
large increases in breathing or heart rate like [carrying or lifting
heavy loads, digging or construction work] for at least 10 minutes continuously?
o Yes
o No

GPAQ2. In a typical week, on how many days do you do vigorous- intensity
activities as part of your work? ___ [Limit 1-7]

GPAQ3. How much time do you spend doing vigorous-intensity activities at work
on a typical day? Hours: Minutes ___ ___: ___ ___

GPAQ4. Does your work involve moderate-intensity activity that causes
small increases in breathing or heart rate such as brisk walking
[or carrying light loads] for at least 10 minutes continuously?
[INSERT EXAMPLES] (USE SHOWCARD)
o Yes
No

GPAQ5. In a typical week, on how many days do you do moderate- intensity
activities as part of your work?
___ [Limit 1-7]

GPAQ6. How much time do you spend doing moderate-intensity activities at
work on a typical day? Hours: Minutes ___ ___: ___ ___
Travel to and from places
The next questions exclude the physical activities at work that you have already mentioned.
Now I would like to ask you about the usual way you travel to and from places. For example to work, for shopping, to
market, to place of worship.

GPAQ7. Do you walk or use a bicycle (pedal cycle) for at least 10 minutes
continuously to get to and from places?
o Yes

o No

GPAQ8. In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places? ___ [Limit 1-7]

GPAQ9. How much time do you spend walking or bicycling for travel on a typical day? Hours: Minutes ___ ___: ___ ___

Recreational activities

The next questions exclude the work and transport activities that you have already mentioned. Now I would like to ask you about sports, fitness and recreational activities (leisure), [insert relevant terms].

GPAQ10. Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like [running or football,] for at least 10 minutes continuously?

o Yes
o No

GPAQ11. In a typical week, on how many days do you do vigorous- intensity sports, fitness or recreational (leisure) activities? ___ [Limit 1-7]

GPAQ12. How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day? Hours: Minutes ___ ___: ___ ___

GPAQ13. Do you do any moderate-intensity sports, fitness or recreational (leisure) activities that causes a small increase in breathing or heart rate such as brisk walking,(cycling, swimming, volleyball)for at least 10 minutes continuously?

o Yes
o No

GPAQ14. In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational (leisure) activities?

___ [Limit 1-7]

GPAQ15. How much time do you spend doing moderate-intensity sports, fitness or recreational (leisure) activities on a typical day? Hours: Minutes ___ ___: ___ ___

Sedentary behaviour

The following question is about sitting or reclining at work, at home, getting to and from places, or with friends including time spent [sitting at a desk, sitting with friends, travelling in car, bus, train, reading, playing cards or watching television], but do not include time spent sleeping.

GPAQ16. How much time do you usually spend sitting or reclining on a typical

day?
Hours: Minutes ___ ___: ___ ___

In this section we would like to ask you some questions about your pregnancy health knowledge.
What percentage of pregnancies are unplanned?
a. Very few
b. About 25%
c. About 50%
d. About 75%
e. Don't know
If you are thinking about getting pregnant, when is the right time for you and your partner (if you have a partner) to
visit a family doctor, nurse, or other health care provider?
a. Right now, before you are pregnant
b. As soon as you discover you are pregnant
c. After you have been pregnant for 3 months
d. The timing of the first visit is not important
e. Don't know
Success of getting pregnant (either on your own or with medical help like in vitro fertilization) is lower for women who are:
a. In their late 20s and older
b. In their early 30s and older
c. In their late 30s and older
d. Don't know
The quality of a man's sperm decreases:
a. In his mid-30s and older
b. In his mid-40s and older
c. In his mid-50s and older
d. Don't know
The best amount of time between pregnancies is:
a. More than 18 months but less than 5 years
b. More than 12 months but less than 4 years
c. More than 6 months but less than 3 years
d. Don't know
Women who have had a caesarean section should wait how long to try to get pregnant again?
a. At least 12 months
b. At least 18 months
c. At least 24 months
d. Don't know
Sexually transmitted infections (STIs)…
a. Cannot affect fertility
b. Cannot be passed on to the infant during pregnancy and/or birth
c. May not have symptoms that you can detect
d. Don't know
If you have a chronic medical condition, it is important to speak with your healthcare provider before getting

