Title: Sustainable eating in medical nutrition therapy for the treatment of type 2 diabetes

Background: Human health cannot be separated from planetary welfare. There is increasing evidence that points to anthropogenic climate change and chronic disease as global crises linked by a common factor – our food systems.[1–3] Agriculture generates roughly 30% of global greenhouse gas emissions, which contribute to climate change and can in turn threaten food quality and availability.[4] In addition, modern food systems promote nutrient-poor and excessive-caloric eating patterns which contribute to rising rates of non-communicable diseases (NCDs) such as type 2 diabetes (T2D).[3,5,6] To address these challenges, the World Health Organization, EAT Lancet Commission, and United Nations Intergovernmental Panel on Climate Change have recommended greater reliance on sustainable diets, which promote health; have low environmental pressure; and are culturally acceptable, accessible, affordable, safe and equitable.[2–4] Despite these recommendations, Canadians have been slow to adopt ecologically-positive eating practices, such as increasing plant-based food intake.[7] To motivate change at individual and policy levels, researchers have evaluated trends in food waste,[8] food security,[2,4] food consumption,[7] and national dietary guidelines.[9–11] Despite these forward-looking activities to improve our food systems and the diets of Canadians, few studies have investigated sustainable diets in medical nutrition therapy (MNT), which are dietary interventions provided by registered dietitians (RDs) to manage disease. *The importance of this research is multifaceted*: MNT is the first line and long-term treatment for the majority of NCDs.[12] The heavy burden of NCDs on global populations signify a large number of people that rely on MNT rather than national food guides as their primary nutrition resource. In addition, people receiving MNT often make dietary changes more successfully when working with RDs.[13] To our knowledge, there have been no reports of how RDs interact with people living with T2D to incorporate sustainable dietary patterns in managing this disease.[14]

Objectives: This 2-year project will: (***1)*** determine if and how dietary patterns currently recommended in MNT for T2D in dietetic practice address the multiple domains of sustainable diets, and ***(2)*** evaluate patients' and RDs' perspectives on sustainable diets in the context of T2D. Questions that will be explored include: Do patients and RDs value sustainability? From their perspective, is it practical to integrate sustainability in MNT? Does adopting sustainable diets in MNT facilitate or impede dietary behaviour change for the betterment of T2D-related outcomes, such as glycemic control and weight management?

Rationale: A primary public health concern is the increasing prevalence of T2D in Canada.[6] It has been established that MNT is integral to managing T2D.[12] Informed by the literature[8,9] and the professional experience of this applicant (Wu, Certified Diabetes Educator, RD), we found that MNT in T2D focuses on human health and sociocultural factors over ecological, agricultural, and economic domains of sustainable diets. What remains unknown are the practical realities, barriers, and/or facilitators that RDs and people with T2D face when navigating the topic of sustainability in therapeutic nutrition counselling. Indeed, certain dietary patterns for treating T2D incidentally involve plant-based food systems;[12] however, the demands of T2D management (*e.g.,* blood glucose monitoring, reducing carbohydrate intake) may be prioritized over sustainable eating practices. This study will help us understand how MNT can incorporate concepts of sustainable diets while upholding quality of care for disease management. Ultimately, results will be used to conceptualize a feasibility study that examines how sustainable eating practices can be incorporated in MNT for T2D.

Methodology: The proposed is a two-phased qualitative study conducted at the University of British Columbia (Vancouver, BC). The Consolidated Criteria for Reporting Qualitative Studies checklist will guide our report.[15]

PHASE 1

Overview: We will conduct a qualitative content analysis of Canadian guidelines and resources used in MNT for T2D. A content analysis will allow us to systematically analyze and develop common themes from professional and patient resources.[10,16] This analysis will be informed by Mazac et al.'s *Sustainability in Food-Based Dietary Guidelines (FBDG) Framework* (Figure 1).[10]

Data Collection & Analysis: Professional and patient resources will be identified through an online environmental scan and coded according to the framework. *Inclusion criteria*: text documents, in English, from reputable sources, and for Canadians. We will consult one RD working in diabetes care from each Canadian province and territory to ensure our list is representative and clinically relevant.

Knowledge Dissemination: A brief report including a visual diagram (such as Figure 1) will be produced to illustrate how sustainability is represented in MNT guidelines for T2D in the Canadian context. As both RDs and people living with T2D are mainly informed by these resources when providing or receiving MNT, this information will also aid in analysis of data in phase two.

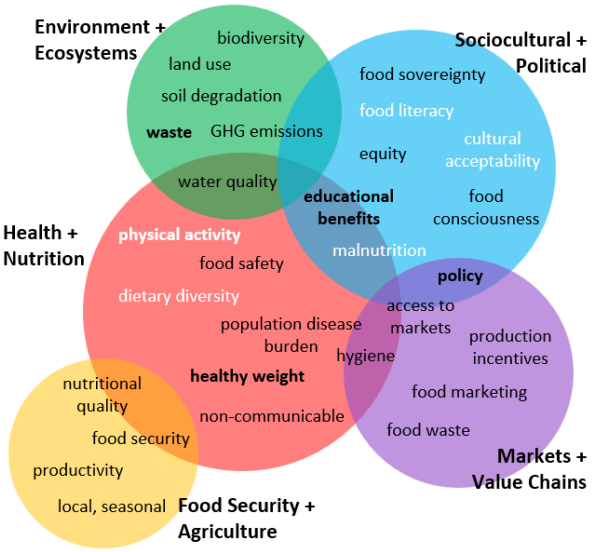


Figure 1. Simplified Sustainability in FBDG Framework[10]

PHASE 2

Overview: We will conduct virtual semi-structured interviews with ***(1)*** people living with T2D, and (***2)*** RDs providing MNT in T2D.

