Mount Saint Vincent University
Department of Applied Human Nutrition

Patient Satisfaction and Knowledge Following Gestational Diabetes Online Education in Atlantic Canada

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Abstract

Title: **Patient Satisfaction and Knowledge Following Gestational Diabetes Online Education in Atlantic Canada**

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Introduction: The rising Gestational Diabetes (GD) prevalence has strained the capacity of Atlantic Canada's largest Diabetes in Pregnancy clinic. Preliminary semi-formal interviews with clinic dietitians revealed perceptions that glycemic index (GI) education was not integrated fully in GD standard care in alignment with Diabetes Canada Clinical Practice Guidelines recommendations (2018). Despite this potential gap, their transition to 'home-based' online follow-ups had reduced workload compared to in-person visits. However, the unanticipated full shift to online education amid the COVID-19 pandemic in March 2020 raised concerns about the quality and effectiveness of care in the absence of in-person interactions. **Purpose and Methods:** This project involved two studies evaluating education effectiveness using the Kirkpatrick Model. Study one (n=4) was a randomized control trial from 2019-22 on the feasibility of integrating online GI educational materials with synchronous videoconferencing and study two (n=29) was a quality assurance survey on the clinic's online asynchronous video education in GD standard care from 2021-22. Adapted versions of the Glycaemic Index Questionnaire © (face- and content-validated) were used in both studies to measure patient satisfaction. Study one also used it to measure knowledge and behaviour change, along with three-day diet records for dietary GI, and self-monitored blood glucose for glycaemic control. **Results**: Findings across both studies indicated consistently high satisfaction levels, irrespective of delivery mode and presence of GI education, with no statistically significant difference between delivery modes. However, feedback indicated that online education was not accepted as a standalone approach to care, with requests for more interaction and one-on-one support. In Study 1, low dietary GI was shown irrespective of lower GI education since baseline (dietary GI < 55). The low GI group, represented by one participant, experienced a notable increase in GI knowledge following online LGI education (scores at baseline: 61%, post-intervention: 71%, and follow-up: 94%)s. **Conclusions**: GD standard care yielded high patient satisfaction levels, in-person and online. The asynchronous approach received more constructive feedback across the studies, particularly highlighting a demand for incorporating synchronous methods to enhance care quality. The consistent low dietary GI since baseline warrants further investigation. Due to results stemming from a small sample and quality assurance data, the ability to draw conclusions is limited, and findings may not represent the patient population and other samples. Future studies with larger samples are necessary to validate these findings and further investigate the impact of online LGI education on glycaemic control in GD.

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Table of Contents

List of Tables

List of Figures

List of Abbreviations

Abbreviation	Expansion
1h PPG	1-hour postprandial glucose
2h PPG	2-hour postprandial glucose
3DDR	Three-day diet record
AMDR	Acceptable macronutrient distribution ranges
BMI	Body mass index
CPG	Clinical practice guidelines
DIP	Diabetes in Pregnancy
DM	Diabetes Mellitus
DRI	Dietary Reference Intake
FPG	Fasting plasma glucose
GD	Gestational Diabetes
GI	Glycaemic index
GWG	Gestational weight gain
KM	Kirkpatrick Model
KT	Knowledge translation
KTA	Knowledge-to-Action
LGI	Lower glycaemic index
MNT	Medical Nutrition Therapy
PARIHS	Promoting Action on Research Implementation in Health Services
RCT	Randomized control trial
RD	Registered dietitian
SMBG	Self-monitored blood glucose
T2D	Type 2 diabetes

Glossary

Term	Definition
Acceptability	The degree to which patients or individuals are willing to embrace and engage with a specific healthcare delivery mode or approach[1].
Cultural Appropriateness	Refers to designing interventions that respect and align with diverse cultural values, promoting inclusivity.
Delivery Mode	Refers to the format through which educational content is provided to patients. Includes in-person education, distance learning and hybrid learning.
Distance Learning	Distance learning, either synchronous or asynchronous, facilitates education remotely, bridging geographical gaps through online or offline methods [2].
Education Program Evaluation	An assessment and analysis of the design, implementation or outcomes of an education intervention with the purpose of learning or decision making [3].
Experience	The events or interactions that individuals go through, which contribute to their understanding and perceptions.
Gestational Diabetes	A type of diabetes that emerges in the during the second or third trimester of pregnancy, resulting in elevated blood glucose levels in individuals not previously disposed with diabetes [4].
Glycaemic Index	A measure indicating the blood glucose-raising potential of digestible carbohydrate in foods, reflecting the glycaemic property in digestion [5].
Knowledge Translation	The process of applying and exchanging knowledge among researchers and users, to expedite research benefits for Canadians [6].
Low Glycaemic Index	Refers to foods or diets that have a Glycaemic Index value of 55 or less [5].
Lower Glycaemic Index	Refers to foods or diets that have a Glycaemic Index that is lower compared to other foods or diets but is not necessarily within the low GI range (55 or less). This term is comparative, indicating that one item or diet has a lower glycaemic index than another [5].
Quality Assurance	Monitoring and evaluation of healthcare practices to ensure they meet established standards and guidelines, to maintain consistent, high-quality care and adherence to best practices [7].
Quality Improvement	The continuous efforts within healthcare to enhance processes, services, and outcomes, involving ongoing assessment, adjustment, and refinement to achieve better results and patient satisfaction [7].
Patient Satisfaction	The level of contentment based on expectations and encounters with a product, service, or situation [8].
Self-Management Support	Strategies to enhance an individual's capacity to independently manage their diabetes [9].
Self-Management Education	Systematic approaches to engage individuals to actively monitor health parameters, make informed decisions, and apply knowledge and skills [9].
Standard Care	Refers to the established, evidence-based practices for diagnosing, treating, and managing diabetes according to the guidelines and recommendations set forth by Diabetes Canada [10].
Video Education	Refers to recorded or live video content for learning [11].

CHAPTER 1.0. INTRODUCTION

Gestational Diabetes (GD) is characterized by transient hyperglycaemia (high blood glucose) during pregnancy, associated with increased maternal and neonatal risks, such as neonatal hypoglycaemia, birth trauma, and increased hospital stays [10,12,13]. According to Statistics Canada (2010-2011), GD affects 3-5% of live birth pregnancies, with an incidence of 54.5 cases per 1,000 deliveries [14,15]. Some provinces have reported higher rates, with Nova Scotia documenting 9.5% of pregnancies diagnosed with GD in 2019 — double the rate since 2014 [10,16,17]. The increase has created significant challenges for local healthcare providers and hospitals, particularly in adapting to the growing number of diagnoses and referrals, which has led to changes in care provision and increased workloads [18].

At Atlantic Canada's largest Diabetes in Pregnancy (DIP) clinic, GD standard care aligns with Diabetes Canada Clinical Practice Guidelines (CPG, 2018) and the Reproductive Care Program of Nova Scotia [10,19]. The primary focus of care has been on glycaemic control and adequate nutrition for both mother and infant. A key component of this program is self-management education, particularly Medical Nutrition Therapy (MNT), which provides patients with knowledge and skills for self-management. This program includes strategies for carbohydrate counting (175g per day) and substituting higher glycaemic index (GI) foods with lower GI alternatives [9,10,20]. Lower GI diets (LGI) have been shown to minimize adverse glycaemic excursions [12,21,22]. To support these recommendations, Diabetes Canada and Dietitians of Canada have developed several evidence-based GI education materials, released between 2014 and 2019 [23–26]. In Nova Scotia, registered dietitians (RD) have self-reported increased GI knowledge and self-efficacy, although they do not perceive their practice has integrated GI education [27].

The COVID-19 pandemic necessitated a shift to online distance learning (fully remote care), prompting a reassessment of care quality [28,29]. Quality assurance (QA) initiatives were undertaken to evaluate the effectiveness of distance learning in delivering both standard care and evidence-based GI educational materials. The Kirkpatrick Model (KM), a comprehensive framework developed by Donald Kirkpatrick in the mid-50s, served to assess education effectiveness (37,38). The foundation of the model, 'reaction', influences subsequent levels, including knowledge uptake, behaviour change, and results (e.g., glycaemic control) [30].

Insights from the KM were instrumental in guiding effective knowledge translation (KT) in practice, aligning with the Knowledge-to-Action (KTA) framework aimed at guiding dissemination, exchange, and application of evidence into practice [6].

This thesis includes two studies conducted in Atlantic Canada's central DIP clinic, spanning periods before and during the COVID-19 pandemic.

Study 1: Adapting a National Glycaemic Index Education Platform for Nova Scotian Patients and Clinicians Treating Gestational Diabetes Using Distance Education Strategies

Initiated in Summer 2019, the GI in GD Online Study aimed to assess the effectiveness of evidence-based GI education layered onto GD standard care and adapted for use in both in-person and distance learning in Nova Scotia.

Study 2: Patient Experience with Home-Based Gestational Diabetes Education during COVID-19: A Satisfaction Questionnaire

Initiated in Winter 2020, the Online GD Education study was a quality assurance initiative designed to evaluate patients' reaction to the clinic's online standard care.

CHAPTER 2.0. LITTERATURE REVIEW

2.1. Overview of Gestational Diabetes

2.1.1. Context and Impact

The prevalence of GD has been rising in Canada in recent years [14,31]. Nova Scotia, for instance, reported a doubling of GD diagnoses in pregnancies from 2014 to 2019, reaching 9.5% [10,16]. Over the course of this project, the prevalence continued to rise, reaching 14.8% in 2024 [32]. In line with national and international statistics, Canada (2010-2011) reported 54.5 cases per 1000 deliveries, affecting 3-5% of live births [14,15]. Additionally, the 10th International Diabetes Federation Atlas (2021) predicts a 24% increase in Diabetes Mellitus (DM) cases, including Type 1 Diabetes, Type 2 Diabetes (T2D), GD, and Prediabetes, in North America and the Caribbean by 2045 (37). Notably, Atlantic Canada has the highest DM rates in the country, with Nova Scotia's higher GD prevalence threatening clinic care capacity and quality [33,34].

The growing costs of GD treatment impact healthcare systems and patients [35,36]. In Nova Scotia, the estimated cost of DM was $114 million in 2022, projected to rise to $130 million by 2032 [37]. One in six households in the region faces food insecurity [38]. This factor increases GD risk due to low income and inadequate access to nutritious food. These challenges are compounded by financial barriers to GD management, including a lack of insurance for medications and supplies, as well as high costs associated with adhering to dietary recommendations and lifestyle change [37–39].

The COVID-19 pandemic, declared a global emergency by the World Health Organization in March 2020, led to a slowdown in the province's economic growth acceleration, resulting in increased costs of living (e.g., groceries, oil, and housing) [28,29,40]. However, Nova Scotia's primary healthcare funding initiative in the 2023/24 budget plan did not prioritize DM care, exacerbating clinic capacity strain [28,29].

2.1.2. Pathophysiology and Complications

During pregnancy, circulating placental and maternal hormones induce insulin resistance to build foetal glucose supply [13,41,42]. In GD, glucose intolerance is attributed to exaggerated insulin resistance and impaired β-cell function, typically presenting between 20 and 24 weeks of

gestation [13,43–45]. Inadequate maternal insulin-stimulated glucose uptake results in unregulated lipolysis, leading to excess circulating fatty acids [13,45]. Both substrates are shunted to the foetus, prompting premature maturation of pancreatic insulin secretion and foetal overgrowth [13,43,45]. Left untreated, these elevated glucose and lipid levels impact health outcomes both during and post-delivery.

Complications from untreated GD affect both maternal and neonatal health. During pregnancy, persisting high maternal glucose and lipid levels have been associated with oxidative stress, causing vascular damage and endothelial dysfunction, such as hypertension and pre-eclampsia [10,13,46]. An additional concern with elevated maternal glucose is macrosomia, characterized by a birth weight of 4000g or more, which increases birth complication risk such as maternal haemorrhage, perineal tearing, and neonatal shoulder dystocia [13,42,47,48].

When maternal nutrient flow is curtailed at birth, changes in the foetus' hormonal regulation and metabolic processes occur. Specifically, the foetus undergoes changes in glucose metabolism and insulin sensitivity, leading to elevated insulin levels (hyperinsulinemia) and a subsequent drop in glucose levels (hypoglycaemia) [42]. Timely intervention to address shoulder dystocia and neonatal hypoglycaemia helps prevent neurological damage and related complications, including birth injuries, neonatal jaundice, and respiratory distress [42,47]. Ongoing dysregulation of glucose metabolism heightens the risk of future T2D development in both mothers and infants [10,13,44].

2.1.3. Risk Factors

GD risk factors include, but are not limited to, genetic makeup, environmental factors, and lifestyle factors such as stress, sleep, and diet quality [10,13,49]. For instance, specific ethnic groups (e.g., African, Arabian, Asian, Latino/a, Indigenous, and South Asian) are at higher risk due to a combination of genetics, socioeconomic factors, environmental influences, and cultural practices [10,49,50]. For example, diets common in Latino/a groups often include higher-GI foods, and both Asian and South Asian cultural patterns may be rich in refined carbohydrates and saturated fats, both of which lead to fluctuating glycaemic response, heightening risk [49]. Additionally, socioeconomic status, lifestyle, and acculturation among immigrants can

exacerbate GD susceptibility by limiting healthcare access, affecting dietary habits, and contributing to migration-related stress (1,2). This is relevant in Nova Scotia, where immigrants, predominantly African and South Asian, make up 7.4% of the population (2022), with 2.2% having arrived in the past five years [51]. Ethnic minority immigrants also represent 32% of the DIP clinic patient demographic.

Chronic disease predisposition prior to birth may be explained by Barker's hypothesis, which is applies to GD. This theory suggests that exposure to suboptimal intrauterine and early postnatal environments increases the risk of metabolic syndrome (e.g., obesity and reduced insulin sensitivity) [52,53]. A potential mechanism supporting the hypothesis is early programming effects observed in epigenetic studies, where exposure to environmental factors (e.g., oxidative stress, hyperglycaemia, and inflammation) induces methylation of genetic material in foetal adipocytes [54,55].

In addition to early programming, advanced maternal age (35 years and older), obesity, and diagnoses associated with insulin resistance (e.g., polycystic ovary syndrome or acanthosis nigricans) or glucose intolerance (e.g., prediabetes, GD, or macrosomia) are linked to hyperglycaemia in pregnancy [10]. In Nova Scotia, there has been a notable increase in advanced maternal age and obesity (defined as an excessive accumulation of body fat that poses a health risk) among those entering pregnancy, mirroring national trends [10,56]. These observations are based on body mass index (BMI), which related weight to height. While the World Health Organization categorizes obesity as a BMI of 30.0 kg/m^2 or greater, BMI is primarily a risk assessment tool and not a definitive measure of obesity; it does not account for muscle mass, bone density, or ethnic variations [10,19,57]. Current practice guidelines recommend assessing obesity by considering BMI alongside other psychological and physical health factors, ensuring comprehensive evaluation [57,58].

2.1.4. Screening and Diagnosis

The International Diabetes Federation 10th Atlas recommends an oral glucose tolerance test between 24 and 28 weeks of gestation, using fasting plasma glucose (FPG), 1-hour postprandial glucose (1h PPG), and 2-hour postprandial glucose (2h PPG) markers [10,59]. However,

variations in screening protocols and criteria exist, resulting in differences in sensitivity and specificity [60].

The Diabetes Canada CPG (2018) endorses criteria from the International Association of the Diabetes and Pregnancy Study Groups and the Canadian Diabetes Association (2013; the former name of Diabetes Canada, renamed in February 2017) as best practice [10]. The criteria, presented as 'alternate' and 'preferred' approaches, detailed in Table 2.1, are derived from risk ratios associated with adverse perinatal outcomes from the Hyperglycaemia and Adverse Pregnancy Outcomes study (2008). Both diagnose GD when plasma glucose exceeds 11.1 mmol/L or the tested reference range (Grade D, Level 4)[1]. The 'alternate' approach, with a risk ratio of 1.75 (Grade B, Level 1), emphasizes sensitivity over specificity [59–61]. This results in a substantial increase in GD prevalence and the potential for false positive diagnoses. The 'preferred' approach has a higher risk ratio of 2.0, more accurately diagnosing GD cases [61].

Table 2.1. Diagnostic criteria for 'Alternate' and 'Preferred' screening approaches

Criteria	Approach	Steps	OGTT Load	No. abnormal	FPG (mmol/L)	1h PPG (mmol/L)	2h PPG (mmol/L)
IAPDSG 2010	Alternate	1	75g	≥1	5.1	10	8.5
CDA 2013	Preferred	2[a]	75g	≥1	5.3	10.6	9.0

Adapted from the International Diabetes Federation Diabetes Atlas and Brown et al. [59,62]
FPG= Fasting Plasma Glucose; 1h PPG= 1-hour postprandial plasma glucose, 2hPPG= postprandial plasma glucose ; OGTT= Oral Glucose Tolerance Test; IADPSG = International Association of the Diabetes and Pregnancy Study Groups, CDA = Canadian Diabetes Association
a. The approach begins with a 50g OGTT with a 1h PPG, followed by a 75g OGTT (Grade C, Level 2).

In Nova Scotia, the GD screening protocol aligns with the Reproductive Care Program of Nova Scotia's guidelines (updated February 2022), integrating recommendations from Diabetes Canada CPG (2018) [19,31,63]. Before COVID-19, screening occurred at 24 to 28 weeks of gestation, using either the 'preferred' or 'alternate' approach, with early screening (before 20 weeks of gestation) reserved for high-risk pregnancies. The 2022 protocol amendment changed

[1] In Diabetes Canada CPG, "Grade" reflects evidence quality (A to D), and "Level" indicates evidence hierarchy (Level 1 to 4, high to low) [9]. For example, a Grade A recommendation signifies high level high-quality evidence indicating confidence that following the recommendation will lead to the desired outcome, while a Level 4 designation indicates least reliable evidence.

early screening inclusion to all pregnancies [31,60]. While early screening is most beneficial for high-risk cases, universal screening is generally low risk, and increases the chance of mitigating prolonged hyperglycaemia [31,60,64]. This approach involves assessing Haemoglobin A1c, with a $\geq$ 5.7% threshold for diagnosing GD (24.7% sensitivity and 95.5% specificity) [64–66]. High-risk patients for renal disease or hemoglobinopathy have FPG tested in early screening, with diagnosis at a $\geq$ 7.0 mmol/L threshold [19,65]. Undiagnosed pregnancies get reassessed at 24 to 28 weeks of gestation, using either 'alternate' or 'preferred' screening approach.

2.1.5. Gestational Diabetes Management

Educational interventions for chronic disease management are complex, often involving components such as patient education, behaviour change strategies, and care coordination to ensure quality of care [67–69]. The Diabetes Canada CPG (2018) organizes care within the Chronic Care Model (figure 2.1), a comprehensive framework of essential components needed within the community and health system for quality care [20]. To achieve quality care, quality improvement (QI) processes are incorporated into standard care, adapting to such variables within these systems [9]. During COVID-19, this model guided the DIP clinic's QI initiative to adapt to changing circumstances and challenges for continuity of care, serving as a contextual framework in the evolution of this project [20,70].

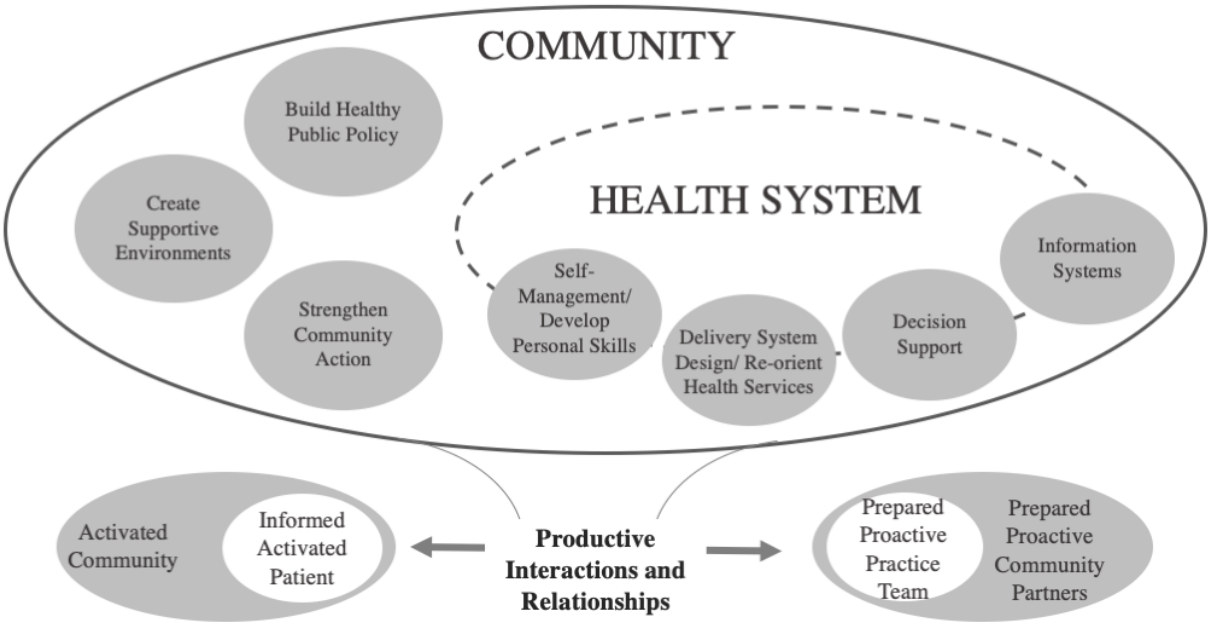

Figure 2.1 The Expanded Chronic Care Model

Adapted from Sherifali et al. (2018), with permission [20]

Per Diabetes Canada CPG recommendations, all individuals with GD should receive self-management education (Grade B, Level 2) [68]. Self-Management support, a cornerstone of DM care, is particularly beneficial when combined with the education, as it empowers patient to manage their condition. The latter improves knowledge and skills for self-monitoring health parameters and informed decision-making [20,68]. Timely education, tailored to enhance self-care practice and behaviours (e.g., willingness to change, culture, health beliefs, and socioeconomic status), is recommended (Grade A, Level 1A). Educational instruction should include cognitive-behavioural interventions (e.g., problem-solving, goal setting, and blood glucose targets) (Grade B, Level 2), given documented initial barriers (e.g., discouragement and anxiety) to behaviour change in GD [69,71–73]. Motivation stems from heightened awareness of risk to foetal well-being and long-term T2D, emphasizing the significance of these recommendations within the limited timeframe from diagnosis [69,74,75].

Lifestyle change (e.g., MNT and physical activity) is recommended as initial treatment, with pharmacological therapy considered if glycaemic targets are not achieved within one to two weeks (Grade D, Consensus) [10]. Challenges have been documented within these methods,

most often when physical activity is contraindicated or when patients are averse to medications [74,76–78]. Insulin, while generally safe, may induce stress and excessive use can impact motivation for behaviour change, potentially leading to gestational weight gain (GWG) [76–79]. Metformin, an oral anti-glycaemic agent, can be offered as an alternative or adjunct to insulin (Grade A, Level 1A), despite limited long-term safety data. Glyburide, though an option when insulin and metformin are declined (Grade B, Level 2) poses a higher risk of preeclampsia and neonatal hypoglycaemia [10,80]. Patients often favour MNT for its relative safety and sustainability, especially when individually tailored [10,78,81–83]. Closely monitored food intake and modified dietary patterns are crucial, particularly to avoid excess carbohydrate intake.

The Diabetes Canada CPG (2018) also recommends monitoring GWG to mitigate fetal overgrowth and caesarean sections (Grade B, Level 2) [10]. The National Academy of Medicine (formerly Institute of Medicine) has specific GWG targets by pre-pregnancy BMI, with more restrictive targets for overweight (15 to 25lb for BMI 25 to 29.9 kg/m2) and obesity (11 to 20 lb for BMI 30 kg/m2 or higher) categories compared to the normal range (25 to 25 lb for BMI 18.5 to 24.9 kg/m2) category [84].

Weight regulation during pregnancy is influenced by a complex interplay of factors, including behaviour, biology, genetics, and environmental conditions [45,84,85]. MNT must account for this individual variability. Research shows that GWG can vary by dietary pattern, even without caloric or carbohydrate restrictions. While a LGI diet is associated with reduced GWG in uncomplicated pregnancies, it did not have a significantly impact on GWG in a study involving gestational hyperglycemia (n = 47) [12]. However, this study demonstrates significant improvements in glycaemic control. While reduced GWG is an important objective of GD management, the findings suggest effective glycaemic management can be achieved even when the diet does not significantly impact GWG.

2.2. Medical Nutrition Therapy

2.2.1 Macronutrient Composition – A Focus on Carbohydrate Quantity

Dietary macronutrient composition is central to MNT for GD, with emphasis on carbohydrate quantity and quality [10,16,86]. Globally, CPGs use Accepted Macronutrient Distribution Range

(AMDR) (45 to 65% carbohydrates, 20 to 35% fat, 10 to 35% protein) and Dietary Reference Intakes (DRI) as evidence-based benchmarks [87]. While guidelines vary in caloric intake and carbohydrate distribution, they consistently prioritize high-quality carbohydrate- and fat-containing foods, like fibre-rich foods, whole grains, fruits, vegetables, nuts, seeds and fatty fish, while limiting highly processed foods, added sugars, sodium and saturated fats (e.g., white bread, sugary cereals, and sugary drinks) [13,88]. This dietary pattern has been associated with improved glycaemia and less untreated GD complications [81,89,90]. However, the complexity of GD management, including varied metabolic responses and long-term outcomes, continues to drive research in carbohydrate distribution (between 26% to 60%) to glycaemic control [89].

Research suggests that higher carbohydrate diets (55 to 65% carbohydrates) do not necessarily worsen glycaemic control in GD. In a randomized crossover study by Hernandez et al. (2014), participants (n = 17) on a high carbohydrate, low fat diet (60% carbohydrate, 25% fat, 15% protein) exhibited lower FPG ($p = 0.03$), reduced insulin resistance ($p = 0.05$), and lower serum free fatty acids ($p = 0.06$) compared to those on a lower carbohydrate, high fat diet (40% carbohydrate, 45% fat, 15% protein) [91]. It is important to note that high-quality carbohydrate and fat intake was recommended to participants in the high carbohydrate, low fat diet group, for potential postprandial benefits amid liberalizing carbohydrate quantity. In a RCT by Moreno-Castilla et al. (2013) on lower and higher carbohydrate diets (40% and 55%) in GD (n = 152), no significant differences were found in insulin requirements or adverse outcomes, particularly given high dietary adherence [92]. These findings underscore that, despite differences in carbohydrate proportions between the diets, outcomes such as insulin requirements and adverse pregnancy outcomes do not differ when participants follow a high-quality carbohydrate diet.

Research suggests that moderate carbohydrate restriction (< 35-45%) in GD may help reduce postprandial hyperglycaemia and the risk of fetal overgrowth [81,93]. Unlike a higher carbohydrate diet, a carbohydrate restriction approach allows the consumption of small portions of lower-quality carbohydrate foods, carefully timed to prevent rapid heightened glycaemic response. However, considerable caution is warranted when lowering carbohydrate distribution to avoid ketosis, which can negatively impacts on foetal neurodevelopment [81]. Ketosis, a result from excessive ketones produced during fat metabolism, can progress to ketoacidosis with

functional risks to circulatory, renal and central nervous systems [10,94]. To meet caloric needs, fat intake is often increased in a low-carbohydrate diet. Prioritizing high-quality fats is advised to mitigate the potential negative effects of saturated and trans fats on exacerbating hyperglycaemia [81]. Additionally, nutrient deficiencies in vitamins (e.g., B vitamins) and fiber common in carbohydrate-rich foods may arise [81,95]. These factors highlight concerns raised in the literature about the sustainability of carbohydrate restriction for GD management.

Carbohydrate counting is a complementary strategy for minimizing the glycaemic impact of carbohydrates throughout the day; it involves portioning carbohydrate servings (by 15g) across meals and snacks, typically with a daily limit of 175g (based on DRI for pregnancy) [10,81,93]. Although its effectiveness as a standalone approach for glycaemic control in GD is limited, a Jordanian RCT (n = 75) found significant reductions in fasting blood glucose (FPG) levels (4.36 ± 0.46 mmol/L, $p = 0.021$) in the carbohydrate counting group compared to the control group (standard care, without carbohydrate counting) (4.81 ± 0.66 mmol/L) [96]. However, individual responses to carbohydrate counting may vary, due to factors such as the type of carbohydrates consumed, personal metabolic responses, and dietary habits. In the same study, a third group, which combined carbohydrate counting and the Dietary Approaches to Stopping Hypertension diet – a diet emphasizing fruits, vegetables, whole grains, lean protein, and low-fat dairy while limiting saturated fat, cholesterol, and sodium – showed further reductions in FPG and 1h PPG, along with significantly reduced serum insulin levels ($p < 0.0001$). These findings support the use of carbohydrate counting for improving glycaemic control, especially when paired with other dietary patterns.