pregnant to: (Select ALL that apply)
a. Ensure your condition is under control
b. Review your medications
c. Discuss potential risks to fertility and pregnancy
d. Don't know
If you are taking medications, it is important to:
a. Stop taking them before getting pregnant
b. Talk with your health care provider to review them and discuss impacts on pregnancy
c. Always change the type and amount before getting pregnant
d. Don't know
Which of the following could impact the health of your pregnancy? (Select ALL that apply)
a. Prescription medications
b. Over-the-counter medications
c. Herbal products
d. Don't know
A history of depression or anxiety before pregnancy: (Select ALL that apply)
a. May increase risk of depression and anxiety after the baby is born
b. Should be discussed with a health care provider before getting pregnant
c. Is a risk factor for complications in pregnancy, like preterm delivery
d. Don't know
Some things you can do to improve mental health include: (Select ALL that apply)
a. Getting 7 to 8 hours of sleep every night
b. Eating a balanced diet
c. Exercising regularly
d. Talking to your health care provider if you experience any symptoms
e. Don't know
Which of the following can be hazardous to fertility and pregnancy? (Select ALL that apply)
a. Smoking tobacco products
b. Smoking e-cigarettes
c. Being exposed to second-hand smoke
d. I don't know
How many alcoholic drinks should women who are pregnant or planning a pregnancy have?
a. A few sips
b. One drink per month
c. Three drinks per month
d. No amount of alcohol is known to be safe during pregnancy
e. Don't know
Which of the following immunizations cannot be given during pregnancy?
(Select ALL that apply)
a. The varicella vaccine
b. The rubella vaccine
c. The influenza vaccine
d. Don't know
Being overweight or underweight can affect: (Select ALL that apply)
a. Your health
b. Your fertility

c. Having a healthy pregnancy
d. Don't know
A healthy weight gain in pregnancy is:
a. 10-20 pounds
b. 20-30 pounds
c. It depends on your weight before pregnancy and your height
d. Don't know
Folic acid should be taken by:
a. All women of reproductive age who could become pregnant, whether or not they are planning a pregnancy
b. Women planning a pregnancy
c. Women during pregnancy
d. Women with a baby who had a neural tube defect
e. Don't know
Healthy nutrition, which can improve your fertility and chances of a healthy pregnancy, should include: (Select ALL
that apply)
a. A balanced diet
b. A diet high in folic acid
c. Reduced caffeine intake
How much moderate/vigorous physical activity should reproductive-age persons get per week?
a. 30 minutes or more
b. 60 minutes or more
c. 120 minutes or more
d. 150 minutes or more
e. Don't know
Feeling very stressed or not having enough money to make ends meet may:
(Select ALL that apply)
a. Impact fertility
b. Cause complications in pregnancy and birth
c. Have no effect on pregnancy or the baby
d. Don't know
Intimate partner violence tends to:
a. Stay the same in pregnancy
b. Increase in pregnancy
c. Decrease in pregnancy
d. Don't know
Which of the following environmental exposures should women limit or avoid when planning a pregnancy or in
pregnancy? (Select ALL that apply)
a. Laundry detergent
b. X-rays
c. Pesticides
d. House cleaning using soda and vinegar
e. Cat litter
f. Don't know

Some types of fish should be avoided when planning a pregnancy or in pregnancy because:
a. They may contain mercury
b. They may contain radiation
c. They may contain solvents
d. Don't know
Which of the following describes a partner's role in preparing for pregnancy?
a. Partners should be screened for sexually transmitted infections
b. Partners should make healthy food and lifestyle choices
c. Partners should talk to their physicians about their health
d. Do not know
For the following questions, please answer "true" or "false".
What a woman eats during pregnancy affects her baby's risk of becoming obese as an adult.
o True
o False
Where a person lives affects their risk of becoming obese.
o True
o False
When people eat too much, they become obese.
o True
o False
Smoking during pregnancy will harm my baby.
o True
o False
Taking daily prenatal multivitamins during pregnancy is good for my baby's health.
o True
o False
Pregnant women should eat as much as they like because they are "eating for two".
o True
o False
People can control whether or not they become obese.
o True
o False
Consuming Guinness or other iron-rich beer will improve my baby's health.
o True
o False
Pregnant women should avoid light exercise and physical activity to protect their babies.
o True
o False
What a woman eats during pregnancy affects her grandchildren's risk of becoming obese.
o True
o False

In this section we would like to ask you some questions to better understand your perceptions of "preconception care". There are no right or wrong answers. Please choose the option(s) that best describes your own knowledge, beliefs and experiences.

What does “preconception care” mean to you?
o Fostering a healthy lifestyle in women of child bearing age who are planning to become pregnant
o Fostering a healthy lifestyle in all adults (both women and men) who are planning to have children
o Fostering a healthy lifestyle starting in childhood
o Other, Specify

The following will be shown after the above question is answered:
Preconception health is a parent’s health before a pregnancy and knowing that poor health can place a woman or her unborn
child at risk for health problems. Preconception care refers to activities that promote a future parent’s health before a
pregnancy.

