Diet and Lifestyle Services for Women with a History of Gestational Diabetes Mellitus

A thesis presented in partial fulfilment of the requirements for the degree of

Master of Science

In

Nutrition and Dietetics

Massey University, Albany
New Zealand

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2025

Abstract

Background: Gestational diabetes mellitus (GDM) is a significant public health concern, affecting approximately 6.2% of pregnancies in New Zealand. Women with a history of GDM are at greater risk of developing type 2 diabetes mellitus (T2DM), cardiovascular disease (CVD), and recurrence of GDM. Evidence suggests that dietary and lifestyle interventions in the post-partum period can reduce these risks, yet there is limited understanding of what services are available to support women in New Zealand during this critical period. This study aimed to determine the availability and characteristics of the diet and lifestyle services available to women with a history of GDM in New Zealand.

Methods: A cross-sectional online survey aimed at health professionals who offer diet and lifestyle services to women with a history of GDM, was disseminated through professional organisations and snowball recruitment throughout New Zealand. The survey questions were developed with the research aims and objectives in mind, informed by existing literature and researcher clinical experience. The survey was pre-tested by healthcare professionals with experience in the field and adapted accordingly prior to final distribution. Data collection occurred over four weeks across July and August 2025. The survey included both quantitative and qualitative questions, gathering data on service availability, delivery, access criteria, costs, cultural responsiveness, and barriers to care. Responses were recorded in Qualtrics, and analysed in Microsoft Excel.

Results: A total of 62 health professionals participated in the survey, including nurses (29%, 18/62), dietitians (21%, 13/62), general practitioners (21%, 12/62), midwives (8%, 5/62), obstetricians (5%, 3/62), nutritionists (5%, 3/62), health coaches (5%, 3/62), and exercise physiologists (2%, 1/62) from all major regions of New Zealand. Respondents largely worked in general clinical (47%, 29/62) or diabetes-specific areas (39%, 24/62). Less than half of respondents provided dietary advice (41%, 21/51), 16% (8/51) of respondents provided lifestyle advice, and 4% (2/51) of respondents offered physical activity-related advice. Other services provided by respondents included: diabetes management and monitoring (43%, 22/51), education (14%, 7/51), antenatal care (12%, 6/51), perinatal care (6%, 3/51), lactation support (4%, 2/51), and CVD risk assessment (4%, 2/51). Services were mostly accessed through self-referral (52%, 28/52) or GP referral (50%, 26/52). Ninety percent (47/52) of

respondents offered in-person service delivery, with 92% of these respondents also offering alternative methods of delivery including telephone and online options. Follow-up services were offered by 94% (49/52) of respondents. Ninety-six percent of respondents reported discussing HbA1C with their patients in their service. Over a third (37%, 18/49) of respondents reported a cost for the patient to access their service, of which most (76%, 13/17) fell between NZD $50-100. Fourty-seven percent (8/17) of respondents reporting costs to their service stated they accept community service cards which reduces cost to NZD $19.50. Over half (53%, 25/47) of respondents reported providing specific services for Māori, including Māori specific providers and services (56%, 14/25), and financial support or reduced costs (24%, 6/25). Just under half (43%, 20/47) of respondents reported offering specific services for other cultures, including Pacific (85%, 17/20) and South Asian (40%, 8/20) communities. Reported service gaps included lack of resources or staffing (42%, 8/19), insufficient resources for South Asian women (12%, 4/34), lack of prevention support (12%, 4/34), and limited patient education (9%, 3/34)

Conclusion: This study identified variability in service provision, with fewer than half of surveyed health professionals offering dietary advice, less offering lifestyle services, and only a small proportion providing physical activity-related services. Access, cost, and cultural support vary between services and respondents describe limited resources and insufficient culturally tailored care as challenges to effectively support women with a history of GDM. These issues in service provision may leave these women at higher risk of developing chronic conditions such as T2DM and CVD, and highlight the need for more long-term, culturally responsive support for women with a history of GDM in New Zealand.

Acknowledgements

I would like to thank my main supervisor Robyn Lawrence and co supervisor Charlotte Oyston for all of their support, guidance, and input throughout the entirety of this research process. I truly appreciate the time and effort you have put into helping me shape this thesis, and I couldn't have asked for better supervisors.