2.2.2. Glycaemic Index – A Focus on Carbohydrate Quality

First introduced by Jenkins et al. in 1981, GI was conceptualized while studying the postprandial influence of carbohydrate-containing foods, recognizing variations in glycaemic response related to food processing, dietary fibre, and carbohydrate composition [22,97]. The GI ranks carbohydrate-containing foods on a scale of 0-100, grouped as high (> 70), medium (56 to 69), and low (< 55) GI [22,97]. High GI foods are associated with a rapid rise and fall in blood glucose, while low GI foods lead to a gradual and sustained response, helping to stabilize blood glucose [16,22,98]. Research highlights the potential of lower GI diets (LGI) to reduce chronic

disease risk, including DM and improved glycemic control [99]. In the context of GD, the LGI diet offers advantages over other dietary approaches, being both safe and adaptable to individual dietary patterns, though it may cause mild bloating or flatulence [16,81,100].

Several studies have investigated the LGI's effectiveness on glycaemic control in GD. A 2018 systematic review and meta-analysis of 18 studies comparing dietary patterns in GD found it to significantly reduce FPG (mean: -5.33 mg/dL; 95% CI: -6.91 to -3.76) and postprandial glucose (PPG) (mean: -7.08mg/dL 95% CI: -12.07 to -2.08), compared to controlled medium- to high- GI diets [21]. These reductions suggest potential for improved glycaemic control, specifically through enhanced insulin sensitivity (reduced FPG) and improved β-cell function (reduced 2h PPG) [81,101,102]. However, it is important to note that only four studies on LGI were included, and they were rated as having low to very low-quality evidence, with high heterogeneity. A more recent meta-analysis by Xu et al. (2020) of six studies reinforces the LGI diet's efficacy in GD, showing significantly reduced 2h PPG (Std MD: -0.46; 95% CI: -0.82 to -0.10, $p = 0.01$) [103].

The impact of LGI diets on insulin sensitivity extends to their impact on insulin requirements. Moses and al.'s (2009) randomized control trial (RCT) found a significantly lower incidence of insulin treatment with the LGI diet (nine of 31 participants) compared to a higher-fibre, higher GI diet (19/32) in GD (n = 62) ($p < 0.05$) [78]. However, a meta-analysis of six studies by Xu et al. (2020), they found the LGI diet had no significant impact on insulin requirements in GD compared to a higher GI diet (Std. MD = 0.91; 95% CI = 0.68 to 1.22; $p = 0.55$), despite significant reductions in 2h PPG (Std. MD = -0.46; 95% CI = -0.82 to -0.10; $p = 0.01$) compared to higher GI diet interventions [78,103]. Interestingly, Wei et al.'s (2016) meta-analysis of five studies found that while higher fibre content in LGI diets didn't significantly affect insulin initiation, there was lower risk of requiring it (RR = 0.69; 95% CI: 0.52-0.92; $p = 0.01$) when fibre levels were similar between LGI and higher GI diets [83]. This suggests that LGI alone may be beneficial in decreasing insulin requirements.

2.2.3. Nova Scotian Recommendations

In Nova Scotia, GD standard care aligns with Diabetes Canada CPG (2018) and the Reproductive Care Program of Nova Scotia, both focusing on glycaemic control and adequate

nutrition for mother and infant [10,19]. Recommendations for MNT include carbohydrate counting with a daily limit of 175g (Grade C, Level 3), and replacing higher GI food with lower GI foods – a new addition in the 2018 update (Grade C, Level 3) [10,19]. The Canadian Food Guide complements these recommendations, emphasizing nutrient-density and limiting highly processed foods, sodium, sugars, and saturated fats [104]. Despite the guide's 2019 update moving away from serving sizes, DRIs and AMDR remain relevant, providing a framework for optimizing nutrient intake during pregnancy. These recommendations provide a foundation for individualizing dietary patterns based self-monitored blood glucose (SMBG) and GWG.

After MNT, glycaemic control is monitored daily with SMBG, targeting FPG, 1h and 2h PPG. These targets, ranging from 3.8 to 5.2 mmol/L for FPG (Grade B, Level 2), 5.5 to 7.7 mmol/L for 1h PPG (Grade D, Level 4), and 5.0 to 6.6 mmol/L for 2h PPG (Grade B, Level 2) are set to mitigate complications [19]. Patients are instructed to report readings four times per day until glycemic targets are met. However, the DIP clinic discontinues SMBG once glycaemic control has been established. This practice opposes findings in T2D indicating that regular monitoring provides valuable insights into glycemic control and intervention effectiveness [105,106].

2.3. Nutrition Education

2.3.1. Education

Education can be categorized into two key components: content and packaging. Content is the knowledge conveyed, while packaging refers to the strategies and materials used to communicate that content [107]. Both components are essential for ensuring that education is informative and applicable for learners. In GD, effective nutrition education promotes behaviour change to mitigate complications [16,81]. The development of this education must consider the feasibility and sustainability of dietary patterns in real-life contexts, factoring cultural appropriateness – such as cultural norms, values, and individual preferences – along with behavioural habits and social circumstances like food security [68]. Each dietary pattern presents distinct considerations for adoption; for example, carbohydrate restriction may require intensive planning and monitoring, whereas the LGI diet offers a more flexible and adaptable alternative. GI education has been recognized as an important strategy for guiding the application of a LGI diet, and equally for its short- and long-term adherence [16,78,81,108].

Since its initial recommendation for Type 1 and T2D, GI education faced a slow uptake among RDs, with only 40% integrating it into practice by 2006 (1). The low adoption, along with partial integration – lacking content on glycaemic response and meal planning – was primarily due to practical barriers, such as the belief that applying GI was too difficult, lacking suitable GI education materials, and insufficient data for diverse populations [109,110]. However, these issues have since been addressed with the development and adoption of evidence-based GI educational materials [67,111]. For instance, in Kate et al.'s (2020) quality assurance study evaluating the effectiveness of Dietitians of Canada's Learning on Demand platform for Nova Scotia RDs (n = 5), all participants showed improvements in self-efficacy and GI knowledge [27]. Despite these advances, semi-formal interviews with DIP clinic RDs revealed that they perceived GI education as not being integrated in their practice [27,112]. This suggested a potential gap between the availability of GI educational materials and their transferability within their clinical setting, highlighting an area requiring investigation to ensure patients could fully benefit from it.

2.3.2. Nutrition Education Content

Nutrition Education within MNT in GD standard care, as outlined in section 2.2.3 encompasses the translation of dietary recommendations into actionable knowledge and strategies to support patient adherence, and considerations for individual and cultural adaptability. Implementing GI education requires careful consideration to ensure patients could effectively apply new knowledge in informed decision-making. This education includes addressing common misconceptions, such as the belief that only low GI foods should be chosen when dining out or meal planning, or that they are more expensive, creating an illusion of limited applicability [110]. However, the benefits of LGI in GD, including reduced FPG, 2h PPG, and insulin initiation, associated with a five to nine unit decrease in dietary GI, are achievable if low GI foods are consumed 50 to 60% of the time [16,78,101,113,114]. This flexibility facilitates moderation, particularly for various cultural lifestyles. LGI interventions have been effective in achieving this reduction in a timely manner, typically within two to ten weeks, which is crucial for overcoming potential challenges in knowledge transfer during the pregnancy period [16,71].

2.3.3. Nutrition Education Packaging

2.3.3.1 Materials

MNT educational materials are important for enhancing patient understanding of dietary recommendations and promoting self-management skills [68]. The DIP clinic supplements oral presentation with their own instructional handouts featuring reviewed content, practical examples and recipes. Resources from Diabetes Canada (e.g., Just the Basics and The Plate Method) and Canada's Food Guide are also provided [4,104].

The perception that GI education may not be integrated partly stems from the absence of region-specific GI education materials, as none had been adapted due to clinic capacity constraints [112]. Grant et al. (2015) conducted a quasi-experimental study in T2D to develop, pre-test and validate the Glycaemic index Questionnaire (GIQ) © tool along with other GI education materials, including a GI Food Guide, a Low GI PowerPoint Presentation, and a Low GI Recipe Book, to evaluate GI education effectiveness [16,67]. These materials were later used with a three day diet record by Grant et al.'s (2017) Central Canadian RCT in urban GD (n = 74), where they were found effective in achieving a high level of patient satisfaction, improving GI knowledge from baseline to post-intervention (mean ± SEM; 47 ± 3% to 88 ± 3%; $p \leq 0.0001$), and significantly decreased dietary GI within two weeks post-intervention (mean ± SEM; 57 ± 0.6 to 51 ± 0.6, $p \leq 0.001$) [16]. While 2h PPG levels were lower in LGI than standard care (mean ± SEM; 6.02 ± 0.03 vs. 6.1 ± 0.02, $p = 0.041$), the intervention did significantly influence the percentage of 2h PPG ≤ 0.67 mmol/L ($p < 0.05$).

In Atlantic Canada, ensuring the cultural appropriateness of educational materials is vital due to the diverse patient population and rising immigrant rates [51,115,116]. Acknowledging cultural nuances enhances understanding of nutrition education and adherence to recommendations [117]. Therefore, GI educational materials should be tailored to reflect regional ethnic groups and nutrition literacy levels, considering cultural and language barriers [16,118]. For instance, in the South Asian ethnic group, where Indian diets include both low and high GI foods, effective GI education should aim to preserve culturally significant foods while promoting healthier choices.

2.3.3.2. Delivery Modes

Until March 2020, the DIP clinic RDs provided education in-person, with phone or e-mail 'home-based' follow-ups [119]. However, the onset of the COVID-19 pandemic suspended in-person visits to prevent spreading the virus [29,40]. To ensure continuity of care amid limited resources and time, the clinic introduced video education, adopting 'distance learning' as an alternative. This term, standardized in 2022 by the Canadian Digital Learning Research Association, refers to education conducted only remotely, contrasting with 'in-person learning' and 'hybrid learning' (a combination of both) [2]. The distinction between hybrid and distance learning has become more relevant in literature since the pandemic, with changes in educational delivery since 2019.

The use of remote methods in GD management education has sparked debate about its impact on care quality [120]. While distance learning offers convenience and elimination of travel needs, its delivery mode – whether synchronous (e.g., phone and videoconference) or asynchronous (e.g., websites, video education) – affect care differently [1,18,121]. Synchronous approaches provide real-time interaction but depend on seamless technical setup and scheduling, whereas asynchronous methods, like the DIP clinic's video education, offer flexibility and self-directed learning, with unlimited access to resources [120,121]. A narrative synthesis in a systematic review of 36 studies by Hoe et al. (2023) has shown that asynchronous methods can be effective in Type 1 and T2D when provided through concise, culturally, linguistically, and knowledge-specific feedback-based videos [11]. However, while these findings suggest effectiveness for video education in diabetes care, direct applicability in GD remains uncertain. Moreover, the absence of ongoing interpersonal communication in asynchronous methods may complicate the management of GD's distinct medical, psychological and social factors.

Many effectiveness studies focus primarily on clinical outcomes, reflecting only physiological impacts, often overlooking enablers and challenges related to packaging [67,122]. While a quantitative systematic review and meta-analysis by Guo et al. (2023) demonstrated that mobile and website delivered education have been associated with significant improvements in FPG (SMD = -2.51; 95% CI -4.716 to -0.303, $p < 0.05$) and a trend toward improvement in 2h PPG (SMD = -1.979; 95% CI -3.987 to -0.029, $p = 0.05$) in GD, the underlying behavioural and

cognitive factors driving these outcomes are less explored [123]. Understanding patient satisfaction from nutrition education is necessary, as it helps gauge its impact on participation and adherence to recommendations [124]. Although distance learning literature in GD is limited, hybrid learning has revealed valuable insights. For example, video education was investigated in Simsek-Cetinkaya and Koc's (2022) RCT in GD (n = 45), combining it with web-based nurse counselling, and bi-weekly in-person MNT with a RD, with findings indicating a high level of satisfaction, as measured by a satisfaction form developed by the authors, although no statistical comparison was conducted [125]. More research was needed to extend these satisfaction levels for video education alone in GD. In a cross-sectional study by Jeganathan et al. (2020) of high-risk obstetrical pregnancies, including those with GD (n = 91), survey data revealed that 86.9% of participants were satisfied with hybrid learning that included a remote phone visit option over in-person visits, and 73.8% preferring it over sole in-person visits [126].

Key reaction outcomes also include patients' acceptability – how well the education aligns with their preferences – and perceived uptake in knowledge and behaviour change, which gauges effectiveness. Feedback from DIP clinic patients (pre-pandemic) indicated previous interest in remote care [112]. Notably, Kozica-Olenski et al. (2022) reported mixed patient preferences following in-person and phone-based visits in their qualitative study on GD (n = 18), with most preferring in-person learning due to care quality concerns [120]. However, some valued the flexibility of remote care, especially those with children and in early pregnancy, highlighting the need to tailor interventions based on different life circumstances. Harrison et al. (2016) surveyed GD patients (phase one, n = 70) and conducted qualitative interviews (phase two, n = 10), finding strong acceptability for hybrid learning, particularly with remote access' convenience and potential to enhance health monitoring [1]. Participants emphasized the need for continuity in care, with consistent provider contact fostering trust, enhancing acceptability, and facilitating knowledge uptake and behavior change [1,123]. However, distance learning, particularly web-based interventions, may struggle with maintaining this continuity. Guo et al. (2023) found that asynchronous methods, while flexible, require sufficient interactivity to be effective in GD [123]. Their meta-analysis revealed that interactive and personalized web-based interventions significantly improved FPG (SMD = -1.8; $p = 0.004$) and 2hPPG (SMD = -1.42; $p = 0.01$),

pointing to their potential to support both knowledge uptake and behavior change in glycemic control.

While GI education in MNT for GD is well-documented, its application through distance learning remains largely unexplored. However, in a central Canadian 2x2 factorial RCT involving patients with recent GDM (n = 149), the participants reported high satisfaction (73% or 64 of 88 rated as excellent/very good) with a hybrid intervention that included in-person diabetes prevention education with 12 phone follow-ups [127]. GI education was provided to 57 participants across two of four study arms, but the feedback reflects those who completed interventions across all four arms, including GI education alone, GI with physical activity and physical activity alone. Despite high attrition, these findings suggest effective synchronous communication of GI education. Additionally, GI education delivered asynchronously on a website demonstrated effectiveness in a western Canadian RCT of older adults with T2D (n = 67) [128]. This intervention significantly reduced dietary GI (mean ± SD) (-2.79 ± 7.77 units; $p < 0.05$) as well as improved GI knowledge and self-efficacy ($p < 0.05$). A significantly higher proportion of participants advanced to the Action/Maintenance phase post-education (from 48% at to 81%) ($p < 0.01$). While these findings suggest potential for GD, its unique physiological circumstances – such as pregnancy-related insulin resistance, hormonal fluctuation on glucose metabolism, and its temporary, non-chronic, nature – make it distinct from T2D, limiting transferability.

2.4. Theoretical Underpinnings

This section introduces and delves into the theoretical underpinnings of the two central theoretical frameworks of this project: the Knowledge-to-Action and the Kirkpatrick Method of Education Evaluation Model.

2.4.1. Knowledge Translation

The KTA framework (figure 2.2), as interpreted from Graham et al. (2006), served as the guiding model for knowledge translation in this project [6]. The framework offers a dynamic planned action approach for moving knowledge into practice, making it particularly valuable for addressing the challenges of translating evidence-based interventions into real-world healthcare

settings [6]. This dynamic action-oriented approach was especially relevant for this project as it ensured the iterative and systematic application of evidence-based strategies while addressing evolving contextual needs. This adaptivity was essential for this project, as it built upon prior research demonstrating the framework's success in fostering KT in GI education within Canada [6,16,129]. Specifically, the framework supported the development of sustainable and effective evidence-based interventions for GD, which served as a foundation for this work.

The framework consists of two interconnected components: 1. the knowledge creation funnel, involving gathering, synthesizing and adapting existing knowledge for dissemination, and 2. the action cycle, focusing on activities for applying this knowledge. The framework's steps are interconnected and communicate with each other to identify and address gaps between what is known — evidence-based GI education — and what is done in practice – integrating it in Atlantic Canada's remote healthcare setting.

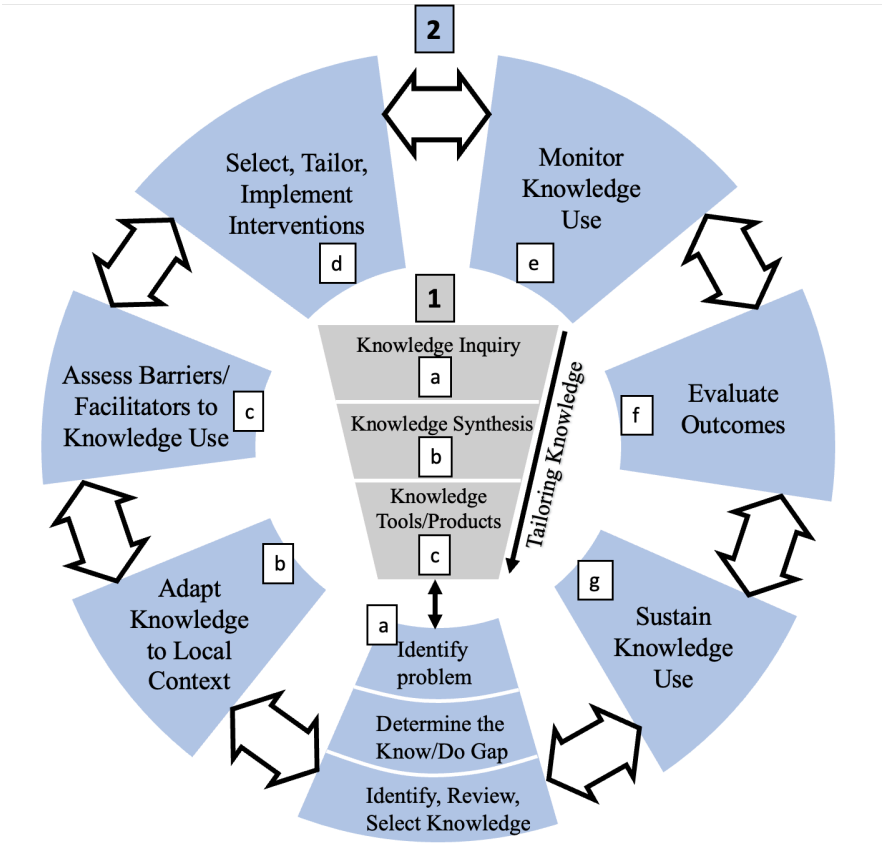

Figure 2.2 Knowledge-to-Action cycle

Adapted from Graham et al. (2006), with permission [1–3]

In addition to building upon previous research, this framework was selected for this project because it aligns with the person-centered nature of dietetic practice and incorporates integrated knowledge translation principles[130]. Dietitians prioritize both patient and provider perspectives, and the KTA framework's inclusion of all knowledge users—clinic healthcare providers and patients—throughout the research cycle reflects this focus. The framework's development with funding from the Canadian Institutes of Health Research further underscores its credibility as a tool for standardizing KT methodologies in Canada [6]. By addressing knowledge gaps and facilitating expedited integration of research findings into practice. This was particularly valuable with the active involvement of the clinic's healthcare providers, who led the research, contributed to the development and implementation of the intervention, and were the primary knowledge users for applying the findings in their practice.

While the KTA was most appropriate for this project, several other frameworks provide valuable perspectives on knowledge translation and implementation science, including the Promoting Action on Research Implementation in Health Services (PARIHS) and its updated version, the integrated-PARIHS model[131]. Both models emphasize the role of facilitation in implementing evidence-based practices, with integrated-PARIHS expanding upon the original by introducing recipients as a core element and focusing on the interplay between evidence, context, and stakeholders. However, these frameworks were not selected because they lack the iterative and flexible structure of the KTA framework, which allows for continuous improvement and adaptation. This made the KTA framework a better fit for addressing the specific needs and challenges of implementing GI education in Atlantic Canada's healthcare context.

2.4.2. The Kirkpatrick Method of Education Evaluation

Evaluating public health intervention design, implementation, and results is essential in implementation studies to assess effectiveness [3]. Insights gained guide QI and future development of similar programs for optimal learning outcomes [30,132].

In this project, the classic KM was chosen for its foundational focus on patient reactions as a measure of education effectiveness [133]. Moreover, it informed the development of Grant et al.'s (2020) evidence-based GI educational materials used in this project and has been

extensively used healthcare settings [111]. Originally designed to measure the impact of education at the University of Wisconsin Management Institute, the classic KM presents a four-level hierarchy of learning outcomes. In figure 2.3, the KM is depicted with relevant learning outcomes for GD standard care. Each level builds upon the previous one to draw insights and assess effectiveness of the education [30,133]. 'Reactions' serve to initially gauge effectiveness based on feedback, including patient satisfaction, as it directly contributes to the trajectory of subsequent outcomes [7,8,30]. While the more comprehensive New World Kirkpatrick Model expands on behaviour and result levels for assessing business goals, this project focuses on immediate reactions and core evaluation achievable with the classic KM [30].

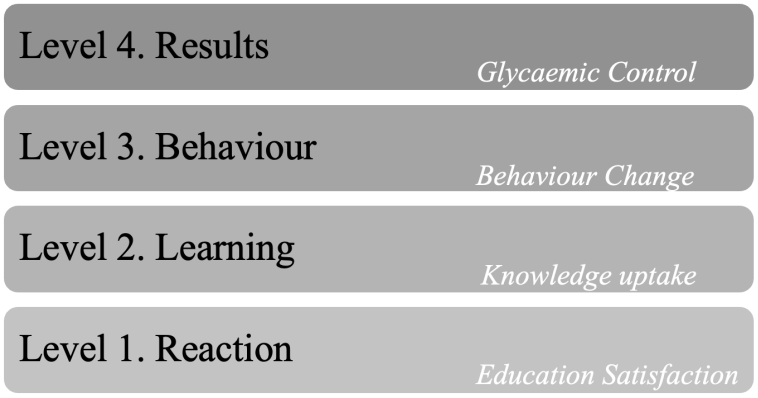

Figure 2.3 The Kirkpatrick Method of Education Evaluation
Adapted from Kirkpatrick et al. (2006) with permission [30]

Behaviour change theory is integral to the KM. The Transtheoretical Model categorizes readiness to change into stages: precontemplation, contemplation, preparation, action, and maintenance [128]. As behaviour change is dynamic, individuals may revert to earlier stages when facing resistance or challenging goals. In this research, behaviour change modulation and interpretation were guided by a blend of the Health Belief Model and Social Cognitive Theory. The Health Belief Model posits that behaviours stem from perceptions about disease and prevention [134,135]. Social Cognitive Theory assumes that human behaviour results from interactions in personal, environmental, and behavioural factors [136]. Self-efficacy, a key construct in both theories, directly influences behaviour, attitudes, and personal agency [16,128,136].

2.5. Rationale for Research

Several factors motivated this research. First, the rising prevalence of GD in Nova Scotia had placed strain on clinic capacity, a challenge further exacerbated by the COVID-19 pandemic. Second, the research was practice-informed, and led by clinic RDs, who, with patients, expressed early interest in online education predating the COVID-19 pandemic. Third, the transition to distance learning lacked data on its effectiveness in maintaining quality of GD standard care in Nova Scotia [120,137]. To address these knowledge gaps, clinic RDs initiated an inquiry into patient satisfaction (KM Level 1: Reactions) with both in-person (pre-pandemic) and online standard care. This investigation was carried out in both studies, with further exploration into the feasibility of implementing GI education as a layer to GD standard care.

2.6. Study-Specific Research Questions and Objectives: An Overview

Two studies evaluated the online education effectiveness within the context of Atlantic Canada's GD standard care, focusing primarily on reactions.

Overarching research question:

How did patients with Gestational Diabetes react to receiving online Medical Nutrition Therapy?

To gain insights into patient reactions, this research also sought to answer:

1. Are patients receiving online education for Gestational Diabetes satisfied?
2. Are patients receiving in-person education for Gestational Diabetes satisfied? And,
3. How does feedback differ between delivery modes in Gestational Diabetes standard care?

CHAPTER 3.0. STUDY 1: ADAPTING A NATIONAL GLYCAEMIC INDEX EDUCATION PLATFORM FOR NOVA SCOTIAN PATIENTS AND CLINICIANS TREATING GESTATIONAL DIABETES USING DISTANCE EDUCATION STRATEGIES

(Short Title: GI in GD Online)

3.0 Study 1: Adapting a National Glycaemic Index Education Platform for Nova Scotian Patients and Clinicians Treating Gestational Diabetes Using Distance Education Strategies (GI in GD Online)

3.1. Abstract

Title: **Adapting a National Glycaemic Index Education Platform for Nova Scotian Patients and Clinicians Treating Gestational Diabetes Using Distance Education Strategies.**

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Backgrounds: Diet-focused clinical trials traditionally center on clinical outcomes (e.g., blood glucose), often overlooking nutrition education complexities. Although Diabetes Canada (2018) recommends choosing low glycemic index (GI) foods for people living with diabetes, there is limited data on its effectiveness during pregnancy. In Atlantic Canada, while RDs have GI education training, it is unclear whether this is consistently embedded in existing Gestational Diabetes standard care or if they require adapted evidence-based GI educational materials. **Objectives:** This study aimed to evaluate the effectiveness of Lower GI (LGI) education in GD on behaviour change (primary outcome) by achieving a significant reduction in dietary GI or achieving average low dietary GI (GI < 55), patient satisfaction, GI knowledge uptake and glycaemic control (2-hour postprandial glucose < 6.7mmol/L). **Methods**: In this pilot prospective parallel randomized control trial (n = 4), participants were clinic patients with GD allocated to either a standard care group or a LGI intervention group. Initially conducted through an in-person workshop, the intervention went online via videoconference in March 2020. A mixed-form questionnaire, three-day diet records, and self-monitored blood glucose data were collected before and after the intervention, at five weeks post-intervention and five weeks postpartum. Descriptive statistics summarized GI knowledge, dietary data, and glycaemic control. Patient satisfaction was analyzed using Fisher's exact test ($p < 0.05$). **Results:** The primary outcome, behaviour change, was achieved in the LGI intervention group (n = 1, online). However, both groups maintained lower dietary GI since baseline. High satisfaction levels and increased GI knowledge (scores at baseline: 61%, post-intervention: 71%, and follow-up: 94%) were achieved by the final study visit. Fisher's exact test revealed no statistically significant difference in patient satisfaction responses between groups ($p > 0.05$). Due to the small sample size and limited glycaemic response data, no inferential analysis could be conducted on dietary allocation and glycemic control, as well as knowledge uptake. **Conclusions:** The LGI intervention was effective for behaviour change, yielding high satisfaction, and improving GI knowledge. However, both groups had lower dietary GI since baseline, suggesting external influencing factors. The results of this study, due their being quality assurance data and a small sample, may not represent the patient population and other samples.

3.2 Rationale

3.2.1. Randomized Control Trial – Pilot and Feasibility Study

The perceived absence of GI education in GD standard care at Atlantic Canada's DIP clinic prompted a request for additional support to ensure its inclusion in practice. This led to an inquiry into the feasibility of layering evidence-based GI educational materials onto existing GD standard care, aligning with best practice recommendations [12,81]. Ensuring this integration was crucial due to the LGI diet's associated benefits on insulin sensitivity and its adaptability to the region's culturally diverse dietary patterns [12,81,89,113]. The evaluation, conducted as part of a pilot study, informed intervention refinement and guided the decision to proceed with a larger clinical trial. However, existing evidence-based GI education materials were designed for in-person interactions rather than the clinic's online, 'home-based' strategies [81,99,100].

Following the KM outcome trajectory, establishing effectiveness of GI education was necessary to ensure its impact on lowering dietary GI [16]. Demonstrating this level of effectiveness emphasizes the diet's potential impact on glycemic control, particularly in reducing 2h PPG as a key therapeutic objective in practice. Quality assurance insights from this study informs GI education exists within existing GD standard care and contribute to advancing KT efforts.

3.2.2. COVID-19 Pandemic Impacts

The COVID-19-necessitated shift in healthcare delivery highlighted a significant knowledge gap: the feasibility of online GI education in GD standard care. This disruption forced a re-evaluation of the initial research question and study design, particularly with the removal of in-person interactions from the clinic's 'home-based' strategies. Though the opportunity to explore online GI education existed before, the shift due to COVID-19 heightened the urgency and provided a unique opportunity to evaluate this approach. Supporting evidence from hybrid learning in related populations with T2D and recent GD suggested potential benefits (KM levels 1 to 3) with remote education delivery. However, the absence of in-person interactions warranted further investigation to ensure transferability to distance learning and GD [127,128]. Therefore, this revision was not just a response to the pandemic but an essential step to evaluate the sustainability and effectiveness of distance learning for GI education in GD.

3.3. Methods

3.3.1. Research Question and Objectives

Initial Research Question:

Will patients with Gestational Diabetes receiving in-person glycaemic index education with distance-based follow ups have lower average dietary glycaemic index than patients receiving standard care?

Revised Research Question:

Will patients with Gestational Diabetes receiving online GI education have lower average dietary glycaemic index than patients receiving standard care?

Objectives

This study was designed to evaluate the effect of glycaemic index education on four key outcomes compared to standard care:

1. Lowering dietary GI (KM Level 3: Behaviour change, primary outcome),
2. Patient satisfaction (KM Level 1: Reaction)
3. Patient GI knowledge (KM Level 2: Knowledge), and
4. Glycaemic control (KM Level 4: Results)

3.3.2. Design

This study was a prospective parallel RCT with two groups: 1. control (standard care) group and 2. LGI intervention. The methodology for this study was based on Grant et al. (2020) LGI intervention materials and data collection tools to the DIP clinic's standard care program [16,111]. Underpinned by the KTA and KM, these resources were justified by their national recognition and documented effectiveness for GD.