Have you ever received preconception care from a health care professional?
WOMEN WITH CHILDREN AND NO PLANS TO HAVE ANOTHER ONE IN THE FUTURE
WOMEN WITH CHILDREN AND PLANNING ANOTHER ONE IN THE FUTURE
o Yes

From whom? (Please select ALL that apply)
o Family Doctor
o Public Health Nurse
o Midwife
o Psychiatrist or mental health specialists
o Other:

When did you receive preconception health care?
o Before I decided on getting pregnant
o When I decided on getting pregnant
o When I got pregnant
o When I had difficulties / issues on getting pregnant

Have you or your partner ever received preconception care from a health care professional?
MEN WITH CHILDREN AND NO PLANS TO HAVE ANOTHER ONE IN THE FUTURE
MEN WITH CHILDREN AND PLANNING ANOTHER ONE IN THE FUTURE
o Yes

From whom? (Please select ALL that apply)
o Family Doctor
o Public Health Nurse
o Psychiatrist or mental health specialists
o Other:

When did you or your partner receive preconception care?

o Before my partner and I decided on getting pregnant
o When my partner and I decided on getting pregnant
o When my partner got pregnant
o When my partner and I had difficulties / issues on getting pregnant
o No, I never received preconception care but my partner did
o No neither my partner nor I have received preconception care

How important do you consider preconception health for the public, in general?
o Very important
o Important
o Moderately important
o Slightly important
o Not at all important

How important did you consider preconception health for you before your last pregnancy?
WOMEN + MEN WITH CHILDREN AND NO PLANS TO HAVE ANOTHER ONE IN THE FUTURE
o Very important
o Important
o Moderately important
o Slightly important
o Not at all important

How important do you consider preconception health for you now?
WOMEN + MEN WITH NO CHILD AND PLANNING ONE IN FUTURE
WOMEN + MEN WITH CHILDREN AND PLANNING ANOTHER ONE IN THE FUTURE
o Very important
o Important
o Moderately important
o Slightly important
o Not at all important

Are you interested in receiving preconception care for your or your partner's future pregnancy?
WOMEN WITH NO CHILD AND PLANNING ONE IN FUTURE
WOMEN WITH CHILDREN AND PLANNING ANOTHER ONE IN THE FUTURE
o Very interested
o Interested
o Somewhat interested
o Slightly interested
o Not at all interested
if female and (interested in any way): When would you prefer to receive preconception care?
o Before I decide to become pregnant
o When I have already decided to become pregnant
o When I become pregnant
o If I have difficulties or issues on becoming pregnant

Are you interested in receiving preconception care for your partner's future pregnancy?
MEN WITH NO CHILD AND PLANNING ONE IN FUTURE
MEN WITH CHILDREN AND PLANNING ANOTHER ONE IN THE FUTURE
o Very interested
o Interested
o Somewhat interested
o Slightly interested
o Not at all interested
if male and (interested in any way): When would you prefer to receive preconception care?
o Before my partner and I decide to become pregnant
o When my partner and I have already decided to become pregnant
o When my partner becomes pregnant
o If my partner and I have difficulties or issues on becoming pregnant

Which of the following would you have liked to have received support on before your last pregnancy?
WOMEN + MEN WITH CHILDREN AND NO PLANS TO HAVE ANOTHER ONE IN THE FUTURE
WOMEN + MEN WITH CHILDREN AND PLANNING ANOTHER ONE IN THE FUTURE
1. I would have liked to receive more information / support aboutthis
2. No, I did not need this information / support – I was already fully informed about this
3. No, I did not need this information / support – This was not important or applicable to me
**

Which of the following would you like to learn more about or receive support with before a future pregnancy?
WOMEN + MEN WITH NO CHILD AND PLANNING ONE IN FUTURE
WOMEN + MEN WITH CHILDREN AND PLANNING ANOTHER ONE IN THE FUTURE
1. I would like to receive more information
2. No, I do not need this information / support – I am already informed about this
3. No, I do not need this information / support – This is neither important nor applicable to me

Preconception support needs
Lifestyle Issues
Being at a healthy weight
Nutrition
Nutritional supplements
Physical activity
Screen time (TV, computer, social media, gaming, etc.)
Sleep
Workplace stress
Environmental hazards
Smoking cessation or second-hand smoke
Alcohol consumption

Marijuana – cannabis
Recreational or street drugs
Mental health issues
Depressive symptoms
Anxiety symptoms
Life stress
Loneliness
Relationships issues
Co-parenting skills
Relationship satisfaction
Domestic violence – intimate partner abuse
Child nutrition, care and behaviour issues
Breastfeeding / Child feeding
Child development
Child growth
Medical related issues
Fertility
Birth control and pregnancy spacing
Sexual health
Family history
Genetic counselling
Influence of pre-existing medical conditions on pregnancy
Influence of pre-existing medical conditions on child health
Pregnancy complications
Child health complications
Medications
Natural health products
Vaccinations - immunizations
Infectious diseases
Sexually transmitted infections

For each of the following, please answer if you strongly agree, agree, are undecided, disagree, or strongly disagree:
5 Strongly Agree
4 Agree
3 Undecided
2 Disagree
1 Strongly disagree

A man's family health history can have serious consequences to the health of his children
A woman's family health history can have serious consequences to the health of her children
A man's health before getting pregnant can have important consequences to the health of his children

A woman's health before getting pregnant can have important consequences to the health of her children

Please think about when people are considering having a baby. During the time period before pregnancy, what changes do you think, if any, should be made by women/men.