Participants: We will recruit people living with T2D for any duration of time, who have met with an RD at least once. *Exclusion criteria* include comorbidities requiring significantly more restrictive diets compared to standard T2D MNT (*e.g.,* late-stage renal disease). We will recruit RDs practicing in T2D for at least 6 months. All participants will be English speaking adults.

Sample Size: Following best practices for qualitative studies,[17] recruitment, data collection, and data analysis will occur in tandem until theoretical saturation (a point where no new themes have surfaced),[17] with a preliminary goal of ~25 interviews with patients and ~25 with RDs.

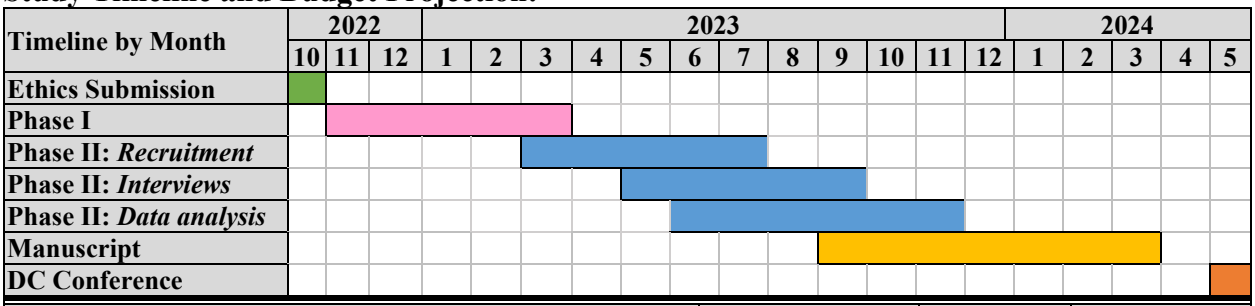
Recruitment: Recruitment strategies will include social media and partnerships with clinics and diabetes education centers to advertise the study during patient group education sessions and via posters in clinic waiting rooms. Purposeful and convenience sampling will be used to achieve gender, age, ethnic, and socioeconomic diversity, as well as representation from all Canadian provinces and territories.

Data collection: Interested participants will be screened for eligibility by phone, and directed to provide consent and complete a sociodemographic questionnaire through *Qualtrics,* a secure online platform for survey data collection. Qualitative data will be collected from virtual interviews that will last ~one hour. Interviews will be conducted by Wu and one to two research assistants. A licensed version of *Zoom* will be used to provide audio recordings that will be transcribed verbatim by a licensed transcription service *(Transcript Heroes, Toronto ON).*

Data analysis: Data will be imported to *NVivo12,* a qualitative data management software, and analyzed by Wu and two research assistants based on a rigorous thematic analysis approach.[18] Inductive coding will be used to identify emerging themes. Data from the two groups (patients and RDs) will be examined for similarities and/or differences. Data will also be compared to phase one outcomes to identify any relationships between patient and RD perspectives and resources used in MNT for T2D.

Relevance to Dietetic Practice: Dietitians are a well-positioned yet underleveraged resource to address the complex challenges in our food and health systems.[19] While the link between sustainable food systems and human nutrition are increasingly evident, ecological sustainability and clinical nutrition remain largely separate topics in dietetic practice. Findings from this research will address an opportunity for RDs to bridge human health and ecological welfare when working with people living with chronic disease. Specifically, this project will inform how dietary counselling balances patient goals, medical priorities, and ecological well-being, and identify how dietary patterns in people living with T2D are informed by various domains of sustainable diets. This knowledge will educate RDs and advance conversations on how MNT can promote both patient-centered care and planetary health.[14,19]

Study Timeline and Budget Projection:



Total Budget	Cost/Unit	Units	Total
[Phase 1] Dietitian consultant honorariums. We estimate ~30 min /call to review the resources.	$50/ person	13 pers	$650.00
[Phase 2] Patient interview honorariums (60 min)	$50/ person	25 pers	$1,250.00
Dietitian interview honorariums (60 min)	$100/ person	25 pers	$2,500.00
Transcription services (60 min/ interview)	$2.19/ min	3000 min	$6,570.00
Printing for coding (~15 pg/ interview x 3 coders)	$0.7/ pg	2250 pgs	$1,575.00
Research assistant salaries (20 hrs for Phase I, 180 hrs for Phase II). Based on UBC Lab Assistant job [union/nonunion, 11.48% vacation pay].	$21.76/hr	200 hrs	$4,352.00
Dissemination and conference travel	$1000.00	1 event	$1,000.00
Total			**$17,897.00**

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