The study commenced in August 2019 and concluded in April 2022 due to recruitment and funding constraints. Study activity paused in March 2020 due to the re-allocation of hospital

resources for COVID-19 research and resumed in December 2020, aligning with the transition to distance learning. Another pause occurred for my maternity leave in Summer 2021.

The study received ethical approval from both the Mount Saint Vincent University Research Ethics Board (#2019-060) and the IWK Health Research Ethics Board (#1026211). Informed consent was obtained from all study participants. Trial details have been reviewed and approved by clinicaltrials.gov (Identifier: NCT 04272840), which is now closed.

3.3.3. Sample

Study eligibility criteria are defined in Table 3.1.

Table 3.1 Study eligibility criteria

Inclusion	Exclusion
• ≥ 18 years of age, • Diagnosed with GD according to IWK Health screening procedures*, • ≥ 20 weeks of gestation, • ≤ 34 weeks of gestation, • being followed at IWK Health, • willing and able to provide informed consent, • willing and able to complete study protocol, • currently living in Nova Scotia, Canada.	• Have been diagnosed with an illness, other than GD and PCOS, impacting carbohydrate metabolism (e.g., Type 1 or T2D, inflammatory bowel disease, liver disease, kidney disease, HIV/AIDS), • take medication that may impact carbohydrate digestion or metabolism, • have multi-fetal pregnancy, • ≥ 35 weeks of gestation, • have insurmountable language barriers.

*Screening criteria changed during the study; GD = Gestational Diabetes

3.3.4. Recruitment, Randomization and Allocation

RDs screened DIP clinic patients for eligibility, followed by snowball sampling through distributed letters of information (**Appendix A**). Convenience sampling was also conducted using posters in the clinic waiting areas and classrooms, and through social media. All participants completed a consent form, with the support of a member of the research team (**Appendix B**).

Participants were randomly assigned to groups using blocks of various sizes to enhance allocation concealment [138,139]. Assignments were sealed in opaque envelopes and opened by an unbiased volunteer. The research coordinator notified participants of their allocation by email.

3.3.5. Intervention

Participants in each group attended a 25–35-minute workshop led by trained dietetic students in a DIP clinic classroom. Participants received a welcome package containing a three-day diet record (3DDR) and a $15 meal voucher. Education materials used to facilitate both workshops reflected the clinic's MNT curriculum, including a PowerPoint presentation (**Appendix C**), food models, and education materials from Diabetes Canada and Health Canada (**Appendix D**). The workshop concluded with an interactive activity to apply knowledge by making changes to food plates relevant to allocated interventions.

Standard Care (control group): This group received GD standard care education, with the same materials as outlined above. The content focused on reviewing the Canadian Food Guide, daily recommended food intakes, carbohydrate counting, and the plate method. Takeaway messages emphasized aiming for more nutrient-dense, higher fibre foods while avoiding processed foods and saturated fats.

Lower GI (intervention group): This group received GI education layered onto standard care.

The LGI intervention included:

1. A LGI PowerPoint presentation (**Appendix E)** with 14 slides to facilitate study orientation and review GI concepts (e.g., the slow absorption model) [16].
2. The GI Food Guide (**Appendix F)**, by Diabetes Canada, featuring the stoplight method (e.g. green = low GI) to outline a GI food substitution list by food group [12,23].
3. GI food cards (103-count), provided by Diabetes Canada, each depicting a food item by GI category, aiding visual learning of GI principles in dietary choices [12,25].
4. LGI recipes (36-count), featuring breakfast, sides, entrees, and desserts, were shared to support applicability [12].

The key takeaway messages of the LGI intervention included:

- Substituting one food per meal, prioritizing Grains and Starches,
- Aiming to consume low GI foods in least 50 to 60% of overall dietary choices.

All participants attended 'home-based' follow-ups (e.g., e-mail and phone) to submit relevant data collection tools at five weeks post-intervention and five weeks postpartum.

In January 2021, both workshops were transitioned to videoconference (Microsoft Teams™) and all data collection tools were administered digitally. No other modifications were made.

3.3.6. Outcomes

The primary outcome for the study was to assess behaviour change with dietary GI (KM Level 3: Behaviour), marked by a significant reduction of at least 5 units compared to the control group [16]. Dietary GI also referenced to evaluate the feasibility of integrating GI education into the DIP clinic's standard care. Since all participants had received GD standard care before the study, it was anticipated that lower baseline dietary GI could indicate prior exposure to GI education.

Secondary outcomes:

- Patient Satisfaction (KM Level 1: Reactions)
- GI Knowledge uptake (KM Level 2: Knowledge)
- Glycaemic Control (KM Level 4: Results)
- Perceived behaviour change

Participant characteristics:

- Maternal height, pre-pregnancy weight, and current maternal weight.
- Maternal age, ethnic group, birth country, language, education level, and employment.
- Risk factors for T2D as per Diabetes Canada CPG (2018).
- Gestational date and age at GD diagnosis, screening results, and medications.

3.3.7. Data Collection and Management

Table 3.2 details the data collection timeline for each adapted data collection tool found in **Appendix G-J**.

Table 3.2 Data collection tool administration schedule

	Visit 1.0 Baseline	**Visit 1.1 Post-intervention**	**Visit 2.0 5 weeks post-intervention**	**Visit 3.0 5 weeks postpartum**
Three-Day Diet Record	X		X	X
Glycaemic Index Questionnaire ©				
1 GI Education Satisfaction		X		
2 Demographic Information	X			
3 GI knowledge	X	√	√	√
4 Acceptability and Application			X	X

GI = glycaemic index, GIQ = Glycaemic Index Questionnaire; X = both groups (standard care and lower GI), √ = LGI only

Three-Day Diet Record

Participants completed 3DDRs (**Appendix G**) to document food and fluid intake [140]. This 'gold standard' tool estimates average intake and captures food characteristics and preparation methods relevant to dietary GI [141]. A three-day reporting period was chosen to minimize accuracy concerns from respondent fatigue and retrospective recording [142,143]. Instructions were given to mitigate measurement error (e.g., recall and social desirability biases) [143,144].

Glycaemic Index Questionnaire

The GIQ is a face/content validated mixed-form questionnaire with four sections designed to measure participant characteristics and the first three levels of the KM [16]. Sections 1,3, and 4 were participant-administered and section 2 was investigator-administered. Estimated completion time at baseline was 10 to 15 minutes, then 20 to 30 minutes in subsequent visits. All close-ended questions were organized vertically for readability [145]. Open-ended questions allowed for elaboration. Each GIQ section is detailed below.

Section 1. Participant Satisfaction

This section is available in **Appendix Hi**. The questions were designed to assess patient satisfaction (Level 1: Reaction), including multiple-choice (3 questions), a Likert scale question series (Table 3.3), and open-ended (5 questions) response formats. Likert scale responses options ranged on a scale of agreeability (e.g., 1 = strongly agree to 5 = strongly disagree).

Table 3.3 Likert scale question purposes

Q#	Statement	Purpose
3	a. I liked getting the welcome package in advance of the introductory class	To assess participant's satisfaction with the welcome package.
	b. The class was easy to understand	To assess clarity of the class
	c. The class was interesting	To assess interest factors
	d. The teacher was easy to understand	To assess clarity of teaching
	e. The hands-on activities (e.g., game) helped me learn.	To assess the learning impact of the game.
	f. The PowerPoint slides helped me learn.	To assess the learning impact of the presentation.
	g. I think that what I learned today will help me make changes to my diet.	To assess the perceived applicability of learning.

Section 2. Getting to Know You

This section is available in **Appendix Hii.** The questions were designed to gather data on participant characteristics, dietary habits, and history with GD management. Question response formats were multiple-choice (11 questions) and open-ended (2 questions). Examples of data examined included ethnic groups, cooking practices at home, and awareness of GI. Objective characteristic data from medical records (e.g. anthropometric data, screening results and medications) were recorded by the researcher in the case report form (**Appendix I**) at visit 1.0.

Section 3. Glycaemic Index Knowledge

This section is available in **Appendix Hiii**. The questions were designed to measure GI knowledge, with one Likert scale question on self-perceived GI knowledge (e.g., 1 = Poor to 5 =Excellent) and 14 multiple-choice skill-testing questions, scored by correct response. Two new

questions (#14 and #15) inquired on mixed-meal effect and food processing impacts on GI, with question #15 assessing retention from question #7.

Section 4. Is your Diet Working for You?

This section is available in **Appendix Hiv**. The questions were designed to measure perceived behaviour change for allocated diets. Questions included true or false (4 questions), multiple choice (2 questions), Likert scale (6 questions on a 5-point scale of quality), and open-ended (2 questions) response formats. Data examined included perceptions of short and long-term dietary adherence and self-efficacy.

The original symptoms multiple-choice question was extracted and adapted into a separate 'Symptoms Questionnaire' to track the presence and severity of symptoms (e.g., headache, fatigue, and diarrhea). It was administered by the research coordinator during each study visit.

Self-Monitored Blood Glucose

Glycaemic markers (FPG and 1h and 2h PPG for each meal) in SMBGs collected as part of GD standard care were used for glycaemic monitoring. Participants were instructed to carbon copy the research team in their e-mail reports to the clinic, with the frequency of reporting determined by their individual monitoring schedule and healthcare provider recommendations [10,112].

3.3.8. Statistical Analysis

3.3.8.1. Sample Size

Means and standards deviations from a LGI intervention in T2D reported by Grant et al. (2020), were referenced to predict this study's sample size [67]. The data demonstrated a significant reduction in dietary GI from baseline (mean ± SD; 58 ± 5.39) to one- and four-weeks post-intervention (both 54+5.39; $p \leq 0.001$).

The sample size was determined using Rosner's (1990) equation (figure 4) [146]. This equation, designed for calculating a sample size using two normally distributed samples of equal size, estimated that 29 participants per group would be needed to detect a significant difference in

dietary GI with 80% power. As the referenced data already factored a 10% dropout rate, a sample size of 58 participants was deemed appropriate [16,67].

$$n = \frac{(\sigma^2 + \sigma^2)(z_{1-\frac{\alpha}{2}} + z_{1-\beta})^2}{\Delta^2}$$

$$n = \frac{(5.39^2 + 5.39^2)(1.96 + 0.82)^2}{(58 - 54)^2}$$

$$n = \frac{(29.05 + 29.05)(2.8)^2}{4^2}$$

$$n = \frac{(58.10)(7.84)}{16}$$

$$n = 28.47$$

Figure 3.1 Sample size calculation

3.3.8.2. Approach to Dietary Intake Analysis

Nutrient composition data were obtained from the Canadian Nutrient File. GI values used in this study were drawn from studies following International Organization for Standardization (ISO 266:2010) guidelines [5]. This methodology ensures reliability in GI data, though variations persist in literature due to differing methodologies [5,22]. Reliable GI values can be accessed in the INQUIS Clinical Research (formerly GI Labs Ltd.) GI Database [147,148]. Despite potential for GI overestimation due to variety, ripeness, processing, and cooking methods, these values were used given this study's logistical constraints on direct measurement [22].

3.3.8.3. Data Analysis

Data analysis was conducted using Microsoft Excel® and IBM SPSS® v28. Inferential tests were planned to explore relationships between dietary GI and dietary assignment, glycaemic control (2hr PPG < 6.7mmol/L), and behaviour change. These included a logistic regression (dietary assignment on blood glucose), SPSS Linear Mixed Model analysis (for mean dietary GI and mean SMBG), t-tests (GI knowledge), and the Wilson Score Method (Likert scale data). Descriptive statistics summarized data for each measured outcome. Means and standard deviations were used to present participant characteristics, knowledge (scored out of 14), and dietary intake (energy, macronutrient, fibre and dietary GI) data. Satisfaction data, analyzed as

counts and percentages, involved coding the responses (e.g., 1 = Strongly Disagree, 5 = Strongly Agree) then collapsing into binomial dichotomous values (Agree > 3, Disagree ≤ 3) for Fisher's Exact analysis. The significance level was set at $p = 0.05$. These quantitative findings were given contextual insights from selected open-ended response quotes as a complementary approach.

3.4. Results

3.4.1. Sample Characteristics

Out of 627 patients provided with a letter of information, 25 signed the letter, and 5 provided informed consent. The CONSORT flow diagrams for before and after COVID-19 are shown in figures 3.2 and 3.3. Reasons for declining participation were: 1. no response (14 recruits), 2. lifestyle factors (e.g., being busy and childcare constraints) (four recruits) 3. feeling overwhelmed (three recruits), 4. pandemic-related stress (three recruits), and 5. inability to commute (one recruit). No adverse symptoms were reported in the Symptoms Questionnaire.

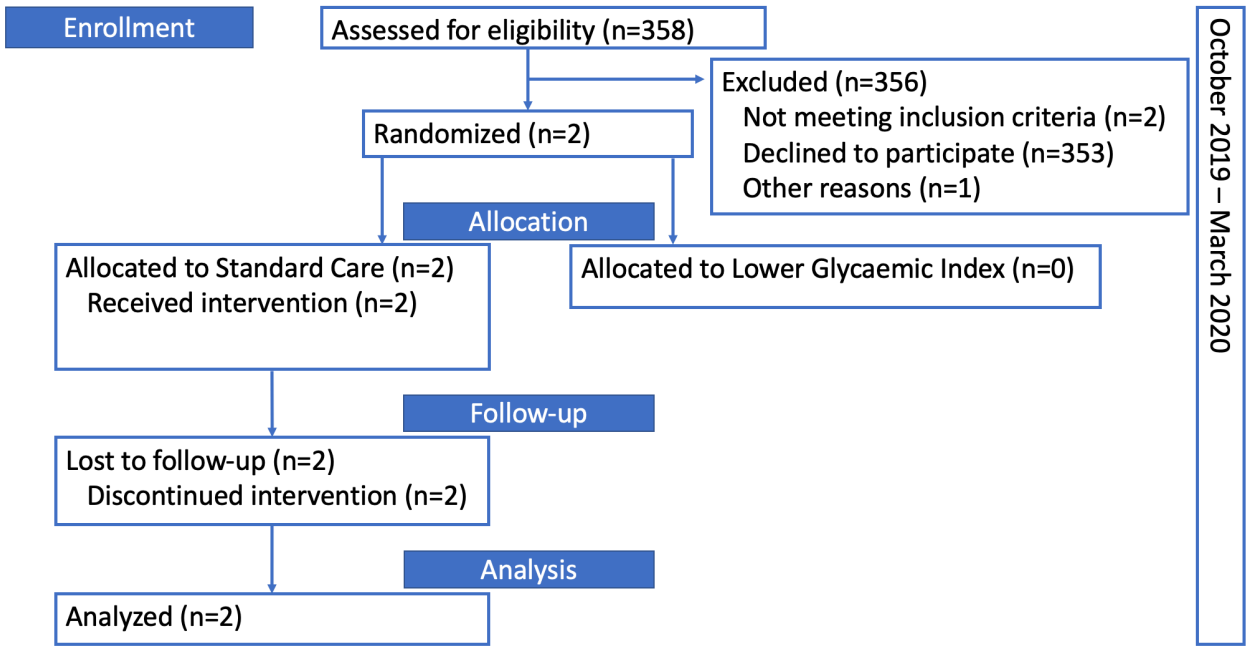

Figure 3.2 CONSORT flow diagram, before COVID-19

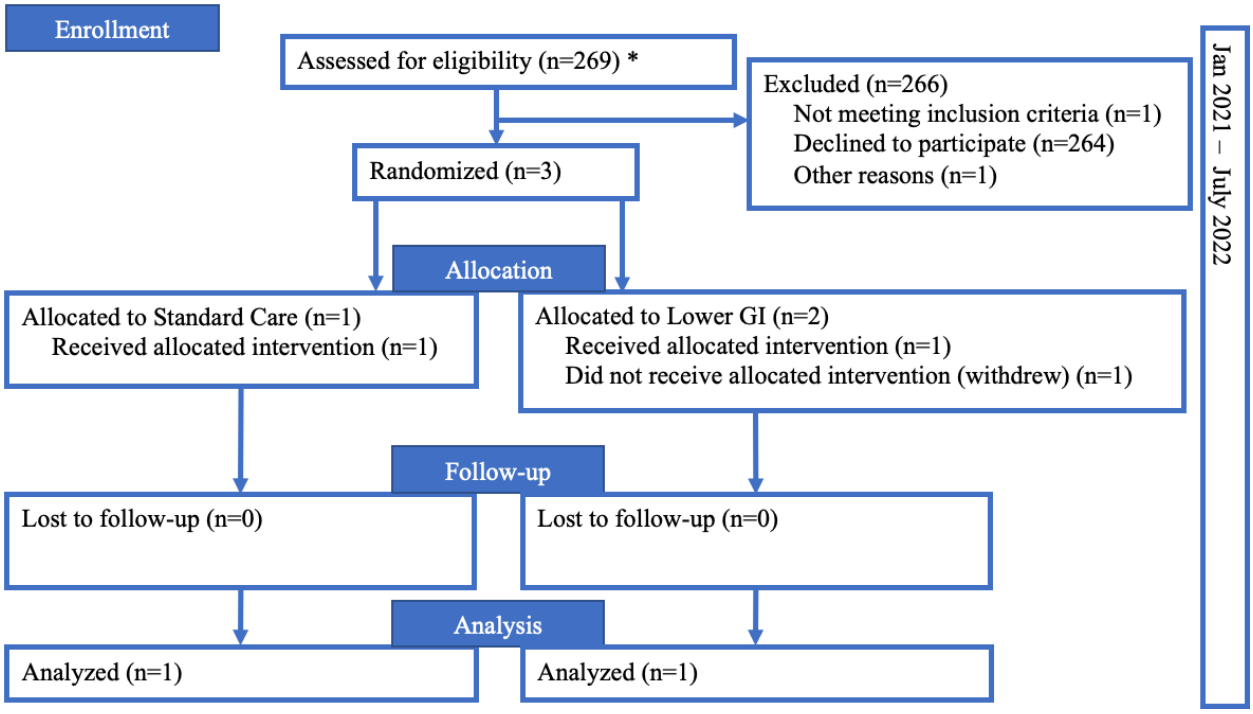

Figure 3.3 CONSORT flow diagram, during COVID-19

*Study activity halted for my maternity leave from May 2021 to September 2021.

Five participants attended the intervention visit: two in-person (participants 101 and 102) and three online (participants 103, 104, and 105). Data analysis was conducted on participants meeting closed-out criteria, which required the submission of either the 3DDR or GIQ section 4 during visit 2.0, to capture data reflecting behaviour change. One participant (participant 103) was lost to follow-up after the workshop, failing to meet these criteria.

Case report findings are shown in Table 3.4, revealing several differences in participant anthropometric and diagnostic data between the groups. Notably, participant ages were similar, though different screening approaches were used for diagnosis. The standard care group experience and the LGI participant experienced GWG. Additional findings were risk factors for T2D among participants: pre-pregnancy BMI ≥ 25 kg/m^2 (n = 1) and hypothyroidism (n = 1) in the standard care group, while a previous obstetrical complication – spontaneous abortion – was noted in the LGI group (n = 1). Medications prescribed in the standard care group included metformin (n = 1) and insulin (n = 2), whereas the LGI group participant did not require any.

Table 3.4. Participant characteristics: anthropometric and diagnostic Data

	Standard Care group n = 3 **Mean (SD)**	**LGI group n = 1** **Mean**
Age (years)	34 ± 3	36
Gestational age at diagnosis (weeks)	28.3 ± 5.9	28.7
Preferred approach results (mmol/L): Step 1	N/A	9.3 (Random)
Preferred approach results (mmol/L): Step 2	N/A	4.6 (FPG) 9.8 (1h PPG) 9.5 (2h PPG)
Alternative approach results (mmol/L)	6.4 ± 1.1 (FPG) 10.9 (1h PPG) 10.4 (2h PPG)	N/A
Pre-pregnancy weight (kg)	93 ± 18.8	56
Current weight (kg)	96 ± 18.8	62.1
Height (cm)	159 ± 17.9	157

LGI = Lower glycaemic index; SD =Standard deviation; N/A = Not Applicable; FPG = Fasting plasma glucose; PPG = Postprandial. *Note*: In the standard care group, two participants had elevated screened FPG, so their 1h and 2h PPG tests were canceled, leaving only one result for those values.

Table 3.5 presents demographic data and management practices obtained from multiple-choice responses in GIQ section 2. Notably, all participants were familiar with the GI and involved in purchasing food, though the LGI participant did not prepare meals and had not met with the clinic RD despite understanding what the GI was. Additionally, the section's Likert scale question on current food choice perceptions, revealed that participants rated recommended foods from 'fair' to 'excellent', with the LGI participant rating them as 'very good'.

Table 3.5. Participant characteristics: demographic and self-management data

	Standard Care group n = 3 **Count (%)**	**LGI group n = 1** **Count (%)**
Ethnic Group	1/3 Indian (33.3) 1/3 Scottish/Irish (33.3) 2/3 English (66.6)	1/1 English (100)
Born in Canada	2/3 Yes (66.6) 1/3 No (33.3)	1/1 No (100)
Education	2/3 College certificate or diploma (66.6) 1/3 Undergraduate degree (33.3)	1/1 College certificate/diploma (100)
Work status	1/3 Full Time; > 32 hours weekly (33.3) 1/3 Part Time; < 32 hours weekly (33.3) 1/3 Stay at home mom (33.3)	1/1 Part Time; < 32 hours weekly (100)
Food purchasing	2/3 I do (66) 1/3 My spouse/partner (33)	1/1 I do (100)
Meal preparing	3/3 I do (100)	1/1 My spouse/partner (100)
Treatment approach	2/3 Diet (66) 1/3 Exercise (33) 1/3 Oral Medication (33) 2/3 Insulin (66)	1/1 Diet (100) 1/1 Exercise (100)
Met with clinic dietitian	3/3 Yes (100)	1/1 No (100)
Heard of GI	3/3 Yes (100)	1/1 Yes (100)
Know what GI is	1/3 Yes (33) 2/3 No (66)	1/1 Yes (100)

LGI = Lower glycaemic index; GI = glycaemic index; SD = Standard Deviation

3.4.2. Behaviour Change (Kirkpatrick Model Level 3)

All study participants submitted a 3DDR in visit 1.0. The LGI group participant submitted one in all study visits. Two standard care group participants submitted in visit 2.0, and one in visit 3.0, with others lost to follow-up.

Planned inferential analyses on dietary GI could not be conducted due to the small sample size. As a result, findings were primarily descriptive. Table 3.6 summarizes dietary intake, showing both groups maintained LGI since baseline. While observable differences in energy and nutrient intake were noted, factors influencing these changes were not measured. Table 3.7 reveals that, while distribution of protein intake fell within AMDR range, carbohydrate intake was lower, and fat intake was higher.

Table 3.6 Average dietary intake

	Visit	Standard care		LGI	
		Mean ± SD	**n**	**Count**	**n**
Glycemic Index	1.0	50.7 ± 5.6	3	56.4	1
	2.0	58.4 ± 0.7	2	54.6	1
	3.0	57.9	1	54.2	1
Energy (kcal)	1.0	1578.5 ± 652.8	3	1701	1
	2.0	1571.6 ± 108.8	2	1781.2	1
	3.0	1650.3	1	1678.3	1
Carbohydrate (g)	1.0	170.3 ± 54.6	3	167.4	1
	2.0	182.3 ± 27.8	2	197.5	1
	3.0	194.1	1	200.2	1
Fibre (g)	1.0	18.9 ± 5.8	3	16.2	1
	2.0	22.2 ± 0.2	2	19.2	1
	3.0	9.4	1	10.7	1
Protein (g)	1.0	72.6 ± 41.2	3	82.3	1
	2.0	63.8 ± 5.1	2	63.0	1
	3.0	57.4	1	60.1	1
Fat (g)	1.0	71.5 ± 30.8	3	76.4	1
	2.0	68.3 ± 6.5	2	83.7	1
	3.0	70.7	1	72.8	1

LGI = Lower glycaemic index; SD = standard deviation

Table 3.7. Daily macronutrient intake

Macronutrient	Visit	Standard care (%)	LGI (%)	Recommended AMDR
Carbohydrate	1.0	41	39	45-65%
	2.0	48	44	
	3.0	47	48	
Fat	1.0	41	40	20-35%
	2.0	40	42	
	3.0	39	39	
Protein	1.0	20	19	10-35%
	2.0	16	14	
	3.0	14	14	

LGI = Lower glycaemic index; AMDR = Accepted Macronutrient Distribution Ranges

3.4.3. Participant Satisfaction (Kirkpatrick Model Level 1)

All participants submitted GIQ section 1, responding "Patient" to question 1 ('*Who are you?')* and "Yes" to question 2 ('*Did you learn anything new during your study welcome?*'). Summarized Likert scale responses data, shown in Table 3.8, had no "Disagree" or "Strongly Disagree" answers, indicating high levels of satisfaction, and no significant differences between groups ($p > 0.05$). All participants positively responded with "Yes" to question 4 ('*After study welcome, do you think you are prepared to complete your study activities?*'). While these findings suggest potential for patient satisfaction with the online LGI intervention, interpretation should be cautious due to the small sample size.

Table 3.8 Participant satisfaction by dietary allocation

#	Statement	Response options	Standard care n = 3 Count (%)	LGI n = 1 Count (%)	p-value
3a	I liked getting the welcome package in advance of the introductory class	Strongly Agree Agree Neither Agree nor Disagree	1 (33.3) 1 (33.3) 1 (33.3)	 1 (100)	1.00
3b	The class was easy to understand	Strongly Agree	3 (100)	1 (100)	
3c	The class was interesting	Strongly Agree Agree	3 (100)	 1 (100)	0.25
3d	The teacher was easy to understand	Strongly Agree	3 (100)	1 (100)	
3e	The hands-on activities helped me learn.	Strongly Agree Agree Neither Agree nor Disagree	2 (66.6) 1 (33.3)	 1 (100)	0.50
3f	The PowerPoint slides helped me learn.	Strongly Agree Agree	2 (66.6) 1 (33.3)	 1 (100)	1.00
3g	I think that what I learned today will help me make changes to my diet.	Strongly Agree	3 (100)	1 (100)	-

The Fisher's Exact Test (2-sided) results in this table are based on collapsed "Agree" and "Disagree" responses (not shown in the table), with a significant p-value = 0.05.

Table 3.9 lists responses from both participants who attended their workshop online, showing that the standard care group participant strongly agreed with all statements, while the LGI group participant reported neutrality on the welcome package, hands-on activities, and the presentation.

Table 3.9 Participant satisfaction with online education

#	Statement	Online Education	
		Standard Care n = 1	**LGI n = 1**
3.a.	I liked getting the welcome package in advance of the introductory class	Strongly Agree	Neither Agree nor Disagree
3.b.	The class was easy to understand	Strongly Agree	Strongly Agree
3.c.	The class was interesting	Strongly Agree	Agree
3.d.	The teacher was easy to understand	Strongly Agree	Strongly Agree
3.e.	The hands-on activities helped me learn.	Strongly Agree	Neither Agree nor Disagree
3.f.	The PowerPoint slides helped me learn.	Strongly Agree	Agree
3.g.	I think that what I learned today will help me make changes to my diet.	Strongly Agree	Strongly Agree

The respondent count for the five open-ended questions is listed below. While there was not enough data for coding, collected feedback offered valuable insights. All responses are presented in this section.

2.b. *If you learned something new during your study welcome, what was the most important thing you learned?* (Respondents = 4)
3.h. *If you have anything else you would like to tell us about your responses to question 3 above, please write them on the lines below.* (Respondents = 1)
4.b. *If you want to elaborate on your response to 4a, please write this on the line below.* (Respondents = 0)
5. *What can we do to make the study welcome better?* (Respondents = 1)
6. *What did you like about your study welcome?* (Respondents = 3)

Responses to question 2.b., elaborating on learned concepts from question 2.a., are shown in Table 3.11. Standard care group participants reported learning about carbohydrate counting, while the LGI group participant learned food processing impacting GI of a potato.

Table 3.10 Reported acquired learnings

Standard Care	LGI
"*Being able to eat 175g/day of carbohydrates. Having [a] snack before bed and adding protein in meals*."	"*cold potatoes have a lower GI then [than] hot*".
"*How much carbs are in various vegetables. How important Fibre is. Water isn't just from drinking*."	
"*Carb serving sizes*"	

Responses to the remaining questions were limited. One participant (101) in the standard care group elaborated in Question 3.h., describing their in-person experience as "*organized*", aligning with positive Likert scale response data. Participant 105 in the LGI group provided constructive feedback concerning technical difficulties in their response to Question 5, stating *"Tech is always an issue. Having alternate options if computers aren't cooperating"*. Positive experiences were noted Question 6 responses; Participant 102 in the standard care group said *"Enjoyed the class. Clear and concise information. Easy to Understand. Great Visuals. Great to have questions answered*". Participant 104 in the standard care group said, "*It was easy to follow and not a huge time commitment*". Participant 105 in the LGI group said it was "*Easy to follow*".

3.4.4. Participant Knowledge (Kirkpatrick Model Level 2)

All participants submitted GIQ section 3 at baseline, with the LGI group participant submitting it at each required visit. At baseline, in response to Question 1 '*Which of the words below best describes your knowledge of GI?*' all participants rated from "Fair" to "Poor". The LGI participant, initially reporting "Fair", consistently rated "Very Good" in subsequent visits, suggesting knowledge benefit from the intervention.