I am also very grateful to the healthcare professionals who took part in this research. Your time, insights, and willingness to share your experiences made this study possible.

Thank you to the Massey 2024/25 Dietetics students and staff for your support and for making this journey such a memorable one.

I am incredibly thankful for my family and friends who have been very supportive and understanding throughout this time, I appreciate all of you. A special thank you to my dad Steve, who has spent hours proof-reading this thesis, and has always encouraged me through every step of my studies.

Lastly, to my fiancé Blair, thank you for your constant encouragement and support. I am so grateful and couldn't have done this without you.

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List of Abbreviations

Abbreviation	**Term**
GDM	Gestational diabetes mellitus
T2DM	Type 2 diabetes mellitus
CVD	Cardiovascular disease
OGTT	Oral glucose tolerance test
HbA1c	Glycated haemoglobin
BMI	Body mass index
MoH	Ministry of Health
hPL	Human placental lactogen

Chapter 1: Background and Purpose

1.0 Background

Gestational diabetes mellitus (GDM) is a condition characterised by the development of hyperglycaemia during pregnancy (World Health Organization, 2024). GDM is a significant public health concern as it increases the risk of immediate and long-term health complications for women and their children (Sheiner, 2020). In 2021, GDM was estimated to affect 21.1 million births globally, representing 16.7% of all live births (International Diabetes Federation, 2021). In New Zealand, GDM affects an estimated 6.2% of pregnancies (Lawrence et al., 2019). GDM is more common in those who have a family history of type 2 diabetes (T2DM), have had a previous GDM-affected pregnancy, have obesity or polycystic ovary syndrome, and those who lead a sedentary lifestyle (Amiri et al., 2021; Choudhury & Devi Rajeswari, 2021).

In most cases GDM will resolve within a few days post-partum with no need for further intervention (Mittal et al., 2025; Moyce & Dolinsky, 2018). However, GDM can lead to complications during pregnancy and the perinatal period such as hypertension, pre-eclampsia and increased rates of caesarean birth (Sheiner, 2020; Sousa et al., 2024). Additionally, women who have experienced a GDM-affected pregnancy face a seven-fold increased risk of developing T2DM after pregnancy (Bellamy et al., 2009), and almost 50% of women will experience GDM in subsequent pregnancies (Lu et al., 2025). The risk of developing cardiovascular disease (CVD) and metabolic syndrome is also largely increased (Kramer et al., 2019; Sheiner, 2020), as well as the risk of anxiety and depression in affected women (OuYang et al., 2021). Additionally, babies born to mothers affected by GDM are at an increased risk of macrosomia and may experience trauma during delivery such as hypoxia, hypoglycaemia, bacterial infection, jaundice, and respiratory distress (Kc, 2015; Nakshine, 2023; Voormolen et al., 2018). Babies born from a GDM-affected pregnancy may also have an increased risk of developing conditions such as T2DM, CVD and obesity later in life (Echeverria et al., 2020; Pathirana et al., 2021; Sheiner, 2020).

While there are no specific dietary guidelines for the management of GDM in New Zealand,

the Ministry of Health (MoH) Adult Eating and Activity guidelines apply to pregnant women and recommend tailored dietary interventions focusing on whole and minimally processed foods (Ministry of Health, 2020b). These include plenty of vegetables, fruits, whole grains, lean proteins, healthy fats, and replacing saturated fats with unsaturated alternatives, while minimising added sugars and salt. In addition to dietary advice, the MoH recommends adults engage in at least 150 minutes of moderate intensity aerobic activity per week to support healthy weight maintenance and reduce chronic disease risk (Ministry of Health, 2020b). Adherence to these guidelines can help manage blood glucose levels during pregnancy and serve as a foundation for long term prevention of T2DM and CVD in the post-partum period. However, leveraging health behaviours learned in pregnancy to optimise life-long health may be a missed opportunity.