Changes WOMEN should make
Changes MEN should make
Maintain a healthy weight
Eat well / good nutrition
Take vitamins
Take folic acid
Increase exercise / physical activity
Improve sleep behaviours
Work on relationship with partner
Stop / reduce smoking tobacco
Stop / reduce exposure to second hand smoke
Stop / reduce drinking alcohol
Stop / reduce prescription drug use
Stop / reduce herbal or supplement use
Stop / reduce over-the-counter drug use
Stop / reduce cannabis use
Stop / reduce illegal drug use
Avoid / reduce environmental hazards
Visit doctor / health care professional
Improve overall general health
Update vaccines or immunizations
Manage medical conditions better
Manage mental health conditions better
Nothing / no change

Does "planning a pregnancy" mean to you that you need to change some of your behaviours to improve your health?

WOMEN + MEN WITH NO CHILD AND PLANNING ONE IN THE FUTURE
WOMEN + MEN WITH CHILD(REN) AND PLANNING ONE IN THE FUTURE
o Yes
o No --> SKIP TO (Q3)

Approximately how long before a pregnancy do you plan to make these changes?

WOMEN WITH NO CHILD AND PLANNING ONE IN THE FUTURE
WOMEN WITH CHILD(REN) AND PLANNING ONE IN THE FUTURE
o I am not planning to change my behaviours
o More than 1 year before getting pregnant

o 1 year before getting pregnant
o 6 months before getting pregnant
o 3 months before getting pregnant
o 1 month before getting pregnant
o When I find out I am pregnant

Approximately how long before your partner's pregnancy do you plan to make these changes?

MEN WITH NO CHILD AND PLANNING ONE IN THE FUTURE
MEN WITH CHILD(REN) AND PLANNING ONE IN THE FUTURE
o I am not planning to change my behaviours
o More than 1 year before my partner gets pregnant
o 1 year before my partner gets pregnant
o 6 months before my partner gets pregnant
o 3 months before my partner gets pregnant
o 1 month before my partner gets pregnant
o When I find out my partner is pregnant

There are a number of things that you may or may not have done either before or during your last pregnancy. Please read the following items and answer if you did it:
WOMEN WITH CHILD(REN) AND NO PLANS TO HAVE ANOTHER ONE IN THE FUTURE

There are a number of things that you may or may not have done either before or during your partner's last pregnancy. Please read the following items and answer if did it:
MEN WITH CHILD(REN) AND NO PLANS TO HAVE ANOTHER ONE IN THE FUTURE
There are a number of things that you may or may not do either before or during your pregnancy. Please read the following items and answer if you are planning to start doing it:
WOMEN WITH NO CHILD AND PLANNING ONE IN THE FUTURE
WOMEN WITH CHILD(REN) AND PLANNING ONE IN THE FUTURE

There are a number of things that you may or may not do either before or during your partner's pregnancy. Please read the following items and answer if you are planning to start doing it:

MEN WITH NO CHILD AND PLANNING ONE IN THE FUTURE
MEN WITH CHILD(REN) AND PLANNING ONE IN THE FUTURE
1. Before your pregnancy
2. During your pregnancy
3. Not at all.
4. If the item is not applicable to you, please answer "not applicable"
1 2 3 4

Look for information about how to improve your health?

Talk to a health care provider about improving your health?
Reduce weight?
Change your eating habits to improve your overall diet?
Change your diet to avoid any specific foods (peanuts, unpasteurized milk or cheese, etc)?
If sex = female Start taking folic acid or any prenatal multivitamin?*
Improve your exercise habits / level of physical activity?
Reduce screen time (e.g., TV, computer, social media, gaming, etc.)?
Take action to improve your sleep?
Take action to reduce / avoid stress?
Avoid / reduce environmental hazards?
Take action to improve your mental health?
Take action to improve your relationship with your partner?
Take action to improve your parenting skills?
Cut down or quit using cannabis products?
Cut down or quit any illicit drug use?
Cut down or quit smoking tobacco?
Stop using or change use of over the counter medications?
Stop using or change any prescribed medications?
Cut down or quit drinking alcohol?
If sex = female Check your immunization status?*
Discuss with your health care provider your family history or any risk factor(s) that could influence the pregnancy?
Discuss with your health care provider your family history or any risk factor(s) that could influence the baby?
Have you spoken to any health care provider about being as healthy as possible prior to conception (getting pregnant)?
WOMEN and MEN WITH NO CHILD AND PLANNING ONE IN THE FUTURE
WOMEN and MEN WITH CHILD(REN) AND PLANNING ONE IN THE FUTURE
o Yes
o No

Did you speak to any health care provider about being as healthy as possible prior to your last pregnancy?