Descriptive GI knowledge scores to skill testing questions 2 to 14 are shown in figure 3.4. The sample size was too small to run comparative t-tests for statistical significance. These findings revealed all participants had similar, moderate GI knowledge with correct answers in 6 out of 14 questions (questions 2, 4, 5, 6, 8, 9, and 11) at baseline (61% and 62 ± 28% (Mean, SD), for standard care and LGI, respectively).

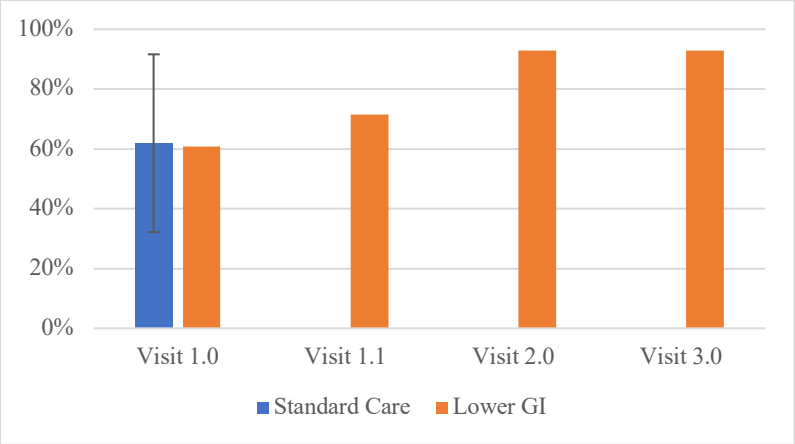

Figure 3.4 Glycaemic index knowledge scores

Following the LGI workshop, the participant experienced knowledge uptake, with their score increasing to 71% in visit 1.1 and further to 93% in visits 2.0 and 3.0. However, questions 13 and 14 were consistently answered incorrectly, indicating a lack of knowledge uptake on the mixed meal effect and varying GI in potato processing. Notably, responses to question 7, also on potato processing, were correct. While this suggests potential for GI knowledge uptake with online education, the small sample size limits generalizability.

3.4.5. Glycaemic Control (Kirkpatrick Model Level 4)

Participants submitted SMBG readings according to personalized and adaptive monitoring schedules managed by the DIP clinic. However, loss to follow-up led to fewer data submissions over time, particularly in the LGI group, where readings were only submitted during visits 1.0 and 1.1. In the standard care group, two participants each submitted readings once, at visits 1.1 and 2.0, with only one participant submitting readings at visit 3.0. Glycaemic markers are summarized in Table 3.12. Due to the small sample size and lack of 2h PPG data, planned inferential analyses were not conducted, preventing the assessment of glycaemic control.

Table 3.11 Glycaemic response data summary

	Visit	Standard Care n = 3		LGI n = 1	
		Mean ± SD (mmol/L)	**n**	**Value (mmol/L)**	**n**
Fasting Plasma Glucose	1.0	4.8	1	5.1	1
	1.1	5.7	1	5.3	1
	2.0	5 ± 2.3	3	-	0
	3.0	6.1	1	-	0
1-hour Postprandial glucose	1.0	6.5	1	7.5	1
	1.1	7.1	1	6.1	1
	2.0	6.5 ± 0.7	3	-	0
	3.0	-	0	-	0
2-hour Postprandial glucose	1.0	-	0	-	0
	1.1	7.1	1	-	0
	2.0	6.3 ± 0.04	2	-	0
	3.0	7.3	1	-	0

GI = Glycaemic Index; Reference ranges: Fasting Plasma Glucose – 3.8 to 5.2 mmol/L; 1-hour postprandial glucose – 5.5 to 7.7 mmol/L; 2-hour postprandial glucose – 5.0 to 6.6 mmol/L.

3.4.6 Perceived behaviour change

All participants, except one in the standard care group submitted GIQ section 4 at visit 2.0. At visit 3.0, one in each group (both online), submitted the questionnaire, with others lost to follow-up. Unfortunately, the planned Wilson Score Method analysis could not be conducted on Likert scale data due to the small sample size. As a result, findings are primarily descriptive in nature.

Summarized close-ended responses from GIQ section 4 are shown in Table 7, positive feedback on the ease of integrating study foods into daily routines, meal planning, and eating out. Notably, the LGI group participant reported incorporating LGI foods into their lifestyle, particularly for traditional meals, but found it more time-consuming and costly. Excluded from the table are responses to question 10 (‘*How would you rate the taste of the study foods that have been added to your diet since study welcome?*’), as only one standard care group participant responded. This participant consistently rated study foods (cauliflower, strawberry, sweet potato, and oatmeal) as “Excellent”, and their rating for high-fibre lentils and chickpeas, initially rated as “Poor”, increased.

Table 3.12 Participant acceptability and applicability

Answer Type	Q#	Statement	Response Options	Visit 2.0		Visit 3.0	
				Standard Care Count (%)	LGI Count (%)	Standard Care Count (%)	LGI Count (%)
True/False	1	I have added study foods to my diet	True False	1 (50) 1 (50)	1 (100)	1 (100)	1 (100)
Multiple Choice	2	What percentage of your total intake has been made up of study foods?	0% to 25% 26% to 50%	2 (100)	1 (100)	1 (100)	1 (100)
Likert Scale	4	Choose the word that best describes your ability to choose study foods in the supermarket.	Very Good Good	1 (50) 1 (50)	1 (100)	1 (100)	1 (100)
Likert Scale	5	Choose the word that best describes your ability to choose study foods when eating out.	Good Fair	1 (50) 1 (50)	1 (100)	1 (100)	1 (100)
Likert Scale	6	Choose the word that best describes your ability to include study foods in meal planning.	Very Good Good Fair	1 (50) 1 (50)	1 (100)	1 (100)	1 (100)
Likert Scale	7	Rate your ability to make traditional meals with study foods.	Very Good Good	2 (100)	1 (100)	1 (100)	1 (100)
Yes/No	8	Have the people you live with been eating study foods?	Yes No	2 (100)	1 (100)	1 (100)	1 (100)
Likert Scale	9	How would your house mates (e.g., family, partner, friends, etc.) rate the study foods?	Very Good Good Fair	2 (100)	1 (100)	1 (100)	1 (100)
True/False	11	Planning meals that include study foods does not require more time than other meals.	True False	2 (100)	1 (100)	1 (100)	1 (100)
True/False	12	Study foods cost the same as other foods.	True False	1 (50) 1 (50)	1 (100)	1 (100)	1 (100)
Yes/No	13	Will you continue to eat study foods after this study is over?	Yes No	2 (100)	1 (100)	1 (100)	1 (100)

The number of respondents to the two open-ended questions is listed below. While there was not enough data to conduct coding, all collected feedback offered valuable insights and listed below.

3. *How would you describe your experience adding study foods to your diet?* (Respondents in visit 2.0 = 3; visit 3.0 = 2)
14. *If you have anything else you would like to say about your experience incorporating study foods into your home, please write on the lines below.* (Respondents in visit 2.0 = 2; visit 3.0 = 1)

Responses to question 3 in visit 2.0 were provided by two standard care participants (102 and 104) and the LGI participant (105). Participant 102 expressed positive uptake of study foods, reporting it may have supported glycaemic control: "*So far it has been great, I have been able to manage my blood sugar levels with my diet, both my dietician [dietitian] and my doctor are very happy with my progress and have indicated that I do not need an insulin shot and there has been no GD issues with the growth for the baby".* Participant 104 echoed this positive uptake, stating *"I am experipenting [experimenting] with adding new foods to my diet".* In the LGI group, Participant 105 indicated that many LGI foods were already part of their diet before the study, saying, *"I was already eating a lot of the foods, I just needed to make small changes, eg [e.g.] rye bread"*. By visit 3.0, responses were solely from online participants. Participant 104 expressed ease in adopting the diet: *"Easier then [than] expected. Having a better understanding of my options was helpful"*. Participant 105's response mirrored pre-study dietary habits also cited in visit 2.0: *"I eat a lot already".*

Responses to question 14 in visit 2.0 were provided by one standard care participant (102), and one LGI group participant (105). Participant 102 expressed intent to continue including study foods daily: "*I hope to continue this in to [into] my daily diet*". although lacking their response in visit 3.0 limits interpretation for postpartum. Participant revealed that despite personal acceptability of LGI foods, applicability to their lifestyle was limited due to family preference and perceived burden: *"I like a lot of the foods from the study but my family I [doesn't] like a lot and im [I'm] not making two different types of rice for dinner."* They additionally revealed a perceived cost burden and misalignment with active lifestyle in visit 3.0: *"im [I'm] very active and find that I [I] need to eat more carbs. Also [Also,] the study foods are a lot more expensive".*

3.5. Discussion

3.5.1 Introduction

This pilot prospective RCT involving four DIP clinic patients aimed to assess the feasibility and effectiveness of a LGI intervention in Atlantic Canada's GD standard care. Results suggested that, when delivered online, the LGI intervention may achieve lower dietary GI (KM Level 3: behavior). However, integrating this intervention may not be necessary, as both groups presented with and maintained lower average dietary GI since baseline, suggesting that the clinic's existing standard care might already be communicating GI education.

This study's design allowed for the observation of positive outcomes suggesting effectiveness for the first three levels of the KM. To my knowledge, no studies on distance learning in GD have investigated effectiveness with this approach to delivering GI education. Although limitations prevented a comprehensive assessment to substantiate overall effectiveness, the findings provide valuable insights into the feasibility of distance learning in GD and contribute to broader knowledge for future KT research.

3.5.2. Nutrition Intervention Evaluation using the Kirkpatrick Model

Understanding participant characteristics is essential for interpreting each study outcome. Despite the small sample size, the sample mirrored the DIP clinic's patient demographic, including high-risk factors of advanced maternal age, obesity, and representation from Indian, Scottish/Irish and English ethnic groups, with half born outside of Canada [16,149,150]. Notably, the clinic sees a higher proportion of Indian ethnic group patients, who were present in the standard care group. This population traditionally follows lower GI dietary patterns (e.g., lentils, beans, coconut milk), which may influence study findings. Additionally, the 'English' categorization lacked specificity regarding British lineage, despite the investigator's training in administering the GIQ. The sample also underrepresented other significant ethnic groups seen in clinic, particularly those of African, Latino/a, and Indigenous descent. This lack of diversity may affect the comprehensive assessment of cultural appropriateness in the findings.

The feasibility of the LGI intervention was evaluated based on several outcomes and considerations. Baseline GI awareness among participants suggests that prior exposure to the GI concept may have facilitated the adoption of LGI dietary patterns, challenging the intervention's feasibility. However, the study did not capture the source of participants' GI awareness – whether from prior exposure or the DIP clinic. This is particularly relevant in the LGI group, as the participant did not meet with the clinic's RD due to COVID-19 restrictions. Additionally, their reported pre-existing LGI intake habits and lower baseline dietary GI deviate from the literature, which typically depicts medium to high GI dietary patterns in patients [67,81,101,111]. This intake may have influenced clinical outcomes, including improved insulin sensitivity, indicated by within-range FPG levels and the absence of prescribed antidiabetic medications at enrolment. However, it is unclear whether later insulin initiated occurred, given limitations in the case report form. It also lacked specificity for full-term maternal GWG, limiting interpretation of this participant's observed below-target GWG of 6.1kg when enrolled at 32 weeks of gestation [84].

The primary outcome, a lower dietary GI (KM level 3: Behaviour), was achieved and maintained across post-intervention visits (GI $\leq$ 56.5). Nutrient intake data supported these results, reflecting typical dietary patterns in GD [93,143,151]. Although the LGI group participant reported consuming 'new' intervention foods 26% to 50% of the time, their pre-existing intake habits suggest this proportion was likely higher, aligning with consuming low GI foods 50-60% of the time, linked to improved glycaemia and reduced insulin initiation. However, due to the descriptive nature of these findings, it remains unclear if true behavior change occurred, and the study lacked power to assess the influence of delivery mode on behavior change. Additionally, the LGI participant reported barriers to long-term adherence, citing misconceptions about GI utility, such as perceived burdens on meal preparation, food cost, and time constraints—issues the intervention's evidence-based materials were designed to address [110]. While these perceived barriers may have limited behavior change in this study, Grant et al. (2020) demonstrated that in-person delivery of the same evidence-based materials in Central Canadian GD populations resulted in a 6-unit reduction in dietary GI by two weeks post-intervention, suggesting that delivery mode may play a critical role in effectiveness [111].

The similarly high levels of patient satisfaction (KM Level 1: Satisfaction) demonstrated by both groups were not significantly different, as indicated by the Fisher's Exact test ($p > 0.05$). The absence of in-person group data limits direct comparison with existing literature on GI in GD, which primarily focuses on in-person and hybrid learning methods. However, the findings do suggest that distance learning was well-received by both participants with online education. While there was some feedback on surmountable technological difficulties, videoconferencing was still deemed satisfactory, comparable to patient satisfaction reported with phone-based hybrid GI education in patients with recent GD [67,101,111,127]. This indicates that, despite the challenges, distance learning may be a viable alternative for delivering GI education. However, questions persist on potential factors influencing this outcome, such as teaching methods, individual patient perspectives, and adaptability of material to the online format [67,110,152].

The observed increase in GI knowledge (KM level 2: Knowledge) from a baseline score of 61% to 93% by the postpartum period mirrors in-person learning from the same materials in GD, where post-intervention scores, also assessed with the GIQ, rose to 88 ± 3% ($p < 0.0001$) [67]. These improvements suggest that the mode of delivery – whether online or in-person – may not significantly impact knowledge acquisition. Additionally, the findings are consistent with knowledge gained in older adults with T2D following website-based hybrid GI education [128]. Notably, the consistent incorrect responses in the last two questions on mixed meal effect and food processing raise concerns about the tool's validity. Despite the LGI participant reported learning about potato processing in section 1 of the GIQ, it is possible these concepts were not effectively conveyed, raising questions about whether higher scores could have been attained with clearer wording [22,110,115].

The impact of the intervention on glycaemic control (KM Level 4: Results) could not be established due to the absence of 2h PPG levels, which are a more accurate marker of GI effects on glycaemic response [111]. Although the LGI group participant submitted SMBG readings from LGI intake in visits 1.0 and 1.1, they did not report 2hr PPG, and therefore, no further interpretation can be made concerning glycaemic control. The lack of SMBG submissions in visits 2.0 and 3.0, combined with the small sample size, hindered the capacity to run intended analyses for associations between diet allocation and dietary GI. Data collection was also

contingent on clinic protocols that relied on individual monitoring schedules. Possible reasons for missing data include participants not including the research team in their e-mailed reporting or SMBG discontinuation per clinic-specific protocols – only reporting 2h PPG when 1h PPG was elevated – or ceasing SMBG following early achievement of glycaemic control. These strategies are not advised as they limit the ability to document whether glycaemic control was maintained throughout the pregnancy [105,106].

3.5.3. Limitations

This study had several limitations. First, the sample size of four participants compromised statistical power, limiting the ability to conduct meaningful analyses and reducing the generalizability of the findings. Recruitment challenges were compounded by clinic protocol changes and impaired decision-making related perceived uncertainties and health concerns during COVID-19 [29,40,126]. Second, dietary data accuracy may have been affected by potential underreporting related to recall, estimation, and social desirability biases [142,151]. Third, the lower baseline dietary GI may reflect the naturally LGI dietary pattern common in the Indian ethnic group or the possible contamination of the GI concept during recruitment. Lastly, participant characteristics may have introduced inaccuracies; for instance, misrepresentation of GD in the standard care group may have occurred due to false positives from alternative screening. However, participants in this group were prescribed antidiabetic medications, indicating that glycaemic control may not have been achievable through lifestyle modification alone. Additionally, risk factors for T2D (e.g., hypothyroidism and obesity) may have influenced insulin sensitivity, influencing SMBG data.

3.6. Conclusion and Future Directions

The GI in GD Online study was a prospective RCT conducted in Halifax, Nova Scotia, involving individuals with GD (n = 4) to assess the effectiveness and feasibility of a LGI intervention layered onto standard care amid the transition from in-person to distance learning due to COVID-19. The primary objective – achieving and maintaining lower GI food intake (KM Level 3: Behaviour) following the intervention – was met, although participants in both groups at baseline were found to already have moderate GI knowledge and lower average dietary GI. Remaining objectives that informed effectiveness were patient satisfaction (KM Level 1:

Satisfaction), GI knowledge uptake (KM Level 3: Knowledge), and glycaemic control (KM Level 4: Results). In summary, while the online intervention achieved high satisfaction levels, increased GI knowledge, and maintained lower dietary GI, the data was insufficient to assess its impact on glycaemic control. Although these findings suggestive the intervention's effectiveness in GD standard care, are presented as quality assurance data and may not be generalizable to broader populations or other samples.

In light of these findings, future research should build upon insights from this study. Although it was not sufficiently powered to analyze the association between dietary allocation and dietary GI, it remains unclear if baseline dietary GI was influenced by inherent GI education from the clinic's GD standard care. The lack of data on glycaemic control further hindered the investigation into the association between dietary GI and 2h PPG. To confirm these connections, future interventions should re-evaluate the intervention with at least 58 participants, ensuring 80% statistical power. This research would not only enhance generalizability, but also offer deeper insights into the influence of individual dietary habits and adherence challenges on behaviour change. Revisiting the recruitment strategy to improve enrollment is warranted, now that the burden of the pandemic on decision-making and clinic practices has subsided.

While this study was not designed to analyze cultural appropriateness, it provides valuable insights for future endeavors. Therefore, extended data collection is recommended to assess cultural sensitivity of the intervention for inclusivity and relevance in Atlantic Canada. Given the clinic's significant South Asian immigrant population, this area warrants attention in ongoing research, which awaits the involvement of upcoming graduate students. Additionally, the consistent collection of 2hPPG data is crucial, as it best depicts the impact of dietary GI on glycaemic control. This can be emphasized by reminding and educating both the clinical team during protocol discussions and patients during consent form revisions.

Summary of future directions:

Re-evaluate GI education with a larger sample size and revised data collection strategies.
Ensure the materials are culturally sensitive and inclusive.
Explore patient reactions with distance learning.

CHAPTER 4.0. STUDY 2: PATIENT REACTIONS TO DISTANCE LEARNING GESTATIONAL DIABETES EDUCATION DURING COVID-19: A MIXED-FORM QUESTIONNAIRE

(Short Title: Online GD Education Study)

4.0. Study 2: Patient Reactions to Distance Learning Gestational Diabetes Education During COVID-19: A Mixed-Form Questionnaire

Title: **Patient Experience with Home-Based Gestational Diabetes Education during COVID-19: A Satisfaction Questionnaire.**

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Background: Atlantic Canada's largest diabetes in pregnancy clinic, facing increasing Gestational Diabetes (GD) referrals, explored distance measures to manage workload and improve access. The COVID-19 pandemic in March 2020 forced a rapid shift to online education, replacing in-person care. This transition occurred without data to support its effectiveness, raising concerns about the impact on care quality. **Objective**: To evaluate differences in patient reactions to online and in-person GD standard care, including patient satisfaction (primary outcome), perceived knowledge uptake, perceived behaviour change, and acceptability. **Methods**: Participants (n = 29) completed the GD Education Feedback Questionnaire, adapted from the Glycaemic Index Questionnaire © (face- and content-validated) to assess patient reactions to GD standard care before (in-person) and since (online video education) March 2020. Descriptive statistics summarized all data, with Likert scale data analyzed using Fisher's exact test with a significance level set at $p = 0.05$. Thematic analysis was used to categorize supportive or constructive open-ended feedback. **Results**: The primary outcome, patient satisfaction, was achieved, with high satisfaction levels reported in both in-person and online delivery modes ($p > 0.05$). Both yielded equally high levels of agreement on acceptability as well as perceptions of knowledge uptake and behaviour change. Thematic analysis categorized feedback primarily around the outcome of acceptability, with both constructive feedback (e.g., insufficiency for learning; 11 instances) and supportive feedback (e.g., accessibility; 11 instances). **Conclusions**: Patient reactions to both in-person and online were positive, with similar effectiveness across outcomes of patient satisfaction, perceived knowledge uptake, perceived behaviour change, and acceptability. However, while the online format was valued for its convenience and flexibility, it should not be relied upon as a standalone approach due to its asynchronous nature and the identified need for supplemental one-on-one support. Future implementations should consider integrating personalized support to enhance online delivery effectiveness. The results of this study, due their quality assurance nature and a small sample size, may not fully represent the broader patient population.

4.2. Rationale

This study was designed following the implementation of a distance learning QI initiative in Nova Scotia's DIP clinic, prompted by a request from clinic RDs to assess the effectiveness of online education as an alternative to in-person learning. Despite the urgency imposed by the COVID-19 pandemic, which necessitated the rapid implementation of online education without prior assessment, the RDs justified this transition using pre-pandemic patient feedback and the perceived benefits (e.g., alleviating healthcare and patient burdens). However, persisting concerns regarding effective delivery stem from limited supportive data in GD on distance learning approaches, as well as literature questioning the quality of care from using distance communications in hybrid learning [1,120]. Moreover, insights gained from online feedback were used to gauge the intervention's overall intervention effectiveness in promoting knowledge uptake and behaviour change for glycaemic control [153].

4.3. Methods

4.3.1. Research Question and Objectives

Research Question

Will patients with Gestational Diabetes receiving online education be satisfied with receiving online standard care?

Objectives

This study was designed to evaluate patient reactions (KM Level 1: Reactions) to online and in-person GD standard care, based on the following four outcomes:

1. Patient satisfaction *(Primary Outcome)*
2. Perceived knowledge uptake
3. Perceived behaviour change uptake
4. Acceptability

4.3.2. Design

This study was a cross-sectional survey conducted from January 2021 until July 2022, with a pause in the Summer of 2021 due to my maternity leave, to investigate patient reactions to in-person and online (distance learning) GD standard care. A mixed-form questionnaire was adapted from section 1 of the GIQ © (face- and content- validated) to collect patient reaction data on two aspects of GD standard care: the overall experience and MNT-specific content.

The study was assessed as minimal risk and classified as quality assurance using the ARECCI Screening Tool. Developed by the (A) pRoject Ethics Community Consensus Initiative (ARRECI) of Alberta Innovates – Health Solutions, this tool evaluates ethical risks in research involving people or health information [154]. The study received ethical approval from both the Mount Saint Vincent University Research Ethics Board (#2021-173) and the IWK Health Research Ethics Board (#1026211). Informed consent was obtained from all study participants.

4.3.2.1. Standard Care

In this study, 'standard care' refers to the GD-focused self-management education provided by DIP clinic healthcare providers. Before COVID-19, this education was offered in-person during an 'education day', which included classroom sessions on MNT and glucometer support, as well as conditional medication consults. All this content was transferred online, delivered through a website featuring video education. For instance, the MNT counterpart was a video titled 'Gestational Diabetes Nutrition Class'. The website, titled 'Gestational Diabetes Online' (available at https://www.iwk.nshealth.ca/gdmteaching), launched on March 15, 2020, with screenshots shown in figure 4.1 [137]. Although hospital policies restricting in-person visits are no longer active, the clinic continues to implement the website in practice.

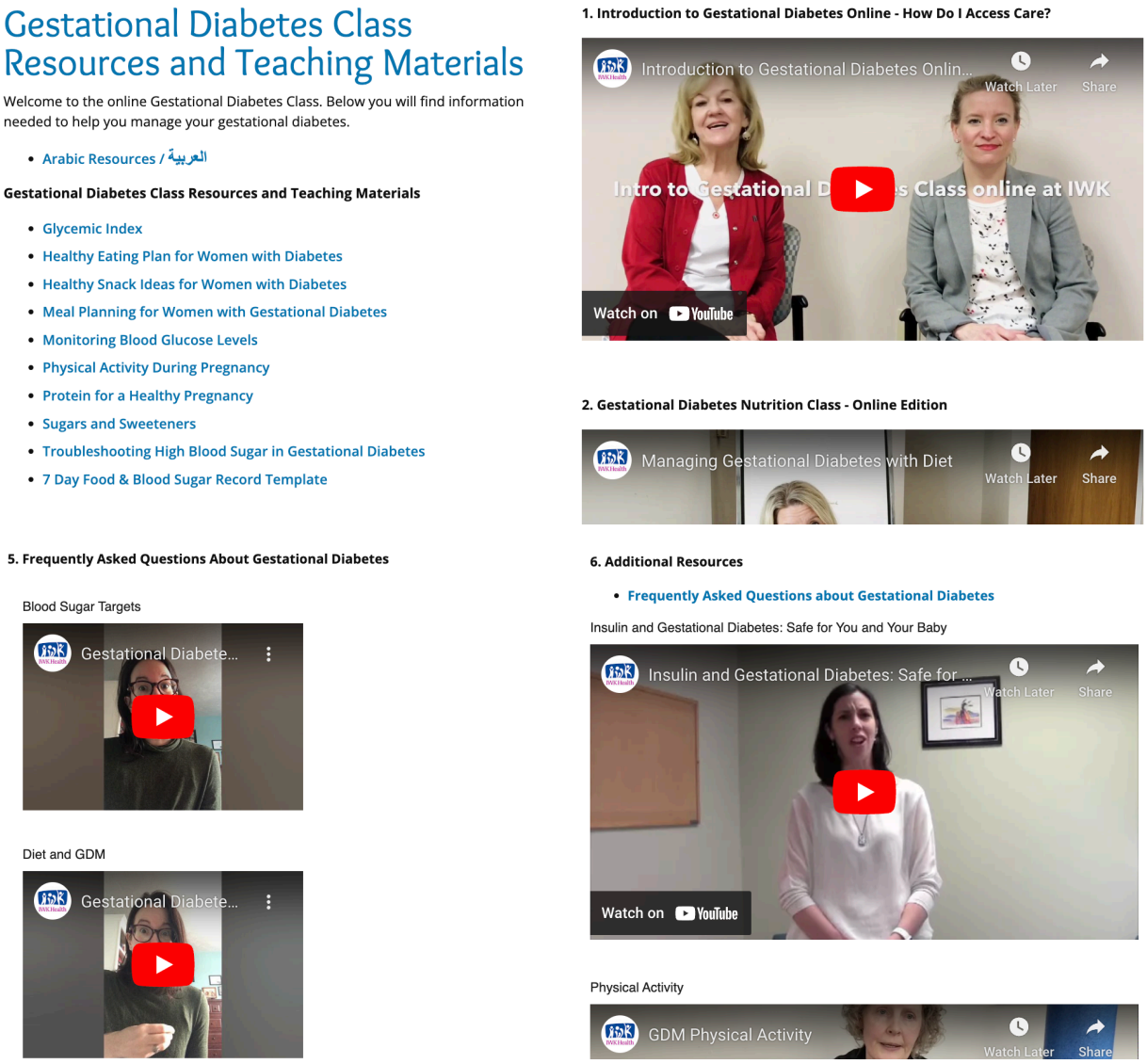

Figure 4.1 Screenshots of Gestational Diabetes Online website

4.3.2.2. Quality Assurance

Healthcare quality encompasses safety, effectiveness, patient-centeredness, timeliness, efficiency, and equity [155,156]. QI and QA play complementary roles in the continuous adaptation and evolution of care processes [7,157]. QI involves proactive efforts to improve care quality, focusing on enhancing processes and systems. QA focuses on monitoring and maintaining established quality standards, ensuring consistency and reliability of care [157]. In QA, patient satisfaction assessments focus on how patients perceive and interpret their care experiences, through the lens of personal expectations and biases [7,8,158]. These assessments inform organizations about care quality and guide efforts to enhance patient-centred care [7,8].

4.3.3. Sample and Recruitment

Study eligibility criteria were defined as follows:

1. ≥18 years of age.
2. Existing or recent diagnosis of GD according to IWK Health screening procedures (see section *2.1.4.* S*creening and Diagnosis*).
3. Followed by IWK Health DIP clinic.
4. Living in Nova Scotia.
5. Received the in-person and/or online education after January 1, 2020

Given the study's exploratory nature and the unique circumstances brought on by COVID-19, a sample size calculation was deemed unnecessary to gain insights from individual experiences with either or both delivery modes.

RDs initially screened DIP clinic patients for eligibility, after which snowball sampling was used through the distribution of letters of information (**Appendix J**). Convenience sampling was also conducted online through posters on social media and the DIP clinic website. Beginning in October 2022, in-person recruitment was extended by adding posters to the clinic waiting areas and classrooms. Participants completed the consent form with the support of a research team member (**Appendix K**).

4.3.5. Outcomes

Study outcomes outlined below informed patient reactions (KM Level 1: Reactions) to online and in-person GD standard care and included:

Primary Outcome:

1. Patient Satisfaction: This outcome measured satisfaction levels, focusing on emotional comfort, communication, clarity, content helpfulness (e.g., cultural appropriateness), and interest factors (whether materials and presentations were engaging).

Secondary outcomes:

2. Perceived knowledge uptake: Measured the extent to which patients perceived having acquired knowledge, as an early indicator of knowledge uptake effectiveness. This outcome was based on feedback related to learning uptake, increased confidence or comfort with new knowledge, and acknowledgement of achieved learning outcomes.
3. Perceived behaviour change uptake: Measured the extent to which patients perceived the education led to tangible lifestyle changes, as an early indicator of behaviour change effectiveness. This was based on feedback related to self-efficacy, intentions for behaviour change, and acknowledgement of practical application.
4. Acceptability: Measured the degree to which patients found receiving GD standard care online acceptable as an isolated approach, identifying gaps in the delivery of care to align with patient preferences and needs (e.g., accessibility, convenience, and interactivity) [1]. This was based on questions regarding its likeability and sufficiency for learning.