Despite the increased risk of T2DM in those with a history of GDM, the only additional recommendation for these women compared to those unaffected by GDM in New Zealand is for an HbA1c test be conducted at 3 months post-partum, then yearly thereafter (Ministry of Health, 2014a). However, uptake of post-partum screening in New Zealand is poor. In a 2022 study which examined data from over a 10-year period and involved 14,443 women with a history of GDM, only 40.9% of women with a history of a GDM-affected pregnancy undertook an HbA1c or OGTT (oral glucose tolerance test) within 3 months post-partum, 53.3% within 6 months and 61.0% within 12 months post-partum (Sise et al., 2022). The study observed Māori women were less likely to receive blood glucose screening with only 35.0% receiving HbA1c screening at 6 months post-partum, identifying possible inequity in the availability or accessibility of these services (Sise et al., 2022). People of Māori ethnicity are at an increased risk of developing T2DM and are 2.5 times more likely to have T2DM when compared with other ethnicities in New Zealand (Holder-Pearson & Chase, 2022), highlighting the significance of this inequity.

As of 2022, there are an estimated 228,000 people in New Zealand living with T2DM, with this figure predicted to grow to 400,000 people by 2040 (Holder-Pearson & Chase, 2022). Diabetes treatment and complications cost the New Zealand healthcare system NZD $2.1B per year; an estimated 10% of the total healthcare budget (Holder-Pearson & Chase, 2022). Using the predicted trajectory of 400,000 people with diabetes by 2040, the estimated cost will rise to NZD $3.5B or an estimated 16% of the total healthcare budget, while diabetes

related expenses to an individual are predicted to rise up to 80% by 2040 (Holder-Pearson & Chase, 2022). If budgeting and resources do not increase proportionately, a rise in expenses could lead to inequities regarding access to healthcare services such as doctor or specialist appointments and prescription related costs. As these services become less accessible, this has potential implication for poorer health outcomes as a result of delayed intervention and treatment unaffordability (Holder-Pearson & Chase, 2022). CVD is the leading cause of morbidity globally (World Health Organization, 2025a), and affects approximately 180,000 New Zealanders (Heart Foundation, 2023). The cost of CVD and its complications amount to NZD $3.3B annually and contribute to New Zealand's already strained public healthcare system (Blakely et al., 2019; Wilson et al., 2023). Provision of quality and easily accessible post-partum GDM services to women in New Zealand, this may reduce both the social and economic strain on the healthcare system. Reducing the prevalence of T2DM and CVD through appropriate lifestyle services may also have a wider intergenerational impact on society, as these women may pass their knowledge and diet and lifestyle habits down to their children.

Diet and lifestyle intervention in the post-partum period could help to mitigate the risk of developing T2DM and CVD in women with a history of GDM (American Diabetes Association, 2015; Jowell et al., 2022; Liu et al., 2024; Takele et al., 2024). However, anecdotally, the availability and delivery of post-partum dietetic support for women with a history of GDM varies across New Zealand. A national survey of dietitians providing services for women with GDM revealed substantial variation in service delivery and 28% of respondents feeling that their services for women with GDM were inadequate (Lawrence et al., 2017). Just under 60% of dietitians in this survey reported giving advice specific to the post-partum diet. These findings highlight possible gaps in the quality of care for women with a history of GDM.

Many women following a GDM-affected pregnancy report feeling abandoned in the post-partum period (Parsons et al., 2018). Once the intensive medical attention received during pregnancy fades, attention is often placed on the baby while the mother can be left uncertain of how to manage her health or any future risks she may face (Morrison et al., 2014; Parsons et al., 2018). As the post-partum period for women with a history of GDM currently lacks clear pathways for follow-up, women may not receive appropriate education following

GDM and may not entirely understand or be aware of their future risks for chronic disease (Lazarus et al., 2025). As a result, this could lead to a lower sense of urgency for personal changes and these women may find it challenging to stay motivated in maintaining healthy lifestyle changes, particularly while managing the increased familial responsibilities, including caring for their newborn (Bennett et al., 2011; Gustavsen et al., 2024; Sinha et al., 2022).

Evaluating the extent to which current healthcare services meet the needs of women after a GDM-affected pregnancy is essential. To date, there is little evidence describing the current services offered to these women post-partum. Previous surveys have described women's care during pregnancy and experience with GDM (Dunne et al., 2024; Lawrence et al., 2017), though to the best of the author's knowledge, no such survey has been completed for those post-GDM in New Zealand. Further research may help to identify gaps in the availability and quality of services provided to women following a GDM-affected pregnancy. This may facilitate planning and provision of equitable access to high quality healthcare services across New Zealand and improve public health outcomes across diverse communities. This could lead to improvements to the health and wellbeing of women and their possible future pregnancies, whilst also reducing the risk of developing chronic disease such as T2DM and CVD. As a result, these improvements could help to alleviate the burden on the New Zealand healthcare system.