WOMEN WITH CHILD(REN) AND NO PLANS TO HAVE ANOTHER ONE IN THE FUTURE
MEN WITH CHILD(REN) AND NO PLANS TO HAVE ANOTHER ONE IN THE FUTURE
o Yes
o No

Right now, how likely would you START a conversation with your doctor or health care provider about
being the healthiest you can be before you have a baby?
WOMEN + MEN WITH NO CHILD AND PLANNING ONE IN THE FUTURE
WOMEN + MEN WITH CHILD(REN) AND PLANNING ONE IN THE FUTURE

Before your pregnancy(s), how likely were you to have a conversation with your doctor or healthcare provider about being the healthiest you could be so that you could have a healthy baby?

WOMEN WITH CHILD(REN) AND NO PLANS TO HAVE ANOTHER ONE IN THE FUTURE
Before your partner's pregnancy(ies), how likely were you to have a conversation with your doctor or healthcare provider about being the healthiest you could be so that you could have a healthy baby?

MEN WITH CHILD(REN) AND NO PLANS TO HAVE ANOTHER ONE IN THE FUTURE
o Very Likely
o Likely
o Unsure
o Unlikely
o Very unlikely

Right now, if your doctor or health care provider STARTED a conversation with you about being the healthiest you could be to have a healthy baby, how likely would you follow their advice?

WOMEN WITH NO CHILD AND PLANNING ONE IN THE FUTURE
WOMEN + MEN WITH CHILD(REN) AND PLANNING ONE IN THE FUTURE
Before your pregnancy(ies), if your doctor or health care provider had a conversation with you about being the healthiest you could be to have a healthy baby, how likely would you have followed their advice?

WOMEN WITH CHILD(REN) AND NO PLANS TO HAVE ANOTHER ONE IN THE FUTURE
Before your partner's pregnancy(ies), if your doctor or health care provider had a conversation with you about being the healthiest you could be to have a healthy baby, how likely would you have followed their advice?

MEN WITH CHILD(REN) AND NO PLANS TO HAVE ANOTHER ONE IN THE FUTURE
o Very Likely
o Likely
o Unsure
o Unlikely
o Very unlikely

In answering the following questions, think about the reason you mentioned previously for why you were unsure or not interested in preconception care in the past. If 'unsure' or 'not interested' for question "Are you interested in receiving preconception care for your future pregnancy"
Strongly
Disagree

Disagree
Unsure
Agree
Strongly Agree

I am unsure or not interested in receiving preconception care for a future pregnancy because….
I am not sure what preconception care means
I do not know where to receive preconception care
I do not have time for preconception care
I do not have health care provider that I trust
and feel comfortable in sharing my pregnancy
plans
I do not think it will benefit my health
I do not think it will benefit a future pregnancy
I am well informed about all health behaviours that
involve a pregnancy
I will not modify any behaviour or attitude at this
point
Preconception care is important for first time
parents, not experienced parents
I do not have any risk factor(s) or health
issue(s) that requires preconception care
Preconception care is only important for my partner
I want to keep my pregnancy plan between my
partner and me (or only me)
I am not comfortable in discussing pregnancy
planning with others
I do not want to be judged or be lectured about my
health behaviours
I can find all information I need from other sources
(books, internet, family, friends, etc.)
I believe getting pregnant should be a natural
process with minimal intervention
I do not want to create expectations about
getting pregnant
I do not want to be disappointed if I cannot get
pregnant
Other, specify

From all the above, what is the main reason why you were unsure or not
interested in receiving preconception care?
o I am not sure what preconception care means
o I do not know where to receive preconception care
o I do not have time for preconception care
o I do not have health care provider that I trust and feel comfortable in sharing my
pregnancy plans

o I do not think it will benefit my health
o I do not think it will benefit a future pregnancy
o I am well informed about all health behaviours that involve a pregnancy
o I will not modify any behaviour or attitude at this point
o Preconception care is important for first time parents, not experienced parents
o I do not have any risk factor(s) or health issue(s) that requires preconception care
o Preconception care is only important for my partner
o I want to keep my pregnancy plan between my partner and me (or only me)
o I am not comfortable in discussing pregnancy planning with others
o I do not want to be judged or be lectured about my health behaviours
o I can find all information I need from other sources (books, internet, family, friends, etc.)
o I believe getting pregnant should be a natural process with minimal intervention
o I do not want to create expectations about getting pregnant
o I do not want to be disappointed if I cannot get pregnant
o Other, specify

In this section we would like to ask you questions to help us better understand your preferences around various
health information sources.