While outcome data related to glucometer teaching, medication and additional videos were collected for clinic quality assurance, they are not reported in this thesis, as they do not directly address the research question. Detailed information is available upon request.

4.3.6. Data Collection

Gestational Diabetes Education Feedback Questionnaire

The 'Gestational Diabetes Education Feedback Questionnaire' (**Appendix L**) was adapted from section 1 of the GIQ © (face/content validated) from the GI in GD Online study (MSVU REB #2019-060; IWK REB #1026211). Selected for its use of KM resources in mixed-form surveying [16,67,159]. It includes 13 mixed-form questions designed to gather feedback on GD standard care experiences, including presentation, clarity, comprehension, perceived utility, and content. Participants completed the questionnaire online via REDCap, a web-based survey software. To enhance engagement and readability, multiple-choice and Likert-scale response options were presented horizontally, aligning with left-to-right reading patterns [145,160].

Participant data related to education experience were collected through multiple-choice questions 1 to 4: Question 1 verified the respondent's identity (as the patient), Questions 2 and 3 determined the format of the GD standard care experience (in-person, online or both), and Question 4 specified which videos were viewed. Subsequent questions were tailored based on these responses, with online education questions focusing on the website and viewed videos, and in-person education questions on the education day and individual sessions (e.g.,. MNT).

Questions 5, 7 and 9 each consisted of a series of bipolar ordinal 5-point Likert scale questions. Specifically, Questions 5 and 9 measured agreement (e.g., 1 = Strongly Agree to 5 = Strongly Disagree), while Question 7 measured satisfaction (e.g., 1 = Very Satisfied to 5 = Very Dissatisfied). Question 5 assessed overall reactions to the GD standard care experience, whereas questions 7 and 9 focused on individual education sessions. Following each Likert scale series, open-ended Questions 6, 8, and 10 provided participants an opportunity to elaborate. The purposes and associated study outcomes for these questions are described in Table 4.1.

Questions 11 to 13 were open-ended to gain a deeper understanding of participant reactions. Question 11 asked those with both in-person and online education experiences to compare the modalities. Questions 12 and 13 sought feedback for refining online education: Question 12 sought constructive criticism, to identify areas of improvement, while Question 13 sought supportive feedback, to identify the platform's valued components.

Table 4.1 Likert scale series question purposes and outcomes

Q#	Question	Purpose	Outcome
5	a. I liked having my standard care in-person/online.	To assess the acceptability of the delivery mode.	Acceptability
	b. The [website or education day] was easy to understand	To assess clarity.	Patient Satisfaction
	c. The [website or education day] was interesting	To assess the level of interest.	Patient Satisfaction
	d. The [website or education day] helped me to learn	To assess the impact on learning.	Perceived knowledge uptake
	e. I think that what I learned will help me make changes to my lifestyle.	To assess self-efficacy for lifestyle change.	Perceived behaviour change
	f. Overall, I was satisfied with [website or education day].	To assess overall satisfaction with standard care.	Patient Satisfaction
6	If you have anything else you would like to tell us about your responses to question 5, please write it the line below.	To allow elaboration on responses to question 5.	Same as question 5
7	a. How satisfied were you with the teacher's instruction?	To assess clarity of the MNT instruction.	Patient Satisfaction
	b. Was the session helpful?	To assess perceived MNT helpfulness.	Patient Satisfaction
	c. Was the session interesting?	To assess the MNT level of interest.	Patient Satisfaction
	d. How satisfied were you with the visual presentation?	To assess if the MNT presentation was satisfactory.	Patient Satisfaction
	e. How satisfied were you with the overall session?	To assess overall MNT satisfaction.	Patient Satisfaction
8	If you have anything else you would like to tell us about your responses to question 7, please write it the line below.	To allow elaboration on responses to question 7.	Same as question 7
9	a. I am confident in my ability to apply what I learned in the session	To assess self-perceived applicability of new MNT knowledge.	Perceived knowledge uptake
	b. I think that what I learned in the session will help me make changes in my lifestyle.	To assess self-efficacy in making dietary changes.	Perceived behaviour change
10	If you have anything else you would like to tell us about your responses to question 9, please write it the line below.	To allow elaboration on responses to question 9.	Same as question 9

MNT = Medical Nutrition Therapy

4.3.7. Data Analysis

Data analysis was conducted using Microsoft Excel®, Word®, and IBM SPSS® v28. Responses were grouped by delivery mode (in-person or online). For participants with both experiences, responses were treated as two distinct entries. Descriptive statistics summarized close-ended data as counts and percentages.

Likert scale response data were coded (e.g., 1 = Strongly Disagree, 5 = Strongly Agree) and converted into binomial values (> 3 = Agree and ≤ 3 = Disagree). The modified data was then imported into IBM SPSS® for Fisher's Exact Test analysis, suitable for small sample size and independent groups. This test assessed significant associations between groups for each categorical variable, with a significance level set at $p = 0.05$. Open-ended responses Questions 6, 8, and 10 underwent systematic grouping and analysis. Responses were categorized based on their alignment with study outcome associated with each question, as outlined in Table 4.1. These responses were grouped as 'Positive', 'Mixed' (both positive and negative), or 'Negative', depending on whether the data positively or negatively informed the aligned outcome. This categorization process aimed to provide a structured interpretation of elaborating open-ended data, ensuring that each response was analyzed in the context of its relevance to the intended study outcomes.

All open-ended data underwent thematic analysis by two trained reviewers, who categorized responses based on emerging patterns and created theme codebooks with coded categories for each delivery mode. Microsoft Word® was used to organize and sort the data by code, sequence, and question, enriching insights from the close-ended response data. Responses with fewer than three words were not coded but retained and counted as quantitative data.

4.4. Results

4.4.1. Sample

Out of 272 patients provided with a letter of information, 56 signed the letter, 35 provided informed consent, and 29 completed the questionnaire. Reasons for declining participation were: 1. no response (264 recruits), 2. lifestyle factors of being busy and time constraints (three recruits), 3. no longer interested (four recruits), and 4. feeling overwhelmed (one recruit).

Data obtained from questions 1 to 4 of the questionnaire provided information on participants' education delivery modes and engagement. All respondents identified as "Patient". Of the 29 respondents, 12 participants (41.4%) received their education in-person, while 23 (79.3%) received it online. Notably, six (20.7%) experienced both modes of delivery. Among those who experienced the website, twenty-two participants confirmed "Yes" to viewing the 'Gestational Diabetes Nutrition Class' video, while one indicated "I don't know".

4.4.2. Patient Reactions

The following sub-sections present patient reactions to GD standard care, emphasizing feedback that is both supportive and constructive feedback as it is essential for quality assurance. All participants engaged with the Likert scale questions except one online participant, who did not respond to Questions 7 and 9 due to their uncertainty about viewing the MNT video (as indicated in Question 4). The Fisher's Exact Test revealed no statistically significant differences in response frequencies between in-person and online education, suggesting that satisfaction and agreement levels were consistently high for either delivery mode.

It is noteworthy that one participant, who received only in-person education, consistently rated close-ended responses as "Strongly Disagree" and "Very Unsatisfied" regarding their overall and MNT-specific experiences. This sub-section details their open-ended feedback, which highlights aspects of in-person standard care for potential re-evaluation and revision.

4.4.2.1. Standard Care: Acceptability, Patient Satisfaction, Perceived uptake in Knowledge and Behaviour Change

Question 5 ('*Please select the answer that best reflects your response to each statement. These statements are about your experience with [website or education day]*') responses are summarized in Table 4.2, showing predominantly supportive feedback concerning the overall standard care experience. The lack of significant differences in response frequencies suggests uniform participant reactions, irrespective of delivery mode.

Table 4.2 Participant reactions to overall standard care experience

Q#	Statement	Response Options	Online n = 23 Count (%)	In-person n = 12 Count (%)	p-value
5.a.	I liked having my standard care in-person/online.	Agree Disagree	21 (91.3) 2 (8.7)	8 (66.7) 4 (33.3)	0.15
5.b.	The [website or education day] was easy to understand	Agree Disagree	18 (78.3) 5 (21.7)	11 (91.7) 1 (8.3)	0.64
5.c.	The [website or education day] was interesting	Agree Disagree	14 (60.9) 9 (39.1)	10 (83.3) 2 (16.7)	0.26
5.d.	The [website or education day] helped me to learn	Agree Disagree	19 (82.6) 4 (17.4)	10 (83.3) 2 (16.7)	1.00
5.e.	I think that what I learned will help me make changes to my lifestyle.	Agree Disagree	15 (65.2) 8 (34.8)	9 (75) 3 (25)	0.71
5.f.	Overall, I was satisfied with [Website or Education Day].	Agree Disagree	17 (73.9) 6 (26.1)	11 (91.7) 1 (8.3)	0.38

Fisher's Exact Test (2-sided) yielded all p-values > 0.05

Seventeen participants provided additional feedback through open-ended responses to Question 6 ('*If you have anything else you would like to tell us about your experiences to Question 5, please write them below.*'). Table 4.3 summarizes how open-ended responses contributed to each outcome from Question 5. Counts represent responses for each delivery mode, including separate responses from three participants who provided feedback for both approaches. The remainder of this section will detail these responses, examining each in relation to corresponding outcomes.

Table 4.3 Summary of open-ended response outcome alignment with Question 5

Q#	Outcome (Sub-Question Purpose)	Alignment	Online n = 12 Count (%)	In-person n = 8 Count (%)
5.a.	Acceptability (Delivery mode)	Positive Mixed Negative N/A	1 (8.3) 2 (16.7) 2 (16.7) 7 (58.3)	1 (12.5) 1 (12.5) 6 (75)
5.b.	Patient Satisfaction (Clarity)	Positive Mixed N/A	 12 (100)	2 (25) 6 (100)
5.c.	Patient Satisfaction (Interest level)	Mixed Negative N/A	1 (8.3) 3 (25) 8 (66.6)	 8 (100)
5.d.	Perceived knowledge uptake (Learning impact)	Positive Negative N/A	1 (8.3) 3 (25) 8 (66.6)	4 (50) 4 (50)
5.e.	Perceived behaviour change (Confidence in lifestyle change)	Positive N/A	 12 (100)	1 (12.5) 7 (87.5)
5.f.	Patient Satisfaction (Overall Standard Care)	Positive Mixed Negative N/A	1 (8.3) 1 (8.3) 10 (83.3)	2 (25) 1 (12.5 1 (12.5) 4 (50)

N/A = Not Applicable

Acceptability

The positive acceptability response for the online education highlighted its convenience and flexibility, particularly for managing time around caring for a toddler. Negative responses critiqued access to information, citing issues of poor video quality (e.g., wrong angles, and incorrect format) and limited content. Mixed responses described the education as good or adequate while outlining a perceived lack of moral support and personalization. One participant provided further feedback on the website's limitations, suggesting it be used as a supplementary tool:

"*I liked having access to the information online yes - but I do not think this compares to or should replace in person learning. […] I found the online option challenging. I think the best option would be for the online options to be there to supplement in person education rather than to replace.*"

The positive acceptability response for in-person acceptability emphasized the ability to ask real-time questions. Conversely, the negative acceptability response indicated a preference for the convenience of online education:

"It was a great experience overall. If I had the choice I would have opted for the online learning as the timing of the education session wasn't convenient for me personally as I didn't drive and lived in Dartmouth at the time."

Patient Satisfaction

Elaborating feedback concerning patient satisfaction with overall online GD standard care was balanced. Overall, positive responses most cited its flexibility and helpfulness, particularly as a refresher to those who have had previous GD education. The mixed responses described the education as adequate but highlighted concerns about the lack of personalization, low engagement and video quality (e.g., too lengthy and bland). Negative responses included two sentiments on loneliness, and two referencing poor video quality (e.g., slow with visibility challenges); One suggested areas for improvement:

"*[...] Things I think can be improved on are; 1. Putting the information in one place; I have links to 2 websites and email links to youtube. Having all the 'Basic' info in one spot would be better. 2. There is a LOT of info, and I honestly skimmed over most of the information that was written. […]."*

In-person education was characterized by predominantly supportive elaborating feedback. Positive patient satisfaction responses on clarity cited it was easy to understand and well presented with visual aids. In terms of overall satisfaction, responses cited the education as helpful, comfortable, supportive, and great. The mixed response expressed discontentment with lacking tailoring for eating disorder history, despite noting the support was later received by the clinic team through personalized modifications:

"[...]I have a history of disordered eating and had concerns about the way that information was presented. The team was really helpful when I self-identified over email about my history and they were quick to make modifications and support me in that[...]

The negative response was from the participant who had provided consistent negative in the close-ended questions. This response noted an impersonal experience related to healthcare provider rotations:

"[...] There was a range/rotation of doctors, nurses, dieticians [dietitians] as it was never the same person 'on'. I found my experience so impersonal and each 'stand in' had their own takes on my diagnosis and personal biases. I had no choice in my care. […]".

Perceived Knowledge Uptake

The positive response on perceived knowledge intake for online education acknowledged knowledge gain, noting it had a lot of useful information and highlighting the effectiveness of having questions answered through email with RDs. Negative responses were related the absence of knowledge gain, including the inability to ask live questions, and overwhelming information:

"Videos were limited by their content and didn't substitute the opportunity to have a conversation with a professional and ask questions as the material was presented."

The positive responses for in-person education were two valuing real-time question-asking, one noting learning information and one remarking a learned concept on how to read labels.

Perceived Behaviour Change

Only one response was considered to further inform perceived behaviour change; a participant indicated positive perceived behaviour change by citing improved self-efficacy for managing GD upon going home following in-person education.

4.4.2.2. Medical Nutrition Therapy: Patient Satisfaction, Perceived uptake in Knowledge and Behaviour Change

Responses to Questions 7 and 9 *('Please select the answer that best reflects your response to each question. These questions are about your experience with the [website videos/in-person sessions]'*) are summarized in Table 4.4, showing high levels of satisfaction and agreement. While slight differences were observed, they were not statistically significant, suggesting generally positive outcomes of participant reactions with the MNT experience in both formats.

Table 4.4 Participant reactions with Medical Nutrition Therapy

Q#	Sub-Question	Response Options	Online n = 22 Count (%)	In-person n = 12 Count (%)	p-value
7.a.	How satisfied were you with the teacher's instruction?	Satisfied Dissatisfied	19 (86.4) 3 (13.6)	10 (83.3) 2 (16.7)	1.00
7.b.	Was the session helpful?	Satisfied Dissatisfied	17 (77.3) 5 (22.7)	9 (75) 3 (25)	1.00
7.c.	Was the session interesting?	Satisfied Dissatisfied	13 (59.1) 9 (40.9)	8 (66.7) 4 (33.3)	0.73
7.d.	How satisfied were you with the visual presentation?	Satisfied Dissatisfied	16 (72.7) 6 (27.3)	9 (75) 3 (25)	1.00
7.e.	How satisfied were you with the overall session?	Satisfied Dissatisfied	18 (81.8) 4 (18.2)	8 (66.7) 4 (33.3)	0.41
9.a.	I am confident in my ability to apply what I learned.	Agree Disagree	19 (86.4) 3 (13.6)	10 (83.3) 2 (16.7)	0.59
9.b.	I think that what I learned in the session will help me make changes in my lifestyle.	Agree Disagree	17 (77.3) 5 (22.7)	9 (75) 3 (25)	1.00

Fisher's Exact Test (2-sided) yielded all p-values > 0.05.

Patient Satisfaction

Eleven participants responded to question 8 ('*If you have anything else you would like to tell us about your experiences to question 7, please write them below.*'). Out of these, seven responses were identified as contributing to a deeper understanding of patient satisfaction with MNT. Notably, two of these responses represent separate feedback from one participant who had experiences with both approaches. Table 4.5 summarizes these open-ended responses contributed

to each outcome from Question 7. The remainder of this section will detail these responses, examining each in relation to corresponding outcomes.

Table 4.5 Feedback on patient satisfaction with Medical Nutrition Therapy

Q#	Outcome (Sub-Question Purpose)	Alignment	Online n = 5 Count (%)	In-person n = 7 Count (%)
7.a.	Patient Satisfaction (Clarity)	Positive N/A	 5 (100)	1 (14.3) 6 (85.7)
7.b.	Patient Satisfaction (Helpfulness)	Negative N/A	1 (20) 4 (80)	2 (28.6) 5 (71.4)
7.c.	Patient Satisfaction (Interest level)	Mixed Negative N/A	1 (20) 1 (20) 3 (60)	 7 (100)
7.d.	Patient Satisfaction (Presentation)	N/A	5 (100)	7 (100)
7.e.	Patient Satisfaction (Overall MNT)	Negative N/A	 5 (100)	1 (25) 3 (100)

N/A = Not Applicable; MNT = Medical Nutrition Therapy)

While none of the responses were identified as positive in terms of patient satisfaction with online MNT, the mixed response acknowledged that although the videos were not engaging, they were still considered "*good*" and "*did the job*". Among the two negative responses, one participant noted that the education was not helpful because it hadn't been tailored to address vegan lifestyles—a limitation they also mentioned in feedback about their in-person experience. The other negative response echoed the videos' low engagement and suggested areas for improvement:

"*I found the videos not at all engaging (sorry) I skipped a lot of it, there is a lot of unnecessary talking […] Most people's attention span is short. Talk to the point, cut out any long pauses, and speak to the camera*."

The positive response regarding the clarity of in-person education cited the teaching as generally good, though the feedback did specifically address MNT. In addition to the response referencing the in-person MNT's limitations for addressing vegan lifestyles, the other negative response

highlighted its limitation in tailoring to the needs of individuals with eating disorder histories (from the same respondents as above in Question 6).

Interestingly, the same participant who had consistently provided negative feedback in the close-ended responses offered mixed feedback in describing a unique in-person MNT experience.

"*I saw [removed for identifying reasons] I believe as my first dietitian. She's lovely. Truly listened. [...] [removed for identifying reasons] was kind, caring, but I didn't get to interact with her every time so I found that frustrating as the 'stand ins' were not to her calibre. But then had someone else the rest of my care. To a point where I refused to see her if she was on because she was abrasive and accused me of depriving my baby of nutrients as I was cutting carbs to reduce my sugars and reduce the amount of insulin required. The meter testing is a blur. As I was inconsolable with the diagnosis. [...] [removed for identifying reasons] was kind, caring, but I didn't get to interact with her every time so I found that frustrating as the 'stand ins' were not to her calibre*."

Perceived Knowledge Uptake and Perceived Behaviour Change

Eight participants responded to question 10 ('*If you have anything else you would like to tell us about your experiences to question 9, please write them below.*'). Table 4.6 summarizes how many open-ended responses informed either perceived knowledge uptake or perceived behaviour change, based on sub-question purposes from Question 9.

Table 4.6 Feedback on perceived uptake in knowledge and behaviour change with Medical Nutrition Therapy

Q#	Outcome (Sub-Question Purpose)	Alignment	Online n = 3 Count (%)	In-person n = 5 Count (%)
9.a.	Perceived knowledge uptake (Learning impact)	Positive		1 (20)
		Mixed	1 (33.3)	
		Negative	1 (33.3)	
		N/A	1 (33.3)	4 (80)
9.b.	Perceived Behaviour Change (Confidence in dietary change)	Positive	1 (33.3)	1 (20)
		Mixed	1 (33.3)	
		N/A	1 (33.3)	4 (80)

N/A: Not Applicable

Two responses regarding online MNT contributed to understanding perceived knowledge uptake. The negative response indicated that no new knowledge was gained, as the respondent claimed having a "*basic understanding of nutrition and how to read labels*". The mixed response, while acknowledging that the videos offered helpful information, noted feeling overwhelmed by the excessive volume of content. This response also considered positive perceived behaviour change:

"*The videos were helpful because it was information I needed, and I will make these changes because I have to Too [to] stay healthy and keep my baby healthy. However, they were provided to me all at the same time, in an email. Yes this is good for reference but would have been easier to accept, remember and apply if also referred to throughout our email correspondence. It felt like a data dump at the beginning and then when I needed to go back and refer to something, took a while to remember which content would be most useful in the moment."*

The other response informing perceived behaviour change, was mixed. While the respondent indicated behaviour change effectiveness, they also highlighted limitations in the materials and areas for improvement to better meet individual needs or expectations:

"The videos will help me make changes, but they might not always be perfect. So what I mean is the videos will help me make better choices, though there will always be room for improvement."

For in-person MNT, the responses informing perceived knowledge uptake and perceived behaviour change were each positive. The response on positive perceived behaviour change highlighted the intended daily application of MNT, showing readiness to integrate the teachings into their routine for effective management of their condition. The response on positive perceived knowledge uptake described an enjoyable and informative experience, appreciating its adaptation to various dietary needs:

"I was really impressed with the dietitian and nurses' ability to adapt to different cultural diets and lifestyles. It was very down to earth, and I left with a lot of information, but not a huge amount of pressure to have a 'perfect' diet 24/7. The staff understood that life happens and explained how to manage that."

4.4.2.3. Open-Ended Feedback on Online Education

The codebook, developed from the thematic analysis of all open-ended responses, is available in **Appendix L**. Two major themes were identified: 1. Constructive and 2. Supportive. Blank responses and those not aligning with codebook categories were assigned "No Answer".

Participant Perspectives on Online vs. In-Person Standard Care

Four participants responded to Question 11 ('*Can you compare your experience with online and in-person Gestational Diabetes education?*'). Three responses were categorized under the 'Supportive' theme, while 'No Answer' was assigned to the fourth response due to the participant indicating only having completed online education, which restricted their ability to compare both delivery modes.

Benefits of online learning were cited in two responses. One, categorized under the 'Content Quality' sub-theme, praised the videos as "*well done*". The other, categorized under both the 'Sufficiency for Learning' and 'Acceptability' sub-themes, favoured the online education for its convenience and suitability for the participant's personal situation.

Three responses highlighted in-person learning benefits, each categorized under the 'Sufficiency for Learning' sub-theme for appreciating real-time question-asking. Additionally, two of these responses were categorized under the 'Content Quality' sub-theme for describing the education as helpful and informative. Table 4.7 provides examples of responses under the in-person education 'Sufficiency for Learning' sub-theme and illustrates nuances in their experiences.

Table 4.7 Responses organized under 'Sufficiency for Learning' for in-person standard care

Question 11. Can you compare your experience with online and in-person gestational diabetes education?	
Response 1	"*For me, the in-person sessions were very helpful because of my ability to ask questions in real time. As someone who had in-person education prior to having the online education, I did think the videos were done well and were informative."*
Response 2	"*Like I said before I enjoyed in-person for my first pregnancy as I was able to see more things and ask questions right there, but I love the online this pregnancy as I have a toddler at home and needed to be able to focus on what I was watching after he went to bed."*

Supportive and Constructive Feedback on the Online Education

Feedback on online education, from constructive feedback from Question 12 (n =16) *('What can be done to make the online education better?*') and supportive feedback from Question 13 (n = 19) ('*What did you like about the online GDM education?*') was analyzed collectively to streamline the coding process and avoid redundancy. This ensured a comprehensive representation of each viewpoint within the dataset.

Theme: Constructive

Constructive sub-themes included: 1. Insufficiency for Learning (11 instances), and 2. Engagement Opportunity (6 instances) 3. Inadequate Content Quality (5 instances).

Responses categorized under 'Insufficiency for Learning' expressed concerns that online learning may not adequately substitute in-person learning, particularly due to its lack of interaction. While two participants favoured in-person learning, seven suggested adding one-on-one support to the website, suggesting various approaches such as in-person follow-ups, teleconferencing, or phone calls. Table 4.8 provides examples of participants' calls for interactive elements in the clinic's online education.

Table 4.8 Responses organized under theme 'Constructive' sub-theme 'Insufficiency for Learning' for online education

Question 12. What can be done to make the online education better?	
Response 1	"*Only utilize the online classes as a supplement to in person opportunities. […] They cannot adequately replace in person conversations, the opportunity to ask questions, and feel like your questions matter and are important*."
Response 2	"*I Think the videos were well done – again I think they just aren't sufficient to replace in person learning for most people who are diagnosed with GDM*."
Response 3	"*Finding out I tested positive for GD had me feeling many different emotions (scared, confused, worried, sad) while I think the online education is a great tool I think that maybe a phone call to talk with someone prior to being introduced to all of this information may be helpful. […].*"
Response 4	"*The videos do not take in account patient experience or learning levels. I think the videos are a great start and could be sent as a first round of education but there should be follow through so patients can ask questions. […] Even a 30 min telephone appt[appointment] to see if the patient understood what they are supposed to do and if they have any questions on the information provided would close that gap*."

Responses under the ‘Engagement Opportunity’ sub-theme highlighted concerns related to the emotional impact of online education. Two responses referenced its impersonable nature, two citing lacking support, two describing it was lonely, and one expressing it was not engaging. Table 4.9 provides examples of how the online education affected participants' emotional well-being and sense of support.

Table 4.9 Responses under theme ‘Constructive’ sub-theme ‘Engagement Opportunity’ for online education

Question 12. What can be done to make the online education better?	
Response 1	*“[…]. Newly diagnosed I felt very alone, unsupported and very overwhelmed with having only online learning opportunities. […].”*
Response 2	*“More engaging content and video quality. I believe that a lot of this content can be viewed as routine or typical nutrition for a lot of people but when pregnant, trying to balance everything, and the possible side effects of not doing this right, the videos felt stressful and distant. I would have appreciated more eye contact and encouragement. […]”*
Response 3	*“It’s fine. It’s the lack of support from people that made the program difficult.”*

Under ‘Inadequate Content Quality’, responses highlighted issues with the educational materials. Two described the information as disorganized and overwhelming, one noted poor visibility due to video quality, one found it unclear, and one expressed dissatisfaction with the lack of diversity in food choice. Table 4.10 provides examples of how the content’s quality affected participants’ experience.

Table 4.10 Responses organized under theme ‘Constructive’ sub-theme ‘Inadequate Content Quality’ for online education

Question 12. What can be done to make the online education better?	
Response 1	“*All the information in one place. Organized better. Eg (E.g.,) having a search bar or a tab specifically for ‘nutrition’ or ‘blood sugar readings’. More engaging videos. More visual tables; I liked the meal planning sample*.”
Response 2	“*I wish some of the food suggestions would have been a bit more diverse. […]*.”

Theme: Supportive

Supportive sub-themes included: 1. Accessibility (11 instances) and 2. Content Quality (10 instances) and 3. Learning Sufficiency (1 instance).

The responses under the 'Accessibility' sub-theme consistently highlighted the convenience and flexible access provided by the online education approach. Table 4.11 provides examples of how this delivery mode met participants' accessibility needs.

Table 4.11 Responses organized under theme 'Supportive' sub-theme 'Accessibility' for online education

Question 13. What did you like about the online education?	
Response 1	*"Liked that it was easily accessible and allowed to watch at your convenience. Pausing and replaying if necessary. Nice to have them all in one place if you want to review them again."*
Response 2	*"Being able to watch the material as many times as I needed in order to feel comfortable with all of the information provided. It was also a helpful tool to be able to revert back to."*
Response 3	*"Can go back and rewatch videos as refreshers at any time."*
Response 4	*"I enjoyed being able to do it on my own time and go back to rewatch [re-watch] if I needed too."*
Response 5	*"Not having to book an appointment and miss work."*

Responses under the 'Content Quality' sub-theme mainly highlighted the education as informative. Four noted the clarity of the content, while one appreciated the quality of the videos. Table 4.12 provide examples of how the content's quality benefitted participants' experience.

Table 4.12 Responses organized under theme 'Supportive' sub-theme 'Content Quality' for online education

Question 12. What can be done to make the online education better?	
Response 1	*"Informative and demonstrations were used when possible."*
Response 2	*"[...] The videos were also simple so someone like me, with no medical background, could follow and understand. The examples were really important as well because it is really hard to put meals together even when you know the individual components you need to include."*
Response 3	*"The information provided through the videos and other documents were very in-depth and detailed. It provided all the answers to my questions and worry."*

Although 'Sufficiency for Learning' was the least common sub-theme, one participant acknowledged online learning as their preferred approach, saying "*I like having access to the videos to watch whenever I had time and when I needed a reminder. I think that was better than having in class sessions. The videos were also simple so someone like me, with no medical background, could follow and understand. […]"*

4.5. Discussion

4.5.1. Discussion

This survey study involving 29 individuals with GD aimed to gauge the effectiveness of in-person and online standard care, based on an evaluation of patient reactions (KM level 1: Reactions). This evaluation provided important information for informing quality assurance and potential improvements for ongoing education initiatives in the DIP clinic. The findings suggest that participants reported positive reactions to both delivery mode, although the small sample size limits generalization. These results highlight the potential of both in-person and online delivery modes in fostering positive outcomes, particularly for the primary outcome of patient satisfaction. Although Fisher's exact tests ($p > 0.05$) for each study outcome did not show statistically significant differences between delivery modes, high levels of satisfaction and agreement in either delivery mode suggest that each was perceived as effective in meeting patient needs.

The sample size of 29 participants was appropriate for a quality assurance study focused on the DIP clinic's population. As quality assurance studies aim to generate actionable insights tailored to specific contexts rather than achieving broad generalizability, context-specific smaller samples are sufficient to evaluate effectiveness and inform quality improvement initiatives [161]. This sample provided meaningful insights into the intervention's learning outcomes, while reflecting the realities of recruitment and available resources.

The feedback from the small subgroup with both in-person and online education experiences (six of 29) offers a comparative perspective that is often unexplored in GD literature, where delivery modes are typically studied in isolation. Their insights highlight distinct strengths in each approach, with appreciation for the convenience of online learning and the interactive, real-time nature of in-person education. This aligns with Guo et al. (2023)'s observed improvements in clinical outcomes using interactive methods. The majority of participants, who received only one delivery mode (23 of 29), focused their feedback on the strengths and limitations of their respective experiences, without direct comparisons or expectations for an alternative delivery mode.

Quantitative findings for both overall standard care and its MNT-specific content showed high patient satisfaction levels in either delivery mode. These results highlight online education's potential to effectively deliver GD standard care. While this study focused solely on asynchronous video education, similar findings have been observed in hybrid learning through combining videos with synchronous online and in-person methods [125]. These findings are particularly informative in the context of the COVID-19 pandemic, during which access to in-person care was restricted. They align with satisfaction levels reported with phone and videoconference-based hybrid learning amid the pandemic [120,126]. However, despite high satisfaction, qualitative feedback was predominantly constructive, with only minimal mentions of the helpfulness and flexibility of online education. This suggests areas for improvement in the delivery and content of online education.

The lack of real-time interaction and personalization was a significant limitation of the online education. Both are critical for effective GD management, as emphasized by Guo et al. (2023) [123]. This finding underscores the limitations of asynchronous learning and the potential benefits of synchronous methods for increased interactivity and support [121]. Concerns about the organization, engagement, and conciseness of video quality and content presentation are consistent with best practices for video interventions in Type 1 and T2D management [11]. Additionally, MNT in both delivery modes was critiqued for lacking personalization, particularly for varying dietary patterns (e.g., vegan, and cultural diets). Addressing these gaps by featuring diverse presenters and tailoring materials to individual dietary and cultural needs has been recommended [11].

The dissatisfaction expressed by the participant with in-person caspre due to the lack of continuity highlights the importance of personalized and consistent care, particularly for those at higher risk. Rotating healthcare providers, while intended to offer comprehensive care, may inadvertently lead to feelings of reduced autonomy, as reflected in Harrison et al.'s (2017) findings that continuity fosters trust and personalization [1]. This points to broader systemic issues, where staffing shortages and the reliance on provider rotation may compromise team cohesion and decision-making, particularly for more complex cases like early GD diagnoses requiring insulin initiation. These concerns underscore the challenge of delivering high-quality,

personalized care, especially in the context of increasing rates GD risk factors such as obesity and advanced maternal age in Canadian pregnancies [10,56].

Participants expressed high levels of agreement for perceived knowledge uptake from both their overall standard care and MNT, suggesting a potential for actual knowledge gain (KM level 2) [30]. While evidence in distance learning remains limited, this finding is supported by literature showing that online education can support knowledge uptake in GD management [125]. Moreover, Hoe et al. (2023) support the utility of video education, as evidenced by that 8 out of 9 studies on Type 1 and T2D with statistically significant knowledge improvement [11]. This suggests that, when combined with other methods, video education may support knowledge gain for informed health decisions.

Although limited, qualitative feedback on perceived knowledge uptake was predominantly constructive, focusing on challenges of online education. The feedback that the content was reported as overwhelming and hard to absorb without real-time question-asking also echoes perspectives from the sub-group with both standard care experiences. Despite these challenges, the thematic analysis revealed that online education was recognized as a valuable supplemental resource. Introducing synchronous methods, such as one-on-one consultations through phone or videoconference, may address the demand for real-time support while mitigating self-directed learning challenges [121]. This approach is supported by findings from two studies that used a combination of synchronous and asynchronous methods in distance learning, both of which found significant improvements in GD management knowledge [123].

The high levels of agreement reported on perceived behaviour change, particularly for lifestyle and dietary modifications, highlight the potential for behaviour change regardless of the delivery mode (KM Level 3) [30]. This aligns with Hoe et al.'s (2022) finding that video education enhanced self-efficacy – a crucial determinant of behaviour change – resulting in high motivation levels for change in Type 1 and T2D [11]. However, because the MNT goals for GD differ from those for Type 1 and T2D, there are concerns that video education might not adequately address the specific needs for individualized care, hands-on guidance, or ongoing support. While the qualitative data for this outcome was limited, predominantly supportive feedback was given for

both delivery modes. Although participants acknowledged the videos' potential to promote behaviour change, the critique that the content may not meet ‘perfect’ standards raises questions about its relevance and applicability for individual contexts [11].

High levels of agreement reported on the acceptability of both delivery modes align with Jeganathan et al.’s (2020) findings that healthcare providers (n = 33) and patients (n = 91) viewed distance learning, albeit synchronous, as acceptable for high-risk obstetrical care [126]. Feedback on acceptability was predominant in the thematic analysis, suggesting that participants were mainly concerned about how the education was delivered. Within the ‘Supportive’ theme, ‘Accessibility’ was the most cited sub-theme (11 instances), emphasizing the benefits of self-paced learning and schedule flexibility (e.g., caring for children) of online education. This aligns with benefits reported in Kozica-Olenski et al. (2022)’s reporting on phone-based remote care in GD, although the study findings also cautioned against replacing in-person visits, as this could potentially compromise care quality [120]. Their recommendation for an initial face-to-face appointment to address barriers to change resonates with this study’s participant feedback calling for more individualized, one-on-one support under the ‘Constructive’ theme under ‘Insufficiency for Learning’ (11 instances). Overall, this supportive feedback indicates a growing acceptance of distance learning, likely driven by the increased use of remote healthcare from COVID-19.

4.5.2. Limitations

This study has several limitations. First, the representation of comparative perspectives is affected by the small number of participants who received both delivery modes. The questionnaire also lacked measuring the timing and location of previous GD standard care, potentially introducing inaccuracies in recall and complicating comparisons with earlier models from any DIP clinic. Second, fluctuations in recruitment success due to the pandemic resulted in a smaller sample size, which limits the generalizability of the findings beyond quality assurance. Third, the questionnaire’s design may have compromised the accuracy of responses. While feedback was predominantly positive, the positively framed Likert scale questions may have induced response bias. Moreover, the open-ended responses overlapped, creating redundancy and misplacing feedback, particularly concerning MNT-specific experiences. The frequency of completed open-ended questions also declined as the questionnaire progressed, likely due to

participant fatigue. Lastly, pandemic-related bias may have skewed perceptions of distance learning, further affecting the study's generalizability beyond the context of COVID-19.

4.6. Conclusion and Future Directions

The Online GD Education study, a mixed-form survey of DIP clinic patients (n = 29) in Halifax, Nova Scotia, aimed to assess patient reactions (KM level 1) to online GD standard care (distance learning) as an alternative to in-person learning. High levels of satisfaction were reported for both delivery modes, suggesting that online education is a viable option for GD care. Positive outcomes were also observed for perceived uptake in knowledge uptake, perceived behaviour change, and acceptability, indicating potential effectiveness. However, while online education was well-received as a supplementary resource, many found it insufficient as a standalone approach, highlighting areas for improvement.

In light of these findings, future directions can be guided by insights gained from this study. The high levels of satisfaction, along with the evolving acceptance of distance learning, support its further exploration as a viable delivery mode for GD standard care. Future investigations should aim to validate these outcomes alongside subsequent KM level outcomes – knowledge uptake (KM level 2), behaviour change (KM level 3), and glycaemic control (KM level 4). To ensure the generalizability of our study's findings to the broader population of women diagnosed with gestational diabetes mellitus (GDM) in Nova Scotia, it's essential to determine an appropriate sample size. Therefore, to achieve a 95% confidence level with a 5% margin of error, an estimated sample size of 295 participants would be required to ensure the generalizability of the study's findings to the broader population [162]. Methodology revisions should be considered. Without the context of COVID-19, an updated recruitment strategy is recommended for attaining a larger sample size. Additionally, to mitigate concerns related to fatigue, it is advisable to streamline the questionnaire. Focusing on key standard care topics (e.g., MNT, Glucometer Teaching, and Medication), along with providing clear instructions for open-ended questions, may improve response rates and data quality.

To ensure effective and relevant GD standard care, continuous optimization of education content and delivery is essential. Personalizing materials to account for various cultural backgrounds and

dietary preferences can significantly improve patient satisfaction. While the clinic commendable has made efforts to improve representation (e.g., addition of Arabic-language videos), challenges in personalization persist. To enhance delivery incorporating synchronous methods, such as one-on-one or group virtual visits, could provide the real-time interaction patients value in in-person learning. Additionally, quality improvement should prioritize strengthening communication with patients to enhance engagement. Implementing a feedback mechanism on the clinic's website can help guide ongoing refinements, while offering support for stressors like busy lifestyles or loneliness could reduce participation barriers and foster more valuable feedback.

Summary of future directions:

Integrate feedback from patient reactions to online GD standard care.
Enhance videos for cultural appropriateness.
Introduce virtual one-on-one visits for additional support.
Evaluate education effectiveness with revised questionnaire and larger sample size.
Continuously revise online education to align with ongoing feedback and best practice.

CHAPTER 5.0 SUMMARY

This project sought to assess how patient reactions to distance learning (online GD standard care), focusing on patient satisfaction (KM Level 1: Reactions). Two studies were conducted to explore patient satisfaction and other outcomes of effectiveness, using patient perspectives from both in-person and online experiences. Both studies reported high levels of satisfaction with GD standard care, regardless of delivery mode. However, due to the small sample sizes and non-significant results, these findings should be interpreted cautiously, as they are not conclusive and should be solely considered in the context of quality assurance.

Study 1, the GI in GD Online study, examined the feasibility of layering GI education onto existing GD standard care in Atlantic Canada. Findings suggested that GI education may already be embedded in the clinic's GD standard care, regardless of delivery mode. The one participant who received the LGI intervention (by online videoconference) reported high satisfaction levels and improved GI knowledge, but further research with a larger sample is needed to confirm these outcomes for the broader population.

Study 2, the Online GD Education study, found that DIP clinic patients were satisfied with both distance and in-person learning for GD education. While in-person sessions were valued for their immediate, face-to-face interactions, online education was appreciated for its convenience and accessibility. These findings emphasize the need to tailor educational strategies to patient preferences and individual circumstances, as both delivery modes offer unique advantages.

CHAPTER 6.0 IMPLICATIONS AND SIGNIFICANCE

The findings from both studies carry important implications for advancing GD standard care strategies. High satisfaction levels reported in Study 1's synchronous and Study 2's asynchronous online education suggest that online education may potentially serve as an acceptable alternative to in-person education. The results suggest that both delivery modes may be equally effective, although small sample sizes limit the ability to generalize these findings, highlighting the need for further research with larger and more diverse cohorts.

Adjusting GD standard care educational strategies to address the challenges brought about by the pandemic – such as reduced in-person contact and increased reliance on online learning – has offered helpful insights for improving educational practices. The feedback from patients in both studies suggest that both delivery modes offer benefits, indicating that online education may be used to complement or even replace in-person learning under certain conditions.

In terms of education, adapting educational materials for an online setting, including the integration of culturally relevant content, may improve patient satisfaction. Further consideration is needed on how to best maintain engagement and clarity using asynchronous formats, as well as how to continue to evolve content delivery to accommodate the diverse needs of GD patients.

In terms of practice, these findings suggest that online education could be a viable supplementary approach for delivering nutrition education in GD standard care, particularly when in-person visits are not feasible. As many participants expressed concerns about the adequacy of using asynchronous distance learning alone, future strategies may benefit from integrating live interaction, whether through a synchronous approach (e.g., phone or videoconference) or in-person visits, to support patient satisfaction. Tailoring delivery based on individual preferences and needs, when possible, could help ensure patients receive comprehensive support and maintain consistent educational engagement.

From a research perspective, the results suggest that further investigation into the effectiveness of online GD education is warranted, particularly across education effectiveness outcomes of patient reactions, knowledge uptake, behavior change, and clinical outcomes (e.g., glycaemic control). Although the LGI intervention showed potential in attaining a lower dietary GI and

improving GI knowledge, the limited sample size calls for additional research to assess whether the LGI intervention leads to significant changes across all study outcomes. While adapting GI educational materials for the clinic's website shows promise, effectiveness of these materials in asynchronous methods needs further evaluation, despite successful asynchronous GI education for lowering dietary GI and improving self-efficacy, knowledge, and HbA1C in T2D [128]. Future research should also explore the dynamics of transitioning between in-person and online education, as the experiences between participants who encountered both delivery modes (balanced) and those who experienced only one (predominantly constructive) highlighted varying levels of satisfaction and acceptance.

Notably, since the thesis preliminary findings were presented to the clinic in Winter 2023, the DIP clinic has integrated these insights to introduce hybrid. This advancement exemplifies effective knowledge mobilization and aligns with principles of implementation science. This study lays the groundwork for future research and practice in GD standard care, offering insights into the potential integration of online education into healthcare settings. While further validation is necessary, the findings could help shape future education for GD care, both locally and in regions facing similar challenges.

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Appendix A. Study 1 Letter of Information

We would like to invite you to learn more about our research study.

Our study will be looking at whether or not glycemic index education helps women receiving nutrition education for gestational diabetes mellitus at the IWK. Patients who meet the following inclusion criteria may be eligible to participate. Women who are:

1. ≥ 18 years of age
2. diagnosed with GDM
3. ≥ 20 weeks gestation
4. ≤ 34 weeks gestation
5. Receiving Gestational Diabetes nutrition support from IWK Health Centre.
6. currently living in Nova Scotia, Canada.

If you choose to join the study, you will be asked to:

1. attend an online nutrition class
2. follow a diet (as best you can)
3. let us to collect information from your medical chart about you and your baby
4. fill out a questionnaire three times
5. Tell us about your diet, activity, and blood glucose

If this study sounds like something you would like to learn more about, please fill out the form below and e-mail it to giingdm@iwk.nshealth.ca . Signing this form does not mean you are joining the study. A research team member will call you at the number provided below to tell you more about the study, answer any questions you may have and review a consent form with you. If you have questions while you wait for us to call or email you, you can email one of our team members at giingdm@iwk.nshealth.ca .

Please complete the following form:

Yes, I consent to one of the study team members calling me Date: _____
day – month - year

Signature: _____ Print name: _____

Phone Number: _____ Best time to contact me is: _____

Email: _____

_____ Yes, it is ok for study staff to leave a voice-mail at the phone number given above.

_____ No, I would prefer if study staff did not leave a message on my voice-mail at the phone number given above.

Version 3; Updated November 24, 2021

Appendix B. Study 1 Consent Form

Informed Consent to Participate in a Research Study

Full Study Title: Adapting a National Glycaemic Index Education Platform for Nova Scotian Patients and Clinicians Treating Gestational Diabetes Mellitus Using Distance Education Strategies

Short Study Title: GI in GDM ONLINE

Research Team Members and Contact Information:

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GI in GDM ONLINE Research Office:
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Phone Number: 902-470-6532

Funding

Mount Saint Vincent University (MSVU) Committee on Research and Publications
1. Standard Internal Research Grant
2. CN Student Research Internship - Management Development for Women Excellence Fund

Do the study investigators have any actual conflicts of interest?

All members of the research team do not have any actual conflicts of interest to report, although this research is to be completed as part of Julianne LeBlanc's training and thesis and Dr. Grant has received honorariums for developing and delivering glycemic index education in the past.

Introduction

We would like to invite you to take part in a research study. If you volunteer for this study, you will be referred to as a "volunteer" or a "participant". A research study is a way of gathering information on a treatment, procedure or medical device or to answer a question about something that is not well understood. This consent form explains the purpose of our study. It also provides information about the tests and procedures involved in, possible risks and benefits of participating, and the rights of participants.

Please read this form carefully and ask questions. After you read it, a research team member will review it with you, to ensure you are confident in your ability to make an informed choice. Please ask the research team to clarify anything in this document you do not understand or you would like to know more about. Make sure all your questions are answered before deciding whether to participate in this research.

Translation services can be accessed to verbally translate this form into your preferred language. Please take as much time as you need/ wish, to decide whether or not to take part in this study. Feel free to discuss this study with your friends and family, or your family doctor. Participating in this study is your choice (voluntary). Informed consent starts with this initial contract about the study and continues until the end of the study. You have the right to choose not to participate or to stop participating in this study at any time.

What is usual (or standard) treatment (or care) for Gestational Diabetes Mellitus (GDM)?

Health care providers (examples: Doctors, Nurses and Dietitians) working with women with GDM refer to the Diabetes Canada Clinical Practice Guidelines. The full guidelines and patient handouts can be found on the Diabetes Canada website: https://www.diabetes.ca/.

All patients receiving care for GDM are introduced to GDM, nutrition therapy for GDM, physical activity recommendations for treating GDM, how to self-monitor blood glucose (sugar), drug treatment options, and the role of your health care team and the people who make it up. Diabetes Canada offers handouts to help you apply what you have learned in your own life. You would be asked to monitor your blood glucose and regularly communicate with your health care professional for nutrition therapy support, until your last appointment (at six to eight weeks after your baby is born).

Why is this study being done?

You have been invited to join this study because you have been diagnosed GDM and are receiving standard care (treatment) in Nova Scotia, Canada.

Glycemic index (GI) is a way to rank different carbohydrate containing foods by how they affect your blood glucose (two hours after a meal). Although, current research generally supports GI as a part of nutrition therapy for women with GDM, more research is required to ensure that various patients are considered. For instance, women living in Atlantic Canada have not yet been part of GI in GDM research. This study (adapted from a study Dr. Grant and colleagues ran in Ontario) will help address this and ensure that women living with GDM in Nova Scotia and receiving home-based nutrition therapy, are considered in future GI education offered through Diabetes Canada (and other groups, like Dietitians of Canada). In order to do this, we will be asking

Appendix B. Study 1 Consent Form

participants questions, using a questionnaire called the Glycemic Index Questionnaire (GIQ) (more in the GIQ below). The main research question we will ask during this study (with participants help) is: Will a low GI education platform decrease average dietary glycemic index in women with GDM, in comparison to those receiving standard care?

Who can participate in this study?

Those who meet the following inclusion criteria can participate in this study. Women who are:

1. ≥ 18 years of age
2. diagnosed with GDM according to IWK Health screening
3. ≥ 20 weeks gestation
4. ≤ 34 weeks gestation
5. Receiving Gestational Diabetes nutrition support from IWK Health Centre
6. willing and able to give informed consent
7. willing and able to complete study protocol (as explained in this consent form)
8. currently living in Nova Scotia, Canada.

Those who meet the following exclusion criteria will not be able to participate. Women who:

1. have been diagnosed with acute or chronic illness, other than GDM and PCOS, that may impact carbohydrate digestion or metabolism (e.g. type 1 or 2 diabetes mellitus, inflammatory bowel disease, liver disease, kidney disease, HIV/AIDS etc.)
2. are currently taking a medication (other than insulin and metformin) that may affect carbohydrate metabolism (e.g. prescribed oral anti-hyperglycaemic medication)
3. ≥ 35 weeks gestation
4. have insurmountable language barriers.

What will participants do?

It is expected that 60 women will participate in this study. The estimated time for each participant to complete the study is five to nine hours, over the course of the 8 to 12 weeks. These time frames will vary by participant. Participants will be randomly assigned (like flipping a coin) to one of two study groups (30 participants per group):

1. ***Standard Care:*** No GI education will be provided, but participants will be taught how to complete a three-day diet record and study questionnaires. Participants will also have the opportunity to ask our research team for clarification on information given during the standard care introductory session (e.g. high fibre foods, carbohydrate counting, clinical practice guidelines for treatment of GDM). This education will take approximately 25 to 35 minutes and will be provided during a video conference session (hosted by Microsoft Teams ©). After this session, participants will communicate with the research team via email.

2. ***Lower GI:*** GI education will be layered onto the nutrition education you received from your health care professional, using resources available online via Diabetes Canada and Dietitians of Canada. This education will take approximately 25 to 35 minutes and will be provided using Microsoft Teams ©. After this session, participants will communicate with the research team via email.

Participants will be involved in the study until standard care for GDM is complete (6 to 8 weeks postpartum). During the study, all participants will be asked to complete a three-day diet record and questionnaire, called the Glycaemic Index Questionnaire (GIQ). The GIQ has four sections. Below is a list and brief description of the sections that make up the GIQ. Table 1 provides estimates of how much time each GIQ will take to complete.

1. Education Satisfaction: This section will ask you what you thought of the class and online education materials.

2. Demographic Information: This is our "getting to know you" section. Examples of demographic information include age, language, education, and ethnicity.

3. Knowledge: This section will be given to each group at baseline, but only the intervention group after that. This section will ask you questions that help us measure your knowledge of GI.

4. Acceptability and Application: This section will ask you about your experience with your diet; whether you think it is acceptable and works in your life.

A three-day diet record is a tool used to collect information on what you eat and drink over three days. You will be asked to record everything you eat and drink for three days including two weekdays and one weekend day. The three-day diet records (10 to 30 min per day) will be collected at each time point in table 1 (total of three). This means each three-day diet record will take 30 to 90 minutes of your time and you will be asked to complete these three times during the study (two times during pregnancy and one time after pregnancy). So, in total you will spend 90 to 270 minutes of your time on three-day diet records, during the study.

In addition, we will collect some demographics data, your self-monitored blood glucose, height, pre-pregnancy body weight and weight during the study, diabetes medications (type, dose, and frequency), date of delivery, and presence/ absence of GDM-related complications (e.g. C-section) and risk factors for Type 2 Diabetes Mellitus, according to Diabetes Canada (e.g. age, family history of diabetes). We will collect your patient identification number (ID) for purpose of chart review. Your name and hospital ID will be kept separate from other study data. Some of this data will be collected from your IWK Health medical record.

What are the risks or harms of participating in this study?

You may experience side effects from participating in this study. Some side effects are known and are listed below, but there may be other side effects that are not expected. If you participate in this study, contact Shannan Grant about any side effects or study-related injuries that you experience. She can be reached at: Shannan.Grant@iwk.nshealth.ca OR 902-457-5400.

This study will require you to make changes to your usual diet. You may experience side effects such as bloating or increased gas. This is expected. The symptoms usually decrease with time. Please let us know if any symptoms persist. You will be told about any new information that might affect your willingness to continue to participate in this study as soon as the information becomes available.

Appendix B. Study 1 Consent Form

Table 1. Glycemic Index Questionnaire Timeline and Study Period

Questionnaire Section		Study Period			
		Pre-intervention	**Post-Intervention**	**4 to 6 weeks post intervention**	**4 to 6 weeks post-partum**
1	Education and Study Satisfaction		X		X
2	Demographic Information	X			
3	GI Knowledge	X	√	√	√
4	Acceptability and Application of Diet			X	X
How long will it take me to complete the GIQ, by section and timepoint?		10 to 15 min	20 to 30 min	20 to 30 min	20 to 30 min
Three-day Diet Record		X		X	X

GI = glycemic index, GIQ = glycemic index questionnaire

X = both groups (standard care and lower GI), √ = lower GI only

To be completed by all study participants

Appendix B. Study 1 Consent Form

What are the benefits of participating in this study?

You may or may not benefit directly from participating in this study. Participation in this study may result in increasing knowledge about nutrition, home-based patient education and the needs of patients receiving treatment for GDM in Nova Scotia, Canada. Your participation may or may not help other people with GDM in the future.

Can participation in this study end early?

Participating in this study is voluntary and you can withdraw at any time. Withdrawing from this study will not affect your participation in any future studies or future interactions with the IWK Health Centre or Mount Saint Vincent University. If you choose to withdraw, you and your family will continue to have the same access to care at the IWK Health Centre (if applicable) as you did before. If you withdraw from the study you are encouraged to contact the research team members (by email) to let them know about your decision. If you withdraw your consent, the information about you that was collected before you left the study will still be used. No new information about you will be collected without your permission.

What are the costs of participating in this study?

There are minimal costs associated with participating in this study. Additional costs may be result from remote (e.g. cell phone usage) correspondence. You will not be paid to participate in this study, but all participants will be mailed a 15-dollar Tim Hortons gift certificate.

What happens if I have a research related injury?

This study is a minimal risk study. This said, if you suffer an injury from participation in this study, medical care will be provided to you in the same manner as you would normally obtain any other medical treatment. In no way does signing this form waive your legal rights nor release the study investigators or involved institutions from their legal and professional responsibilities. Financial compensation for such things as lost wages, disability or discomfort due to this type of injury is not routinely available.

How will my privacy be protected?

All information collected, used or disclosed for this study will be handled in a manner that corresponds with institutional, provincial and national requirements for ethical research.

If you decide to participate in this study, the research team will look at your personal health information (PHI), but only collect information they need for the study. PHI is health information that could identify you (e.g. name, address, telephone number, date of birth, hospital identification number). You have the right to access, review and request changes to your personal health information.

Certain individuals overseeing ethical conduct of research studies at IWK and MSVU may look at participant personal health information to check the information collected for the study is correct and to make sure the study followed the required laws and guidelines. For IWK participants, these include representatives of the IWK Health Centre, IWK Health Centre or the IWK Health Centre Research Ethics Board.

Research team access to personal health information will take place under the supervision of the Principal Investigator Shannan Grant. “Study data” is health information about you that is collected for the study, but that does not directly identify you. Any study data about you that is sent outside of the IWK Health will have a de-identifiable ID and will not contain any information that directly identifies you. These data (without information that can be used to identify you) will be sent to Mount Saint Vincent University to be used only for research outlined in this consent form.

The research team will keep the information they see or receive about you confidential, to the extent permitted by applicable laws. Even though the risk of identifying you from the study data is very small, it can never be completely eliminated. The research team will keep any personal health information about you in a secure and confidential location for 10 and then destroy it according to IWK Health Centre policy. All PHI collected for study purposes will be destroyed after study activity and data collection is completed.

When the results of this study are published or shared in a public forum, your identity will not be disclosed. You have the right to be informed of the results of this study once the entire study is complete.

What are the rights of participants in a research study?

Your signature on the form indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to participate as a subject. In no way does this waive your legal rights nor release the investigator(s), sponsors, or involved institution(s) from their legal and professional responsibilities.

If you become ill or injured as a direct result of participating in this study, necessary medical treatment will be available at no additional cost to you. You are free to withdraw from the study at any time without jeopardizing the health care you are entitled to receive.

You have the right to review any and all information that could help you decide about participating in the study. You also have the right to ask questions about the study and your rights as a research participant, and to have them answered to your satisfaction, before you make any decision. You also have the right to ask questions and receive answers throughout this study.

If you have any questions for the principal investigator, please contact Dr. Shannan Grant at Shannan.Grant@iwk.nshealth.ca or 902-457-5400. Voice mail is available on this phone line. Messages are only picked up by Dr. Grant. The research team will be available to answer your questions regarding the educational materials and protocol by email between 8am and 6pm Monday to Friday (see page one for contact information). If you have any questions at any time during or after the study about research in general you may contact the Research Office of the IWK Health Centre at (902) 470-8520, Monday to Friday between 8:00a.m. and 4:00p.m. If you have any questions regarding your rights as a research participant or any ethical issues related to the study that you wish to discuss with someone not directly involved in the study, you may contact the IWK Research Ethics Board at (902) 470-7879 or MSVU Research Ethics coordinator at (902) 457-6350.

Appendix B. Study 1 Consent Form

DOCUMENTATION OF INFORMED CONSENT

Full Study Title: Adapting a National Glycaemic Index Education Platform for Nova Scotian Patients and Clinicians Treating Gestational Diabetes Mellitus Using Distance Education Strategies
(Short title: GI in GDM Online)

Name of Participant: _____

You will be given a copy of this consent form after it has been signed and dated by you and a research team member. You can complete this form using an electronic device, or by printing to sign.

Participant:

By signing this consent form, I confirm that (initial each box below):

This research study has been fully explained to me and all of my questions answered to my satisfaction
I understand the requirements of participating in this research study
I have been informed of the risks and benefits, if any, of participating in this research study
I have been informed of any alternatives to participating in this research study
I have been informed of the rights of research participants
I have read each page of this form
I authorize access to my personal health information, medical record and research study data as explained in this form
I have agreed, or agree to allow the person I am responsible for, to participate in this research study

Name of participant (print)	Signature	Date (Day/ Month/ Year)

ASSISTANCE DECLARATION

Was the participant remotely assisted during the consent process? ☐ Yes ☐ No

☐ The consent form was read to the participant/substitute decision-maker, and the person signing below attests that the study was accurately explained to, and apparently understood by, the participant/substitute decision-maker.

☐ The person signing below acted as a translator for the participant/substitute decision-maker during the consent process. He/she attests that they have accurately translated the information for the participant/substitute decision-maker, and believe that that participant/substitute decision-maker has understood the information translated.

Name of Person Assisting (Print)	Signature	Date (Day/ Month/ Year)

Person obtaining consent

By signing this form, I confirm that (initial every box):

_____ This study and its purpose has been explained to the participant named above
_____ All questions asked by the participant have been answered
_____ I will send a copy of this signed and dated document to the participant

Name of Person obtaining consent (print)	Signature	Date (Day/ Month/ Year)

Statement of Investigator

I acknowledge my responsibility for the care and well-being of the above participant, to respect the rights and wishes of the participant as described in this informed consent document, and to conduct this study according to all applicable laws, regulations and guidelines relating to the ethical and legal conduct of research.