Where do you currently obtain information about any health questions you may have?
(Please select ALL that apply)
o Family Doctor
o Public Health Nurse
o Other Health Care Provider:who:
o Partner
o Family members: who:
o Friends
o Internet (e.g., Google search)
o Social Media (e.g., Facebook, YouTube, Instagram, Twitter)
o Printed Materials (e.g., books, magazines, newspapers, handouts,posters)
o Radio/Television
o Other, please specify:
o I do not look for health information

IF SEX=FEMALE

If you were seeking help or advice regarding the maintenance of healthy behaviours, such as regular physical
activity/exercise and healthy eating before / during pregnancy, what kind of help or resource would you prefer?
(Multiple responses are permitted. Please check your top three)
o Advice from a doctor or other health care provider in person
o Advice from a health care provider over the telephone
o A paper booklet on maintaining healthy behaviours during pregnancy and after the baby is born
o An electronic booklet on maintaining healthy behaviours during pregnancy and after the baby is born
o A referral to community programs available in my area

o A website that will help me improve my health behaviours
o An app that will help me improve my health behaviours
o Telephone calls to help me improve my health behaviours
o Telephone texts to help me improve my health behaviours
o Emails to help me improve my health behaviours

IF SEX=MALE
If you were seeking help or advice regarding the maintenance of healthy behaviours such as regular physical activity/exercise and healthy eating before / during your partner's pregnancy, what kind of help or resource would you prefer (Multiple responses are permitted. Please check your top three)
o Advice from a doctor or other health care provider in person
o Advice from a health care provider over the telephone
o A paper booklet on maintaining healthy behaviours during pregnancy and after the baby is born
o An electronic booklet on maintaining healthy behaviours during pregnancy and after the baby is born
o A referral to community programs available in my area
o A website that will help me improve my health behaviours
o An app that will help me improve my health behaviours
o Telephone calls to help me improve my health behaviours
o Telephone texts to help me improve my health behaviours
o Emails to help me improve my health behaviours

IF SEX=FEMALE
If you were seeking help or advice related to managing stress and optimizing your mood and mental health during pregnancy and after the baby is born, what kind of help or resource would you prefer? (Multiple responses are permitted. Please check your top three)
o Advice from a doctor or other health care provider in person
o Advice from a health care provider over the telephone
o A paper booklet on maintaining healthy behaviours during pregnancy and after the baby is born
o An electronic booklet on maintaining healthy behaviours during pregnancy and after the baby is born
o A referral to community programs available in my area
o A website that will help me improve my health behaviours
o An app that will help me improve my health behaviours
o Telephone calls to help me improve my health behaviours
o Telephone texts to help me improve my health behaviours
o Emails to help me improve my health behaviours

IF SEX=MALE
If you were seeking help or advice related to managing stress and optimizing your mood and mental health during your partner's pregnancy and after the baby is born, what kind of help or resource would you prefer? (Multiple responses are permitted . Please check your top three)
o Advice from a doctor or other health care provider in person

o Advice from a health care provider over the telephone
o A paper booklet on maintaining healthy behaviours during pregnancy and after the baby is born
o An electronic booklet on maintaining healthy behaviours during pregnancy and after the baby is born
o A referral to community programs available in my area
o A website that will help me improve my health behaviours
o An app that will help me improve my health behaviours
o Telephone calls to help me improve my health behaviours
o Telephone texts to help me improve my health behaviours
o Emails to help me improve my health behaviours

How effective do you think the following sources of information would be in influencing WOMEN toimprove their health before they become pregnant?

Not
Effective
Slightly
Effective
Moderately
Effective
Somewhat
Effective
Very
Effective

Family Doctor
Public Health Nurses
Other health care provider
Partner
Family members
Friends
Teacher or guidance counsellor
Preconception classes, if available
Pregnancy groups, if available
Experienced mothers in the community
Books from a library / bookstore
Media such as radio or TV
Social Media (Facebook, Twitter)
Apps/Websites
Written materials from a doctor's
office, public health department
or pharmacy

How effective do you think the following sources of information would be in influencing MEN to improve their health before their partners become pregnant?

Not
Effective
Slightly
Effective
Moderately
Effective
Somewhat
Effective
Very
Effective

Family Doctor
Public Health Nurses
Other health care provider
Partner
Family members
Friends
Teacher or guidance counsellor
Preconception classes, if available
Pregnancy groups, if available
Experienced mothers in the community
Books from a library / bookstore
Media such as radio or TV
Social Media (Facebook, Twitter)
Apps/Websites
Written materials from a doctor's
office, public health department
or pharmacy

In the next section, we would like to ask you questions to help us better understand how you might
use technology to access health information.

What type of mobile device do you primarily use?
o Apple
o Android
o Non-smartphone
o Other:
o I do not own or use a mobile device -- > skip to Q4.

What is the make and model of your mobile device (e.g., Samsung S8, LG G6, Apple iPhone, etc.)