Name of Investigator (print)	Signature	Date (Day/ Month/ Year)

Appendix B. Study 1 Consent Form

Are you interested in receiving results from this study?

You have already provided us with your telephone number and email, so please answer the above question by putting your initials on the box next to the best answer for you.

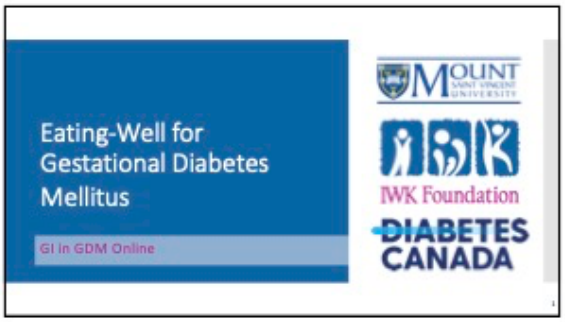
☐ Yes
☐ No

Would you like an e-mailed copy of your signed consent form?

Please note email is not considered a secure form of communication; certain third-party webmail services (e.g. Gmail, Hotmail, etc.) may be stored/routed outside of Canada and governed by foreign laws. Your email address will not be used for any other purpose.

☐ Yes
☐ No

Appendix C. Standard Care PowerPoint Slides



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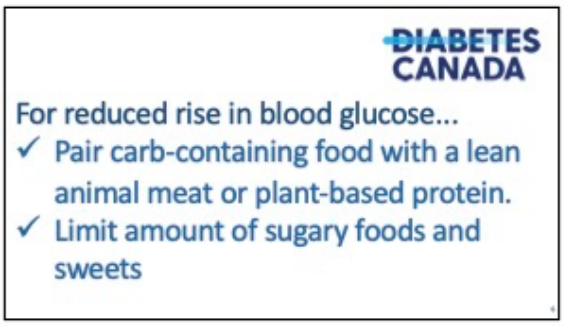

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Appendix C. Standard Care PowerPoint Slides

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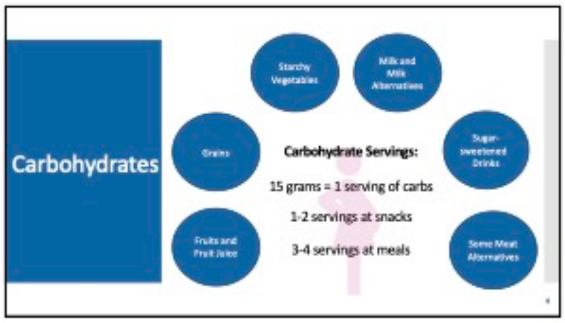

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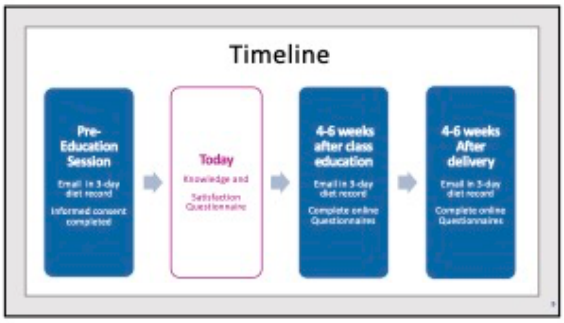

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Appendix D. Standard Care Educational Materials

Figure C.1. 2019 Canadian Food Guide by Health Canada

Appendix D. Standard Care Educational Materials

DIABETES CANADA

Just the basics

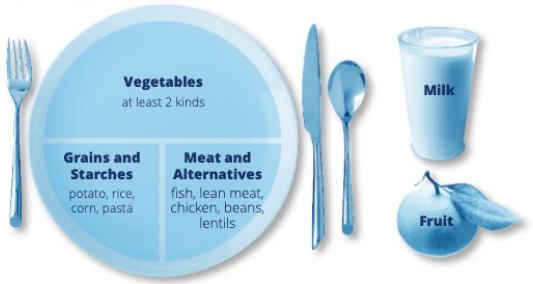
Diabetes is a condition in which your body cannot properly use and store food for energy. The fuel that your body needs is called glucose, a form of sugar. Glucose comes from foods such as fruit, milk, some vegetables, starchy foods and sugar.

To control your blood sugar (glucose) you will need to eat healthy foods, be active and you may need to take pills and/or insulin.

Here are some tips to help you until you see a registered dietitian.

Tips:	Reasons:
Eat three meals per day at regular times and space meals no more than six hours apart. You may benefit from a healthy snack.	Eating at regular times helps your body control blood sugar levels.
Limit sugars and sweets such as regular pop, desserts, candies, jam and honey.	The more sugar you eat, the higher your blood sugar will be. Artificial sweeteners can be useful substitutes.
Limit the amount of high-fat food you eat such as fried foods, chips and pastries.	High-fat foods may cause you to gain weight. A healthy weight helps with blood sugar control and is healthier for your heart.
Eat more high-fibre foods such as whole grain breads and cereals, lentils, dried beans and peas, brown rice, vegetables and fruits.	Foods high in fibre may help you feel full and may lower blood sugar and cholesterol levels.
If you are thirsty, drink water.	Drinking regular pop and fruit juice will raise your blood sugar.
Add physical activity to your life.	Regular physical activity will improve your blood sugar control.
Limit alcohol consumption.	Alcohol can affect blood sugar levels and cause you to gain weight.

Plan for healthy eating



- Eat more vegetables. These are very high in nutrients and low in calories.
- Choose lean animal proteins. Select more vegetable protein.
- Select plant oils such as olive and canola, and nuts instead of animal fats.
- Include low-glycemic-index foods such as legumes, whole grains, and fruits and vegetables.
- Consider learning about counting carbohydrates, and different types of eating patterns (e.g. Mediterranean, DASH) when you see a registered dietitian.

It's natural to have questions about what food to eat. A registered dietitian can help you include your favourite foods in a personalized meal plan.

Handy portion guide

Your hands can be very useful in estimating appropriate portions. When planning a meal, use the following portion sizes as a guide:

Grains and starches*/ Fruits*
Choose an amount the size of your fist for grains or starches, or fruit.

Milk and alternatives*
Drink up to 1 cup (250 mL) of low-fat milk with a meal.

Vegetables*
Choose as much as you can hold in both hands. Choose brightly coloured vegetables (e.g., green or yellow beans, broccoli).

Meat and alternatives*
Choose an amount the size of the palm of your hand and the thickness of your little finger.

Fat*
Limit fat to an amount the size of the tip of your thumb.

* Food group names taken from *Beyond the Basics: Meal Planning for Healthy Eating, Diabetes Prevention and Management.*

Figure C.2.A "Just the Basics" by Diabetes Canada

Appendix D. Standard Care Educational Materials

- Diabetes Canada recommends that all people with diabetes should receive advice on nutrition from a registered dietitian.
- Be sure to eat breakfast. It provides a good start to the day.
- Try to prepare more of your meals at home and use whole, unprocessed ingredients.
- Eat together as a family more often to model healthy eating behaviours to children and teenagers.
- If you are planning on fasting, talk to your health-care team 1 to 2 months in advance.

Sample meal plan

For smaller appetites

Breakfast:
Cold cereal (½ cup, 125 mL)
Whole grain toast (1 slice)
1 orange
Low-fat milk (1 cup, 250 mL)
Peanut butter (2 tbsp, 30 mL)
Tea or coffee

Lunch:
1 sandwich
  2 slices of whole grain bread or 6" pita
  meat, chicken or fish (2 oz, 60 g)
  non-hydrogenated margarine (1 tsp, 5 mL)
Carrot sticks
Grapes (1/2 cup, 125 mL)
Low-fat plain yogurt (¾ cup, 175 mL)
Tea or coffee

Dinner:
Potato (1 medium) or rice (2/3 cup, 150 mL)
Vegetables
Non-hydrogenated margarine (1 tsp, 5 mL)
Lean meat, chicken, or fish (2 oz, 60 g)
Cantaloupe (1 cup, 250 mL)
Low-fat milk (1 cup, 250 mL)
Tea or coffee

Evening Snack:
Low-fat cheese (1 oz, 30 g)
Whole grain crackers (4)

Increase your physical activity

- Build time for physical activity into your daily routine.
- Try to be active most days of the week.
- Walk whenever you can, instead of taking the car.
- Start slowly and gradually increase the amount of effort; for instance, progress from strolling to brisk walking.
- Make family activities active; try swimming or skating instead of watching TV or a movie.
- Try new activities; learn to dance, play basketball, or ride a bike.
- Enjoy your improved sense of health and well-being.

Follow a healthy lifestyle

- Have at least 3 out of the 4 key food groups at each meal from *Eating Well with Canada's Food Guide:*
  - vegetables and fruit
  - grain products
  - milk and alternatives
  - meat and alternatives
- Have portion sizes that will help you reach or maintain a healthy body weight.
- Include high-fibre foods such as whole grain breads, cereals, and pastas, fresh fruits, vegetables and legumes.
- Make lower fat choices (e.g. use skim milk and lean ground beef, trim fat on meat, chicken etc., and use small amounts of added fat such as oil and salad dressings).
- Healthy eating habits should be built around a healthy lifestyle – keep active every day.

Sample meal plan

For bigger appetites

Breakfast:
Cold cereal (½ cup, 125 mL)
Whole grain toast (2 slices)
1 orange
Low-fat milk (1 cup, 250 mL)
Low-fat cheese (2 oz, 60 g)
Tea or coffee

Lunch:
Soup (1 cup, 250 mL)
Sandwich
  2 slices whole grain bread or 6" pita
  lean meat, chicken or fish (3 oz, 90 g)
  tomato slices
  non-hydrogenated margarine (1 tsp, 5 mL)
Carrot sticks
Grapes (1/2 cup, 125 mL)
Low-fat plain yogurt (¾ cup, 175 mL)
Tea or coffee

Afternoon Snack:
1 medium apple or small banana

Dinner:
1 large potato or cooked noodles (1½ cup, 375 mL)
Vegetables
Green salad with low-fat salad dressing
Lean meat, chicken or fish (4 oz, 120 g)
1 medium pear
Low-fat milk (1 cup, 250 mL)
Tea or coffee

Evening Snack:
Peanut butter (4 tbsp, 60 mL)
Whole grain crackers (4)
Low-fat milk (1 cup, 250 mL)

Related articles: *Physical activity and diabetes, Glycemic index, Eating away from home, Alcohol and diabetes, Managing weight and diabetes*

DIABETES CANADA **diabetes.ca | 1-800 BANTING (226-8464) | info@diabetes.ca**

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Figure C.2.B "Just the Basics" by Diabetes Canada

Appendix D. Standard Care Educational Materials

DIABETES CANADA

Basic carbohydrate counting for diabetes management

Carbohydrate counting is a flexible way to plan your meals. It focuses on foods that contain carbohydrate as these raise your blood sugar the most. Follow these steps to count carbohydrates and help manage your blood sugar levels. Your registered dietitian will guide you along the way.

STEP 1 Make healthy food choices

- Enjoy a variety of vegetables, fruits, whole grains, low fat milk products, and meat and alternatives at your meals. A variety of foods will help to keep you healthy.
- Use added fats in small amounts. This helps to control your weight and blood cholesterol.
- Choose portion sizes to help you to reach or maintain a healthy weight.

STEP 2 Focus on carbohydrate

- Your body breaks down carbohydrate into sugar (glucose). This raises your blood sugar levels.
- Carbohydrate is found in many foods including grains and starches, fruits, some vegetables, legumes, milk and milk alternatives, sugary foods and many prepared foods.
- Meat and alternatives, most vegetables and fats contain little carbohydrate. Moderate servings will not have a big effect on blood sugar levels.

STEP 3 Set carbohydrate goals

- Your dietitian will help you set a goal for grams of carbohydrate at each meal and snack. This may be the same from day to day or may be flexible, depending on your needs.
- Aim to meet your target within 5 grams per meal or snack.

STEP 4 Determine carbohydrate content

- Write down what you eat and drink throughout the day.
- Be sure to note the portion sizes. You may need to use measuring cups and food scales to be accurate.
- Record the grams of carbohydrate in these foods and drinks.
- For carbohydrate content of foods, check the *Beyond the Basics* resources, food packages, food composition books, restaurant fact sheets and websites.

STEP 5 Monitor effect on blood sugar level

- Work with your health-care team to correct blood sugar levels that are too high or too low.

Nutrition Facts
Per 90 g serving (2 slices)

Amount	% Daily Value
Calories 170	
Fat 2.7 g	4 %
Saturated 0.5 g + Trans 0 g	5 %
Cholesterol 0 mg	
Sodium 200 mg	8 %
Carbohydrate 36 g	13 %
Fibre 6 g	24 %
Sugars 3 g	
Protein 8 g	
Vitamin A 1 %	Vitamin C 0 %
Calcium 2 %	Iron 16 %

Finding carbohydrate values using the Nutrition Facts table

The amount of carbohydrate in a food is listed on the Nutrition Facts table.

- The amount listed is for the serving size given. Are you eating more, less, or the same amount? Compare your serving size to figure out the amount of carbohydrate you are eating.
- The total amount of carbohydrate in grams is listed first. This number includes starch, sugars and fibre. (Starch is not listed separately.)
- Fibre does not raise blood sugar and should be subtracted from the total carbohydrate (i.e. 36 g carbohydrate – 6 g fibre = 30 g available carbohydrate).

Let's carb count! Sample carbohydrate counting

Food	Portion size	Grams of carbohydrate	Carbohydrate choices
Example – sandwich lunch			
Bread, whole wheat*	2 slices	30 g	2
Chicken breast	2 oz/60 g	0	0
Margarine	1 tsp/5 mL	0	0
Carrot sticks	½ cup/125 mL	0	0
Green grapes*	½ cup/125 mL	15 g	1
Milk*	1 cup/250 mL	15 g	1
Tea/coffee	1 cup/250 mL	0	0
	TOTAL	60 g	4 choices
What did you eat and drink? (write it below)			
	TOTAL		

*Carbohydrate containing food

Related articles: *Just the basics for healthy eating, Glycemic Index, and Sugars and sweeteners*

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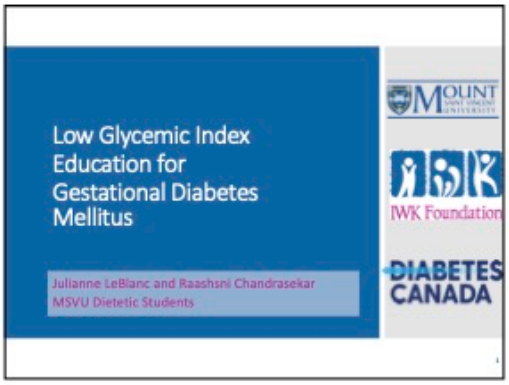
Figure C.3. "Basic Carbohydrate Counting" by Diabetes Canada

Appendix E. Glycaemic Index Intervention PowerPoint Slides



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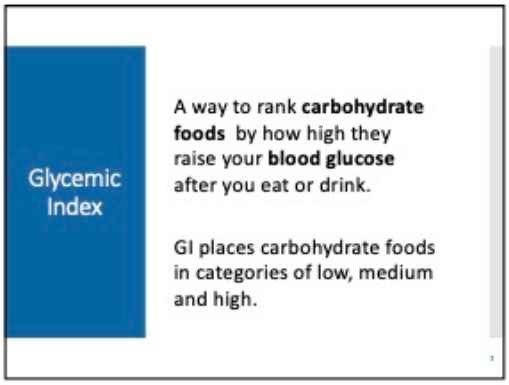

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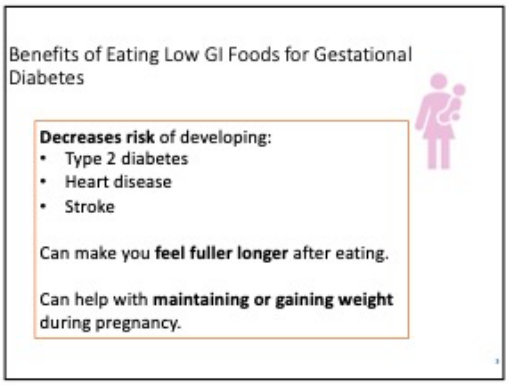

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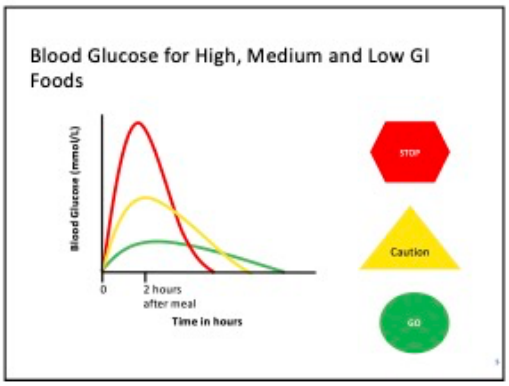

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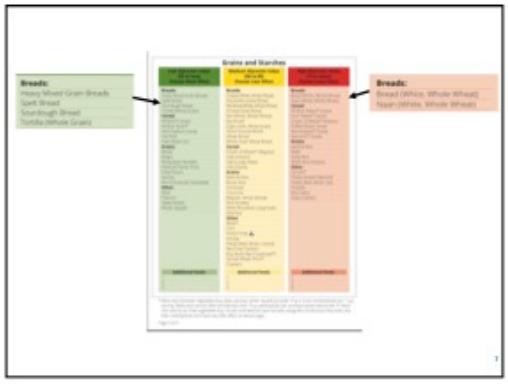
Appendix E. Glycaemic Index Intervention PowerPoint Slides



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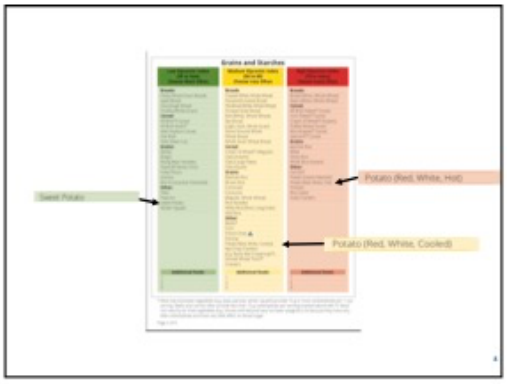

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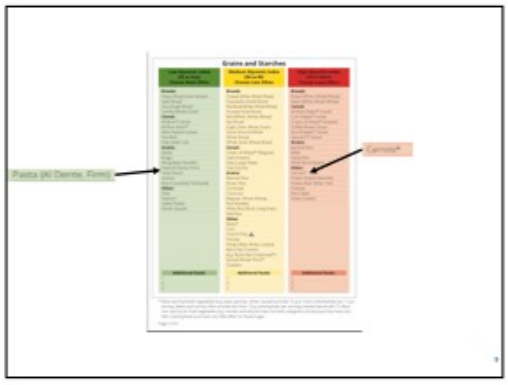

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Appendix E. Glycaemic Index Intervention PowerPoint Slides

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Appendix F. Glycaemic Index Food Guide

Glycemic Index Food Guide

The glycemic index (GI) is a scale that ranks a carbohydrate-containing food or drink by how much it raises blood sugar levels after it is eaten or drank. Foods with a high GI increase blood sugar higher and faster than foods with a low GI.

There are three GI categories:

Green = Go
Low GI (55 or less) Choose Most Often

Yellow = Caution
Medium GI (56 to 69) Choose Less Often

Red = Stop and think
High GI (70 or more) Choose Least Often

Foods in the high GI category can be swapped with foods in the medium and/or low GI category to lower GI.

A low GI diet may help you:

- decrease risk of type 2 diabetes and its complications
- decrease risk of heart disease and stroke
- feel full longer
- maintain or lose weight

Try these meal planning ideas to lower meal GI:

- Cook your pasta al dente (firm). Check your pasta package instructions for cooking time.
- Make fruits and milk part of your meal plate (Figure 1). These foods often have a low GI and make a healthy dessert.
- Try lower GI grains, such as barley and bulgur.
- Pulses can be grains and starches or meat and alternatives. Swap half of your higher GI starch food serving with beans, lentils or chickpeas. For example, instead of having 1 cup of cooked short grain rice, have ½ cup of cooked rice mixed with ½ cup of black beans.

Diabetes Canada recommends choosing lower GI foods and drinks more often to help control blood sugar.

Work with your Registered Dietitian to add foods and drinks to your lists, create action plans that include choosing low**er** GI foods, adapt your favourite recipes, and find ways to swap/substitute low GI foods into your meal plan.

Checking your blood sugar before, and 2 hours after, a meal is the best way to know how your body handles certain foods and drinks.

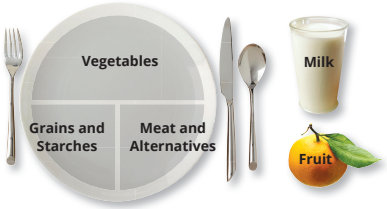

Figure 1: The Plate Method. Using a standard dinner plate, follow this model to control your portion sizes. www.diabetes.ca/mealplanning

Some carbohydrate-containing foods and drinks have so little carbohydrate that they do not have a GI value. This does not mean they cannot be included as part of a healthy diet. Examples include green vegetables, lemons, and some low-carbohydrate drinks. Diabetes Canada calls these foods and drinks "free" because they do not impact the blood sugar of people living with diabetes. You can put free foods in the green category, but they do not have a GI and have not been included in the food lists.

Items with this symbol are "sometimes foods"
(foods and drinks eaten only on occasion)

DIABETES CANADA

Grains and Starches

Low Glycemic Index (55 or less) Choose Most Often	Medium Glycemic Index (56 to 69) Choose Less Often	High Glycemic Index (70 or more) Choose Least Often
Breads:	**Breads:**	**Breads:**
Heavy Mixed Grain Breads	Chapati (White, Whole Wheat)	Bread (White, Whole Wheat)
Spelt Bread	Flaxseed/Linseed Bread	Naan (White, Whole Wheat)
Sourdough Bread	Pita Bread (White, Whole Wheat)	**Cereal:**
Tortilla (Whole Grain)	Pumpernickel Bread	All-Bran Flakes™ Cereal
Cereal:	Roti (White, Whole Wheat)	Corn Flakes™ Cereal
All-Bran™ Cereal	Rye Bread (Light, Dark, Whole Grain)	Cream of Wheat™ (Instant)
All-Bran Buds™ With Psyllium Cereal	Stone Ground Whole Wheat Bread	Puffed Wheat Cereal
Oat Bran	Whole Grain Wheat Bread	Rice Krispies™ Cereal
Oats (Steel Cut)	**Cereal:**	Special K™ Cereal
Grains:	Cream of Wheat™ (Regular)	**Grains:**
Barley	Oats (Instant)	Jasmine Rice
Bulgur	Oats (Large Flake)	Millet
Mung Bean Noodles	Oats (Quick)	Sticky Rice
Pasta (Al Dente, Firm)	**Grains:**	White Rice (Instant)
Pulse Flours	Basmati Rice	**Other:**
Quinoa	Brown Rice	Carrots*
Rice (Converted, Parboiled)	Cornmeal	Potato (Instant Mashed)
Other:	Couscous (Regular, Whole Wheat)	Potato (Red, White, Hot)
Peas	Rice Noodles	Pretzels
Popcorn	White Rice (Short, Long Grain)	Rice Cakes
Sweet Potato	Wild Rice	Soda Crackers
Winter Squash	**Other:**	
	Beets*	
	Corn	
	French Fries	
	Parsnip	
	Potato (Red, White, Cooled)	
	Rye Crisp Crackers (e.g. Ryvita Rye Crispbread™)	
	Stoned Wheat Thins™ Crackers	
Additional foods:	**Additional foods:**	**Additional foods:**
1.	1.	1.
2.	2.	2.
3.	3.	3.

* Most starchy/sweet vegetables (e.g. peas, parsnip, winter squash) provide 15 g or more carbohydrate per 1 cup serving. Beets and carrots often provide less than 15 g carbohydrate per serving (marked above with *). Most non-starchy (or free) vegetables (e.g. tomato and lettuce) have not been assigned a GI because they have very little carbohydrate and have very little effect on blood sugar.

Appendix F. Glycaemic Index Food Guide

Fruits

Low Glycemic Index (55 or less) Choose Most Often	Medium Glycemic Index (56 to 69) Choose Less Often	High Glycemic Index (70 or more) Choose Least Often
Apple	Banana (Ripe, Yellow)	Banana (Brown, Overripe)
Apricot (Fresh, Dried)	Cherries (Bottled)	Watermelon
Banana (Green, Unripe)	Cherries (Fresh)	
Berries	Cranberries (Dried)	
Cantaloupe	Figs (Fresh, Dried)	
Grapefruit	Grapes	
Honeydew Melon	Kiwi	
Mango	Lychee	
Orange	Pineapple	
Peach	Raisins	
Pear		
Plum		
Pomegranate		
Prunes		
Additional foods:	**Additional foods:**	**Additional foods:**
1.	1.	1.
2.	2.	2.
3.	3.	3.

Some fruits have not been assigned a GI because they contain less than 15 g of available carbohydrate per serving (e.g. lemon and lime).

Many fruits and vegetables fall in the low or medium GI categories.

Milk, Alternatives and Other Beverages

Low Glycemic Index (55 or less) Choose Most Often	Medium Glycemic Index (56 to 69) Choose Less Often	High Glycemic Index (70 or more) Choose Least Often
Almond Milk		Rice Milk
Cow Milk (Skim, 1%, 2%, Whole)		
Frozen Yogurt		
Greek Yogurt		
Soy Milk		
Yogurt (Skim, 1%, 2%, Whole)		
Additional foods:	**Additional foods:**	**Additional foods:**
1.	1.	1.
2.	2.	2.
3.	3.	3.

Milk, alternatives, and other beverages listed include flavoured (e.g. chocolate), sweetened and unsweetened varieties.

Meat and Alternatives

Low Glycemic Index (55 or less) Choose Most Often	Medium Glycemic Index (56 to 69) Choose Less Often	High Glycemic Index (70 or more) Choose Least Often
Baked Beans	Lentil Soup (ready-made)	
Chickpeas	Split Pea Soup (ready-made)	
Kidney Beans		
Lentils		
Mung Beans		
Romano Beans		
Soybeans/Edamame		
Split Peas		
Additional foods:	**Additional foods:**	**Additional foods:**
1.	1.	1.
2.	2.	2.
3.	3.	3.

Meat, poultry and fish do not have a GI because they do not contain carbohydrate. When ½ cup or more of pulses are eaten, they can be included in the Grains and Starches food group or the Meats and Alternatives group.

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Appendix G. Three-Day Diet Record

Office use only:
ID: _____ Visit:

Date: ___/___/_____
Day/Month/Year

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IWK Foundation

How do you Properly Complete a Three-Day-Diet Record?

1. Please write down what you eat and drink for 3 days. Please write down what you eat and drink on two weekdays and one weekend day.

2. When measuring the food you eat and the liquid you drink, you can use tools to help you keep track. For example, you can use measuring cups and tablespoons.

3. On your diet record (next page) under the heading "time", please write down the time of day you eat or drink.

4. Under the heading "method of preparation", please write down details about how you make your meal. For example, you may like to fry eggs in one teaspoon of vegetable oil…

5. Under the heading "descriptor", please give additional details about the food you eat and the liquid you drink. For example, if you eat a bagel, write down if it is from Tim Hortons or a Dempster's bagel. If you eat an apple, write down if it is a granny smith or a red delicious.

6. Please write down things that you add to your food and drinks. For example, we would like to know if you add sugars, sweeteners, sauces, coffee cream, mayonnaise, curry, coconut milk, salad dressing, or peanut butter to your meals.

7. Write down drinks, desserts, and snack foods you eat and drink.

8. Under the heading "amount" please write down how much of the food you eat or liquid you drink. For example: 1 litre of water, 2 cups of Cheerios, or 1 teaspoon of butter.

Office use only:
ID: _____ Visit:

Date: ___/___/_____
Day/Month/Year

Three Day Diet Record

Time	Food Details			Amount	
	Food Name	Method of Preparation	Descriptor	#	Unit of measure

Appendix G. Three-Day Diet Record

Office use only:
ID: _____ Visit:

Date: ___/___/_____
Day/Month/Year

Three Day Diet Record

Time	Food Details			Amount	
	Food Name	Method of Preparation	Descriptor	#	Unit of measure

Office use only:
ID: _____ Visit:

Date: ___/___/_____
Day/Month/Year

Three Day Diet Record

Time	Food Details			Amount	
	Food Name	Method of Preparation	Descriptor	#	Unit of measure

Appendix G. Three-Day Diet Record

Office use only:
ID: _____ Visit:

Date: ___/___/_____
Day/Month/Year

Three Day Diet Record

Time	Food Details			Amount	
	Food Name	Method of Preparation	Descriptor	#	Unit of measure

Office use only:
ID: _____ Visit:

Date: ___/___/_____
Day/Month/Year

Recipe Name: _____

Food Details			Amount	
Ingredient	Method of Preparation	Descriptor	#	Unit of measure

Total Servings in Recipe: _____

Recipe Notes:

_____

_____

_____

_____

_____

_____

_____

_____

Appendix G. Three-Day Diet Record

Office use only:
ID: _____ Visit:

Date: ___/___/_____
Day/Month/Year

Recipe Name: _____

Food Details			Amount	
Ingredient	Method of Preparation	Descriptor	#	Unit of measure

Total Servings in Recipe: _____

Recipe Notes:

_____

_____

_____

_____

_____

_____

_____

_____

Office use only:
ID: _____ Visit:

Date: ___/___/_____
Day/Month/Year

Recipe Name: _____

Food Details			Amount	
Ingredient	Method of Preparation	Descriptor	#	Unit of measure

Total Servings in Recipe: _____

Recipe Notes:

_____

_____

_____

_____

_____

_____

_____

_____

Appendix Hi. Glycaemic Index Questionnaire Section 1

Research Team use only:
Participant ID: ___ ___ ___ ___ ___/___ ___/___ ___ ___ ___
Day/Month/Year

Glycemic Index Questionnaire Section 1: Participant Satisfaction
(*Participant Administered – All Participants - After Class*)

Please answer the following questions as directed below. If you do not have an answer or prefer not to answer, please leave the question blank.