_____
About how much of your time is spent using your mobile device in a day?

o I do not use a mobile device daily
o Under 30 minutes
o 30 – 60 minutes
o 60 – 120 minutes
o Over 120 minutes

Which of the following do you regularly use? Check all that apply
o Desktop (Mac)
o Desktop (PC)
o Laptop (Mac)
o Laptop (PC)
o Tablet (not a computer) skip to Q
o I do not regularly use a computer skip to Q

About how much of your time is spent using your computer and/or tablet in a day?
o I do not use a computer/tablet daily
o Under 30 minutes
o 30 – 60 minutes
o 60 – 120 minutes
o Over 120 minutes

If you had access to a website or app that gave you personalized information that could improve your health and your family's health, when do you think you might use it?
o At home in the morning
o At home in the afternoon
o At home in the evening
o While going to work or school
o At work, during breaks
o At work, at my desk
o Other,

What social media platforms do you use regularly? Check all that apply.
o Facebo
o Instagram
o Twitter
o LinkedIn
o Pinterest
o Reddit
o Snapchat
o WhatsApp
o Other,

Look at the apps on your phone and think of the ones you use regularly and have had on there the longest. How would you characterize them? Check all that apply:
o Games
o Business

o Education
o Lifestyle
o Entertainment
o Utilities
o Travel
o Health & Fitness
o Reading
o Food & Drink
o Productivity
o Music
o Finance
o Photo & Video
o Reference
o Sports
o Social Networking
o News
o Medical
o Shopping

Have you accessed any websites related to health or parenting in the past month?
o Yes
o No
If yes, please list your top 2:

Have you used any apps on your phone related to health or parenting in the past month?
o Yes
o No
If yes, please list your top 2:

Do you currently use any website or app to improve your child(ren)'s health?
MEN OR WOMEN WITH CHILDREN
o Yes
o No
If yes, is there one you would recommend?

If an e-health resource (e.g. website, app) is recommended to you with the aim of improving your child(ren)'s health, how likely would you be to use it?

WOMEN + MEN WITH CHILD(REN) AND PLANNING ANOTHER ONE IN THE FUTURE
WOMEN + MEN WITH CHILD(REN) AND NO PLANS TO HAVE ANOTHER ONE IN THE FUTURE

If an e-health resource is recommended to you with the aim of improving your baby's health, how likely would you be to use it?

WOMEN + MEN WITH NO CHILD AND PLANNING ONE IN THE FUTURE
o Very likely
o Likely
o Unsure
o Unlikely
o Very unlikely

If you had access to a personalized website or app that could help you improve your health or your family's health, consider what would prevent you from using it on an ongoing basis. For each of the following problems, please indicate how much they would affect your frequency of use of the app or website.

1. Takes too long to log in
    1. This would not affect my frequency of use
    2. This would have a minor effect on my frequency of use
    3. Neutral
    4. This would have a moderate effect on my frequency of use
    5. This would have a major effect on my frequency of use
2. Forgetting password
    1. This would not affect my frequency of use
    2. This would have a minor effect on my frequency of use
    3. Neutral
    4. This would have a moderate effect on my frequency of use
    5. This would have a major effect on my frequency of use
3. Information not being updated
    1. This would not affect my frequency of use
    2. This would have a minor effect on my frequency of use
    3. Neutral
    4. This would have a moderate effect on my frequency of use
    5. This would have a major effect on my frequency of use
4. Information not relevant to me
    1. This would not affect my frequency of use
    2. This would have a minor effect on my frequency of use
    3. Neutral
    4. This would have a moderate effect on my frequency of use
    5. This would have a major effect on my frequency of use
5. Information not interesting
    1. This would not affect my frequency of use
    2. This would have a minor effect on my frequency of use
    3. Neutral
    4. This would have a moderate effect on my frequency of use
    5. This would have a major effect on my frequency of use
6. Takes too long to load
    1. This would not affect my frequency of use
    2. This would have a minor effect on my frequency of use
    3. Neutral

4. This would have a moderate effect on my frequency of use
5. This would have a major effect on my frequency of use

7. Difficult to use
    1. This would not affect my frequency of use
    2. This would have a minor effect on my frequency of use
    3. Neutral
    4. This would have a moderate effect on my frequency of use
    5. This would have a major effect on my frequency of use
8. Ugly design
    1. This would not affect my frequency of use
    2. This would have a minor effect on my frequency of use
    3. Neutral
    4. This would have a moderate effect on my frequency of use
    5. This would have a major effect on my frequency of use

We are creating a website that helps parents and parents-to-be improve their health. Which of the following features would you most likely use?

View graphs illustrating the results of your last health assessment
1. Extremely unlikely
2. Unlikely
3. Neutral
4. Likely
5. Extremely likely

View expert-recommended resources relevant to your personalized health goals.
1. Extremely unlikely
2. Unlikely
3. Neutral
4. Likely
5. Extremely likely

Rate the quality of the expert-recommended resources for you andother families (to be seen publicly)
1. Extremely unlikely
2. Unlikely
3. Neutral
4. Likely
5. Extremely likely

Comment on how you felt about expert-recommendedresources.
1. Extremely unlikely
2. Unlikely
3. Neutral
4. Likely
5. Extremely likely

Have access to the latest news and research on health, parenting, and child development.
1. Extremely unlikely
2. Unlikely
3. Neutral
4. Likely
5. Extremely likely

Links to relevant communities and resources such as Facebook or WhatsApp groups.
1. Extremely unlikely
2. Unlikely
3. Neutral
4. Likely
5. Extremely likely

Input and view your child's growth over time.
1. Extremely unlikely
2. Unlikely
3. Neutral
4. Likely
5. Extremely likely

Compare your child's growth to other children.
1. Extremely unlikely
2. Unlikely
3. Neutral
4. Likely
5. Extremely likely

Are we missing any features you would like to see on a website that assists you in improving your health and the health of your family?