1. Who are you?
→ Please put an "X" next to the best answer for you.

☐ Patient

☐ Friend of patient

☐ Spouse or partner of patient

☐ Other

b. If you picked "Other", please describe who you are on the line provided below:

_____

2a. Did you learn anything new during your study welcome (study welcome package + education video)?
→ Please put an "X" next to the best answer for you.

☐ Yes

☐ No

2b. If you learned something new during your study welcome, what was the most important thing you learned? Please write your answer on the line below.

_____

Research Team use only:
Participant ID: ___ ___ ___ ___ ___/___ ___/___ ___ ___ ___
Day/Month/Year

3. Please put an "X" next to the answer that best reflects your response to each statement. The statements are about your study welcome (study welcome package + education video).

a) I liked getting the welcome package in advance of the education video.
- ☐ Strongly agree
- ☐ Agree
- ☐ Neither agree of disagree
- ☐ Disagree
- ☐ Strongly disagree

b) The video was easy to understand.
- ☐ Strongly agree
- ☐ Agree
- ☐ Neither agree of disagree
- ☐ Disagree
- ☐ Strongly disagree

c) The video was interesting.
- ☐ Strongly agree
- ☐ Agree
- ☐ Neither agree of disagree
- ☐ Disagree
- ☐ Strongly disagree

d) The teacher was easy to understand.
- ☐ Strongly agree
- ☐ Agree
- ☐ Neither agree of disagree
- ☐ Disagree
- ☐ Strongly disagree

Appendix Hi. Glycaemic Index Questionnaire Section 1

Research Team use only:
Participant ID: ____ ____ ____ ___ ___/___ ___/___ ___ ___ ___
Day/Month/Year

e) The hands-on activities (e.g. game) helped me learn.

☐ Strongly agree
☐ Agree
☐ Neither agree of disagree
☐ Disagree
☐ Strongly disagree

f) The PowerPoint slides helped me learn.

☐ Strongly agree
☐ Agree
☐ Neither agree of disagree
☐ Disagree
☐ Strongly disagree

g) I think that what I learned today will help me make changes to my diet.

☐ Strongly agree
☐ Agree
☐ Neither agree of disagree
☐ Disagree
☐ Strongly disagree

h) If you have anything else you would like to tell us about your responses to question 3 (above), please write them on the lines below. For instance, you can provide more feedback on the welcome package or video (and related materials) here.

_____

Research Team use only:
Participant ID: ____ ____ ____ ___ ___/___ ___/___ ___ ___ ___
Day/Month/Year

4a. After study welcome, do you think you are prepared to completed your study activities?

☐ Yes
☐ No
☐ I am not sure

b) If you want to elaborate on your response to 4a, please write this on the line provided below.

_____

5. What can we do to make the study welcome better? Please write your answer on the line provided below.

_____

6. What did you like about your study welcome? Please write your answer on the line provided below.

_____

Appendix Hii. Glycaemic Index Questionnaire Section 2

Research Team use only:
Participant ID: ___ ___ ___ ___ ___/___ ___/___ ___ ___ ___ ___
Day/Month/Year

Glycemic Index Questionnaire Section 2: Getting to Know You
(*Investigator Administered – All participants - Before or After Class*)

For Administrator: *Administer only at baseline. Ask questions as written and follow directions provided. For true and false and multiple-choice questions, please put an "X" next to the answer(s) the participant chooses. Typically, one answer will be appropriate for close-end questions, but it will be clearly noted when multiple options are appropriate/ invite. If a respondent does not have an answer or would prefer not to answer, please leave the question blank.*

1. Which ethnic group(s) do you identify with? Check all that apply (inspired by Omand et al. Annals of Epidemiology. 24; 2014: 246-253.).

☐ Aboriginal
☐ European
☐ African/Caribbean
☐ West Indian
☐ Scottish/ Irish
☐ English
☐ Latin American
☐ Indian
☐ Middle Eastern
☐ East Asian
☐ South East Asian
☐ Other

1b. If an "X" was placed next to other (in 1a), please ask the participant to list all ethnic groups identified with on the line provided below.

_____

2. Were you born in Canada? Check the best answer.

☐ Yes
☐ No

Research Team use only:
Participant ID: ___ ___ ___ ___ ___/___ ___/___ ___ ___ ___ ___
Day/Month/Year

2b. If No, when did you move to Canada? Please write the year the participant immigrated to Canada on the line provided.

_____

3. What is the main language you speak at home? Please write the participants response on the line provided.

_____

4. In your home, who purchases the food most often?

☐ I do
☐ My spouse/ partner
☐ My parent(s)
☐ My children
☐ My roommate
☐ Other → Who purchases food in your home most often? _____

5. In your home, who makes the meals most often?

☐ I do
☐ My spouse/ partner
☐ My parent(s)
☐ My children
☐ My roommate
☐ Other → Who makes the meals most often? _____

6. What is the highest level of education you have finished? Please ask the participant to choose all that apply.

☐ High school or high school equivalent
☐ College certificate or diploma
☐ Undergraduate degree
☐ Graduate degree: Masters
☐ Other → _____

Appendix Hii. Glycaemic Index Questionnaire Section 2

Research Team use only:
Participant ID: ___ ___ ___ ___ ___/___ ___/___ ___ ___ ___ ___
Day/Month/Year

7. What words or phrases best describe your current work status? Please choose all that apply.

☐ Full time (≥ 32 hrs per week)
☐ Part time (≤ 32 hrs per week)
☐ Casual employee
☐ Stay at home mom
☐ Full time student
☐ Part time student
☐ Disability
☐ Other: _____

8. How do you treat or control your diabetes today? Please choose all that apply.

☐ Diet
☐ Exercise
☐ Oral Medication
☐ Insulin
☐ Other: _____

9. Have you ever met with a Dietitian before to talk about diet?

☐ Yes
☐ No
☐ I do not know

10. Have you ever heard of the glycemic index before your involvement in this study?

☐ Yes
☐ No
☐ I do not know

11. Do you know what the glycemic index is?

☐ Yes
☐ No
☐ I do not know

Research Team use only:
Participant ID: ___ ___ ___ ___ ___/___ ___/___ ___ ___ ___ ___
Day/Month/Year

12. Overall, how would you describe your feelings about your current food choices?

☐ Excellent
☐ Very good
☐ Good
☐ Fair
☐ Poor

13. Is there any other information you would like to share with us that you think will help us understand you as a patient or study participant?

_____

Appendix Hiii. Glycaemic Index Questionnaire Section 3

Research Team use only:
Participant ID: ___ ___ ___ ___ ___/___ ___/___ ___ ___ ___
Day/Month/Year

Glycemic Index Questionnaire Section 3: Glycemic Index Knowledge
(*Participant Administered – Intervention only - Before and After Class*)

→ Please put an "X" on the line next to the response option that is the most right/ correct.

1. Which of the words below best describes your knowledge of glycaemic index (GI)?

_____ Poor
_____ Fair
_____ Good
_____ Very good
_____ Excellent

2. The glycemic index (GI) is a tool we can use to group carbohydrate (or carb) foods by the effect they have on blood glucose/ sugar. Is this statement true or false?

____ True
____ False
____ I do not know the answer

3. Which breakfast food (below) has the lowest GI?

_____ Corn flakes
_____ White bread
_____ Bran buds
_____ Oatmeal
_____ Bran Flakes
_____ I do not know the answer

Research Team use only:
Participant ID: ___ ___ ___ ___ ___/___ ___/___ ___ ___ ___
Day/Month/Year

4. Which meal (below) has the lowest GI?

_____ Canned pasta in tomato sauce
_____ "Al dente" (cooked for about 10 minutes and still firm) spaghetti in tomato sauce
_____ Instant white rice with tomato sauce
_____ A hamburger on a white bun with French fries
_____ I do not know the answer

5. The GI is a number between 1 and 100. For example, 55. Is this statement true or false?

____ True
____ False
____ I do not know the answer

6. According to the Diabetes Canada (formerly the Canadian Diabetes Association), a high GI food is a food that has a GI of:

____ Less than 55
____ between 56 and 69
____ 70 or more
____ I do not know the answer

7. The GI of a white potato will be the lowest when served as _____. Which of the response options best fills in the blank line?

____ A cold potato salad with olive oil
____ A hot baked potato with butter
____ A warm boiled potato with salsa
____ A warm potato salad with olive oil
____ I do not know the answer

Appendix Hiii. Glycaemic Index Questionnaire Section 3

Research Team use only:
Participant ID: ___ ___ ___ ___ ___/___ ___/___ ___ ___ ___
Day/Month/Year

8. Which snack food, listed below, has the highest GI?

____ Popcorn
____ Ryvita rye crisps
____ Pretzels
____ Couscous
____ I do not know the answer

9. Which foods are absorbed most quickly?

____ Low GI foods
____ Medium GI foods
____ High GI foods
____ Acidic foods
____ I do not know the answer

10. Foods that are broken down fast by the body are _____. Which of the response options best fills in the blank line?

____ Medium GI foods
____ High GI foods
____ Low GI foods
____ Super foods
____ I do not know the answer

11. The GI ranks food by how much it raises _____. Which of the response options best fills in the blank line?

____ Flatulence (farting)
____ Blood protein
____ Calories
____ Blood glucose
____ I do not know the answer

Research Team use only:
Participant ID: ___ ___ ___ ___ ___/___ ___/___ ___ ___ ___
Day/Month/Year

12. Medium to high GI foods will raise your blood glucose _____ than low GI foods. Which of the response options best fills in the blank line?

_____ Faster and higher
_____ Slower and higher
_____ Slower and lower
_____ Medium to high GI foods will not affect your blood glucose
_____ I do not know the answer

13. Fresh meat, fish, and poultry have a GI value of _____. Which of the response options best fills in the blank line?

____ 0
____ Meat, fish and poultry do not have a GI
____ 55
____ between 72 to 100
____ I do not know the answer

14. You can lower the glycemic index of a food or drink by adding fat or protein. Is this statement true or false?

____ True
____ False
____ I do not know the answer

15. To lower the glycemic index of a supper/ dinner including a warm baked Russet potato, which food would you substitute in?

_____ Sweet potato fries, fried in olive oil
_____ Cooled baked Russet potato
_____ Baked salmon
_____ I do not know the answer

Appendix Hiv. Glycaemic Index Questionnaire Section 4

Research Team use only:
Participant ID: ___ ___ ___ ___ ___/___ ___/___ ___ ___ ___
Day/Month/Year

Glycemic Index Questionnaire Section 4a: Is Your Diet Working for You?
(*Participant Administered – All Participants – 4 to 6 weeks After Class and Postpartum*)

Please put an "X" on the line next to the response option that is best for you. If you do not have an answer or prefer not to answer, please leave the question blank.

1. Since the study welcome, I have added study foods to my diet. Is this statement true or false?

☐ True

☐ False

2. Since the study welcome, what percentage of your total intake has been made up of study foods?

☐ 0%

☐ 0 to 25%

☐ 26 to 50 %

☐ 51 to 75%

☐ 76 to 100 %

☐ I am not sure

3. How would you describe your experience adding study foods to your diet? Please write your answer on the line provided below.

_____

Research Team use only:
Participant ID: ___ ___ ___ ___ ___/___ ___/___ ___ ___ ___
Day/Month/Year

4. Please choose the word below that best describes your ability to choose study foods in the supermarket.

☐ Poor

☐ Fair

☐ Good

☐ Very good

☐ Excellent

5. Please choose the word below that best describes your ability to choose study foods when eating out of the home.

☐ Poor

☐ Fair

☐ Good

☐ Very good

☐ Excellent

6. Please choose the word below that best describes your ability to include study foods in meal planning.

☐ Poor

☐ Fair

☐ Good

☐ Very good

☐ Excellent

Appendix Hiv. Glycaemic Index Questionnaire Section 4

Research Team use only:
Participant ID: ___ ___ ___ ___ ___/___ ___/___ ___ ___ ___ ___
Day/Month/Year

7. How would you rate your ability to make traditional meals with study foods?

☐ Poor
☐ Fair
☐ Good
☐ Very good
☐ Excellent
☐ This question does not apply to me

8. Since the study welcome, have the people you live with been eating study foods?

☐ Yes
☐ No
☐ This question does not apply to me

9. In your opinion, how would your house mates (i.e., family, partner, friends, etc.) rate the study foods?

☐ Poor
☐ Fair
☐ Good
☐ Very good
☐ Excellent
☐ This question does not apply to me

10. How would you rate the taste of the study foods that have been added to your diet since the study welcome?

Food Choice	Poor	Fair	Good	Very good	Excellent
e.g. Barley			X		

Research Team use only:
Participant ID: ___ ___ ___ ___ ___/___ ___/___ ___ ___ ___ ___
Day/Month/Year

11. Planning meals that include study food does not require more time than planning other meals. Is this statement true or false?

☐ True
☐ False

12. Study foods cost the same as other foods. Is this statement true or false?

☐ True
☐ False

13. Do you think you will continue to eat study foods after this study is over? Is this statement true or false?

☐ Yes
☐ No

14. If you have anything else you would like to say about your experience incorporating study foods into your routine, please write it on the lines provided below.

Appendix I. Study 2 Letter of Information

We would like to invite you to learn more about our research study.

The Maternal Newborn Program is conducting a study to evaluate patient satisfaction with in-person and online education approaches for managing Gestational Diabetes. Patients who meet the following inclusion criteria may be eligible to participate.

Women who are/have:

1. ≥ 18 years of age
2. Existing or Recent Diagnosis of Gestational Diabetes in Pregnancy
3. Followed by IWK Health Centre DIP Clinic
4. Currently living in Nova Scotia, Canada
5. Received in-person and/or online education after January 1, 2020.

If you choose to join the study, you would be asked to:
1. Complete an Online Patient Satisfaction Questionnaire (10- to 15- minute duration)

If this study sounds like something you would like to learn more about, please fill out the form below and e-mail it to GIinGDM@iwk.nshealth.ca . Signing this form does not mean you are joining the study. A research team member will call you at the number provided below to tell you more about the study, answer any questions you may have and review a consent form with you. If you have questions while you wait for us to call or email you, you can email one of our team members at GIinGDM@iwk.nshealth.ca.

Please complete the following form:

Yes, I consent to one of the study team members calling me Date: _____
day – month - year

Signature: _____ Print name: _____

Phone Number: _____ Best time to contact me is: _____

Email: _____

_____ Yes, it is ok for study staff to leave a voicemail at the phone number given above.

_____ No, I would prefer if study staff did not leave a message on my voicemail at the phone number given above.

Appendix J. Study 2 Consent Form

Informed Consent to Participate in a Research Study

Full Study Title: Patient Experience with Home-Based Gestational Diabetes Education during COVID-19: A Satisfaction Questionnaire.
Short Study Title: COVID-GDM

Research Team Members and Contact Information:

Shannan Grant, PDt, MSc, PhD (Principal Investigator)
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COVID-GDM Research Office:
Room Number: G7047.1
Phone Number: 902-470-6532

Funding
This study is not supported by any funding body.

Do the study investigators have any actual conflicts of interest?

All members of the research team do not have any actual conflicts of interest to report, although this research is to be completed as part of Julianne LeBlanc's training and thesis development using study findings as secondary data.

Introduction

We would like to invite you to take part in a research study. If you volunteer for this study, you will be referred to as a "volunteer" or a "participant". A research study is a way of gathering information on a treatment, procedure or medical device or to answer a question about something that is not well understood. This consent form explains the purpose of our study. It also provides information about the tests and procedures involved in, possible risks and benefits of participating, and the rights of participants.

Please read this form carefully and ask questions. After you read it, a research team member will review it with you, to ensure you are confident in your ability to make an informed choice. Please ask the research team to clarify anything in this document you do not understand or you would like to know more about. Make sure all your questions are answered before deciding whether to participate in this research.

Translation services can be accessed to verbally translate this form into your preferred language. Please take as much time as you need/ wish, to decide whether or not to take part in this study. Feel free to discuss this study with your friends and family, or your family doctor. Participating in this study is your choice (voluntary). Informed consent starts with this initial contract about the study and continues until the end of the study. You have the right to choose not to participate or to stop participating in this study at any time.

What is usual (or standard) treatment (or care) for Gestational Diabetes Mellitus (GDM)?

Health care providers (examples: Doctors, Nurses and Dietitians) working with women with GDM refer to the Diabetes Canada Clinical Practice Guidelines. The full guidelines and patient handouts can be found on the Diabetes Canada website: https://www.diabetes.ca/.

All patients receiving care for GDM at the IWK Health Centre attend an introductory class, taught by a Registered Dietitian (PDt or RD) and Registered Nurse (RN). This 1.5-hour class introduces patients to GDM, nutrition therapy for GDM, physical activity recommendations for treating GDM, how to self-monitor blood glucose (sugar), drug treatment options, and the role of the health care team and people who make it up. After this education, you will monitor your blood glucose and regularly communicate with the PDts (by telephone and email) for nutrition therapy support, until your last appointment (at six to eight weeks after your baby is born).

The recent outbreak of the Novel Coronavirus (COVID-19) outbreak led the IWK Health Centre to enact safety protocols and social distancing policy. With limited time and resources, the GDM clinic has uploaded videos and handouts for standard care to the IWK website, available from http://www.iwk.nshealth.ca/gdmteaching. Since March 15, 2020, clinic patients have received their education online instead of in-person for the duration of the pandemic.

Appendix J. Study 2 Consent Form

Why is this study being done?

You have been invited to join this study because you have been diagnosed GDM and are or have been receiving standard care (treatment) with the IWK Health Centre in Halifax, Nova Scotia.

Patient satisfaction of this education is needed to indicate quality in health care. Patient satisfaction affects how well standard care will help patients to achieve and troubleshoot blood glucose.
In order to do this, we will be asking study participants questions, using a questionnaire called the Gestational Diabetes Education Feedback Questionnaire. The main research question we will ask during this study (with participants help) is: Are women receiving care at the IWK for gestational diabetes mellitus satisfied with the existing distance education offered by the Maternal Newborn Program?

Who can participate in this study?

Those who meet the following inclusion criteria can participate in this study. Women who are:

1. 18 years of age or older
2. Existing or recent diagnosis with GDM according to IWK Health Centre screening procedures
3. Followed by IWK Health Centre
4. Willing and able to give informed consent
5. Willing and able to complete study protocol (as explained in this consent form)
6. Currently living in Nova Scotia, Canada
7. Attended the clinic since January 1, 2020.

Those who meet the following exclusion criteria will not be able to participate. Women who:

1. have language barriers that cannot be addressed.

What will participants do?

The estimated time for each participant to complete the study is 10 to 15 minutes. This research study will be completed remotely with assistance by e-mail.

If you agree to participate, you will be asked to complete a feedback questionnaire on your experience with in-person and/or online education experience. The questions will be designed to evaluate experience according to the following six factors: 1.) Presentation of content, 2.) Clarity, 3.) Comprehension, 4.) Applicability, 5.) Usefulness, and 6.) Content. You will be asked to answer questions on a scale of satisfaction and you will be able to write feedback.

What are the risks or harms of participating in this study?

There are no known harms from participating in this study, but there may be harms that are not expected. If you participate in this study, contact Shannan Grant about any harms or study-related injuries that you experience. She can be reached at: Shannan.Grant@iwk.nshealth.ca OR 902-457-5400.

You will be told about any new information that might affect your willingness to continue to participate in this study as soon as the information becomes available.

What are the benefits of participating in this study?

You may or may not benefit directly from participating in this study. Participation in this study may result in increasing knowledge about nutrition, home-based patient education and the needs of patients receiving treatment for GDM in Nova Scotia, Canada. Your participation may or may not help other people with GDM in the future.

Can participation in this study end early?

Participating in this study is voluntary and you can withdraw at any time. Withdrawing from this study will not affect your participation in any future studies or future interactions with the IWK Health Centre or Mount Saint Vincent University. If you choose to withdraw, you and your family will continue to have the same access to care at the IWK Health Centre as you did before. If you withdraw from the study you are encouraged to contact the research team members (by email) to let them know about your decision. If you withdraw your consent, the information about you that was collected before you left the study will still be used unless you request to have it withdrawn. No new information about you will be collected without your permission.

What are the costs of participating in this study?

Minimal costs may be involved by participants during remote correspondence (e.g. internet usage). You will not be paid to participate in this study.

How will my privacy be protected?

All information collected for this study will be handled in a manner that corresponds with institutional, provincial and national requirements for ethical research. If you decide to participate, the Research Coordinator will look at your personal health information (PHI) for the purpose of collecting your informed consent. Your PHI will not be associated with your questionnaire answers. PHI is health information that could identify you (e.g. name, address, telephone number, date of birth, hospital identification number).

The research team will keep the information they see or receive about you confidential, to the extent permitted by applicable laws. Even though the risk of identifying you from the study data is very small, it can never be completely eliminated. The research team will keep any personal health information about you in a secure and confidential location for 5 years and then destroy it according to IWK Health Centre policy.

When the results of this study are published or shared in a public forum, your identity will not be disclosed. You have the right to be informed of the results of this study once the entire study is complete.

Appendix J. Study 2 Consent Form

What are the rights of participants in a research study?

Your signature on the form indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to participate as a subject. In no way does this waive your legal rights nor release the investigator(s), sponsors, or involved institution(s) from their legal and professional responsibilities.

If you become ill or injured as a direct result of participating in this study, necessary medical treatment will be available at no additional cost to you. You are free to withdraw from the study at any time without jeopardizing the health care you are entitled to receive.

You have the right to review any and all information that could help you decide about participating in the study. You also have the right to ask questions about the study and your rights as a research participant, and to have them answered to your satisfaction, before you make any decision. You also have the right to ask questions and receive answers throughout this study.

If you have any questions for the principal investigator, please contact Dr. Shannan Grant at Shannan.Grant@iwk.nshealth.ca or 902-457-5400. Voice mail is available on this phone line. Messages are only picked up by Dr. Grant. The research team will be available to answer your questions regarding the educational materials and protocol by email between 8am and 6pm Monday to Friday (see page one for contact information).

If you have any questions at any time during or after the study about research in general you may contact the Research Office of the IWK Health Centre at (902) 470-8520, Monday to Friday between 8:00a.m. and 4:00p.m. If you have any questions regarding your rights as a research participant or any ethical issues related to the study that you wish to discuss with someone not directly involved in the study, you may contact the IWK Research Ethics Board at (902) 470-7879.

DOCUMENTATION OF INFORMED CONSENT

Full Study Title: Patient Experience with Home-Based Gestational Diabetes Education during COVID-19: A Satisfaction Questionnaire. (Short Study Title: COVID-GDM)

Name of Participant: _____

You will be receiving a copy of this consent form after it has been signed and dated by you and a research team member. You can complete this form using an electronic device, or by printing to sign.

Participant:

By signing this consent form, I confirm that (Initial each box below):

☐	This research study has been fully explained to me and all of my questions answered to my satisfaction
☐	I understand the requirements of participating in this research study
☐	I have been informed of the risks and benefits, if any, of participating in this research study
☐	I have been informed of any alternatives to participating in this research study
☐	I have been informed of the rights of research participants
☐	I have read each page of this form
☐	I authorize access to my research study data as explained in this form
☐	I have agreed, or agree to allow the person I am responsible for, to participate in this research study

Name of participant (print)	Signature	Date (Day/ Month/ Year)

Appendix J. Study 2 Consent Form

ASSISTANCE DECLARATION

Was the participant remotely assisted during the consent process? ☐ Yes ☐No

☐ The consent form was read to the participant/substitute decision-maker, and the person signing below attests that the study was accurately explained to, and apparently understood by, the participant/substitute decision-maker.

☐ The person signing below acted as a translator for the participant/substitute decision-maker during the consent process. He/she attests that they have accurately translated the information for the participant/substitute decision-maker, and believe that that participant/substitute decision-maker has understood the information translated.

Name of Person Assisting (print)	Signature	Date (Day/ Month/ Year)

Person obtaining consent

By signing this form, I confirm that (initial every box):

	This study and its purpose has been explained to the participant named above
	All questions asked by the participant have been answered
	I will send copy of this signed and dated document to the participant

Name of Person obtaining consent (print)	Signature	Date (Day/ Month/ Year)

Statement of Investigator

I acknowledge my responsibility for the care and well-being of the above participant, to respect the rights and wishes of the participant as described in this informed consent document, and to conduct this study according to all applicable laws, regulations and guidelines relating to the ethical and legal conduct of research.

Name of Investigator (print)	Signature	Date (Day/ Month/ Year)

Are you interested in receiving results from this study?

You have already provided us with your contact information, so please answer the above question by putting your initials on the box next to the best answer for you.

☐ Yes

☐ No

Would you like an e-mailed copy of your signed consent form?

Please note email is not considered a secure form of communication; certain third-party webmail services (e.g. Gmail, Hotmail, etc.) may be stored/routed outside of Canada and governed by foreign laws. Your email address will not be used for any other purpose.

☐ Yes

☐ No

Appendix K. Gestational Diabetes Education Feedback Questionnaire

Table K.1 Gestational Diabetes Education Feedback Questionnaire

Answer Type	Q#	Question	Response Options
Multiple Choice	1	Who are you?	Patient Friend of Patient Spouse or partner of patient Other
Yes/No	2	Did you receive in-person education?	Yes No I don't know
Yes/No	3	Did you receive online education?	Yes No I don't know
Yes/No	4	Did you watch the following videos?	Introduction to Gestational Diabetes Online Gestational Diabetes Nutrition Class Glucometer Teaching Medication for Gestational Diabetes Blood Sugar Targets Diet and GDM Fasting Blood Sugars Label Reading Risk Factors Troubleshooting Blood Sugar Insulin and Gestational Diabetes Physical Activity
Likert Scale	5	These statements are about your experience: a. I liked having my education with the [Website or Education Day]. b. The [Website or Education Day] was easy to understand. c. The [Website or Education Day] was interesting.	Strongly Agree Agree Neither Agree or Disagree Disagree Strongly Disagree

Appendix K. Gestational Diabetes Education Feedback Questionnaire

		d. The [Website or Education Day] helped me to learn. e. I think that what I learned will help me make changes to my lifestyle. f. Overall, I was satisfied with [Website or Education Day].	
Open	6	If you have anything else you would like to tell us about your responses to question 5, please write it the line below.	-
Likert Scale	7	Please select the response that best reflects your response to each question about your experience with each topic. a. How satisfied were you with the teacher's instruction? b. Was the session helpful? c. Was the session interesting? d. How satisfied were you with the visual presentation? e. How satisfied were you with the overall session?	Very Satisfied Satisfied Neither Satisfied or Dissatisfied Dissatisfied Very Dissatisfied
Open	8	If you have anything else you would like to tell us about your responses to question 7, please write it the line below.	-
Likert Scale	9	Please select the response that best reflects your experience to each statement about your experience with each topic. a. I am confident in my ability to apply what I learned. b. I think that what I learned in the session will help me make changes in my diet.	Strongly Agree Agree Neither Agree or Disagree Disagree Strongly Disagree
Open	10	If you have anything else you would like to tell us about your responses to question 9, please write it the line below.	-
Open	11	Can you compare your experiences with online and in-person gestational diabetes education?	-
Open	12	What can be done to make the online education better?	-
Open	13	What did you like about the online GDM education?	-

Appendix L: Theme Codebook

Table L.1. Theme Codebook

Theme	Sub-Theme	Definitions
Supportive	Accessibility	Feedback indicating that educational resources were easily accessible, convenient, and offered flexible scheduling options.
	Content Quality	Feedback of appreciating the education (and materials) as helpful, culturally appropriate, informative, easy to understand, clear, engaging, and interactive.
	Emotional Response	Feedback indicating feelings of increased confidence, comfort with the class/content/learning space, a positive liking for their education, and a sense of empowerment.
	Sufficiency for Learning	Feedback with expressions of preference for a particular delivery mode, acknowledgment of personal benefits, noted knowledge improvement, and intent for behavior change.
Constructive	Engagement opportunity	Feedback about experiences being perceived as not personable, lonely or distant, stressful, lacking support, and overwhelming
	Inadequate content quality	Feedback about limited content, slow or time-consuming videos, insufficient demonstrations, poor video quality, information/data overload, and education content bring culturally appropriate for personal and diverse contexts.
	Insufficiency for Learning	Feedback with expressions of preference for alternative delivery modes, suggestions for modifications, and outlined limitations of the delivery mode.