PREFERENCES FOR PARTICIPATING IN A RESEARCH STUDY

In order to understand the impact of a parent's health on their next pregnancy and on their children's health, we are developing a new study. In this section, we would like to ask you questions to help us understand how we can best design a study to engage study participants..

To determine if we are improving family health, we plan to collect survey data. What would be the preferred way for you to complete a study questionnaire? Please indicate your top two preferences:
• In person - at the local public health unit

• Phone calls
• E-mail
• Mailed

How would you like to be informed that a questionnaire is due to be completed?
• Notifications form a study app
• Notifications from a study website with a private webpage for each study family
• email
• text,
• telephone call,
• Other: please specify

In this new study, there will be contact between the participants and a study nurse. How frequently do you think an
appropriate amount of time would be to be in contact with the study nurse?
• o 2-3 times per week
• o Once per week
• o 2-3 times per month
• o Once per month
• o Once every two months
• Other: provide space for comments

In the new study we may request participants to provide a small blood sample. How likely would you be willing to participate in a study that required a blood sample, assuming all criteria of confidentiality would be preserved?
o Very Likely
o Likely
o Unsure
o Unlikely
o Very unlikely

If “very likely” or “likely”… Would you agree to have your child’s blood drawn for the study when they get older?
o Yes
o No

If yes, At what age?
o Newborn or older
o 6 months old or older
o 1 year old or older
o 2 years old or older
o 5 years old or older
o Other:

Would you agree to go to a commercial lab (e.g. Life Labs) to provide your blood sample for the study?

o Yes
o No
If No: Why not?

In this study, we plan to follow families for over 8 years. How frequently would you be willing to provide a blood
sample?
o Every 6 months
o Every year
o Every two years
o Only at the beginning and end of the study
o Only at the beginning and at the end of the study
o Unsure
If "unsure" ….

What are the main reason(s) that you might be uncertain? [Please select ALL that apply]:
o It depends on how my blood will be taken
o It depends on the frequency my blood will be taken
o I do not like needles
o I do not feel comfortable providing a blood sample
o Other, specify____

Would you be comfortable with providing other samples?
o Yes
o No

If yes, what samples would you be comfortable providing?
o Urine
o Stool
o Mouth swab / Saliva
o [If Male] Sperm

If no, why not?
o I would have concerns regarding the confidentiality of the study
o Assuring all confidentiality ethical procedures (e.g. no one except the research team will have access to your data; coding your identity under a study ID number keeping your name and personal information out of
the database, etc.), would this increase the likelihood of your participation in the study?
o There is no particular reason, I am just not sure if I would like to be part of the study

Would any of the following activities increase the likelihood of your participation in this study?
o Knowing that your participation will improve care provided to future families
o Receiving a regular newsletter about the progress of the study
o Receiving a gift card as a token of appreciation each time you provide blood
o None of the above would be a determinant for me to participate

o Receiving a brief health report from the research team about your blood findings increase the chances of your
participation in this study?
Is there anything the research team can do to improve the chances of your participation in this study?

K. Pearson correlations used to identify if participants' characteristics used for regression analysis were closely correlated.

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pwcorr WEEKLYPA education age income borncanada pregnancyintent cig parity
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	WEEKLYPA	educat~n	age	income	bornca~a	pregna~t	cig
WEEKLYPA	1.0000						
education	0.0173	1.0000					
age	-0.0463	0.1573	1.0000				
income	0.0924	0.1688	0.2222	1.0000			
borncanada	0.0924	-0.0610	-0.0573	0.0936	1.0000		
pregnancyi~t	-0.0610	-0.0343	-0.3082	-0.1105	-0.0231	1.0000	
cig	-0.0343	-0.1687	-0.0292	-0.1096	-0.0091	0.0089	1.0000
parity	-0.0350	-0.0066	0.1895	0.0425	-0.0389	-0.1500	0.0156

	parity
parity	1.0000

L. Pregnancy Intention Among Participants

Intention Planning Among Participants (n=1227)	
Are you currently thinking about or planning to have a child? • I have no plans for a pregnancy at this time/ My partner and I have no plans for a pregnancy at this time	644 (52%)
• I am currently trying to get pregnant/ My partner and I are currently trying to get pregnant	195 (16%)
• I am considering a pregnancy in the next 1 to 2 years/ My partner and I are considering a pregnancy in the next 1 to 2 years	306 (25%)
• I am considering a pregnancy in the next 3 to 5 years/ My partner and I are considering a pregnancy in the next 3 to 5 years	82 (7%)