A comprehensive exploration of what services are available, who delivers them, and how they are provided would deepen our understanding of the current landscape of post-partum GDM management across New Zealand. This research aims to identify and characterise what services are currently available to women with a history of GDM in New Zealand, specifically focusing on those offering diet and lifestyle advice to mitigate risk of progression to chronic disease after GDM.

1.1 Aims

To determine the availability and characteristics of diet and lifestyle services available to women with a history of GDM in New Zealand.

1.1.1 Objectives

- Describe and characterise the modality, frequency, accessibility, location and availability of the services available to women following a GDM-affected pregnancy
- Evaluate the costs to patients associated with the available services
- Describe professional qualifications of those delivering the services

1.1.2 Hypothesis

- A range of different services exist for women with a history of GDM in New Zealand
- There is regional variation in the availability and characteristics of post-GDM care services for women in New Zealand.

1.1.3 Structure of Thesis

Chapter one introduces the purpose of this research in addition to outlining the aims, objectives, and hypotheses. Chapter two is a narrative review of relevant literature, exploring the background of gestational diabetes mellitus, and the current care women in New Zealand with a history of this condition receive in the years that follow. Chapter three outlines a research manuscript and includes an introduction, research methods, results from a cross-sectional survey, and a discussion and interpretation of survey findings. Chapter four concludes the

results, discusses how the aims and objectives were achieved, outlines the limitations and strengths of the research, and explores future research directives.

1.1.4 Researchers' Contributions

Table 1.1 Summary of researchers' contribution to thesis

Author	**Contribution to Thesis**
Katrina Crisford MSc Nutrition and Dietetics Student	Primary author of thesis Survey development and distribution Interpretation and presentation of results
Dr Robyn Lawrence Primary Supervisor Lecturer at Massey University	Primary supervisor of thesis Ethics application Assisted in survey development Revised and approved thesis Assisted in interpretation and presentation of results
Dr Charlotte Oyston Co-Supervisor Senior Lecturer at University of Auckland	Co-supervisor of thesis Ethics application Assisted in survey development Revised and approved thesis Assisted in interpretation and presentation of results

Chapter 2: Literature Review

2.0 Introduction

GDM is a growing public health concern. Although there is no comprehensive national surveillance data available for New Zealand, regional studies estimate that GDM affects approximately 6.2% of New Zealand pregnancies (Lawrence et al., 2019), and an estimated 16.7% of pregnancies globally (International Diabetes Federation, 2021). Women who have experienced a GDM-affected pregnancy are at an increased risk of developing chronic conditions such as T2DM and CVD later in life (Bellamy et al., 2009; Sheiner, 2020). Effective post-partum care and health services are essential in mitigating these risks. Health interventions such as universal post-partum HbA1c screening, dietary counselling, physical activity programmes, health education programmes, and psychological support have been shown to reduce risks of developing chronic disease and promote positive long term health outcomes for these women (Adam et al., 2023; Wang et al., 2024).

This literature review focuses on the pathophysiology of GDM, long-term risks associated with GDM and healthcare services available for women with a history of GDM in New Zealand. It explores how these services contribute to the prevention of long-term health conditions such as T2DM and CVD, and evaluates the consistency, accessibility, and cultural responsiveness of current care pathways. It aims to identify common barriers that women face when accessing services and highlights potential gaps in post-partum care that may be addressed through future improvements.

2.1 Pathophysiology of Gestational Diabetes

GDM is a condition which presents as hyperglycaemia during pregnancy, though it often resolves following delivery or end of pregnancy without need for intervention (Mittal et al., 2025; Moyce & Dolinsky, 2018). Pregnancy involves complex hormonal and metabolic changes that alter glucose metabolism to support fetal growth. In early pregnancy, insulin

sensitivity increases and promotes uptake of glucose into adipose tissue for storage in preparation for the increased energy requirements of later pregnancy (Plows et al., 2018). As pregnancy progresses, hormones such as progesterone, oestrogen, and human placental lactogen (hPL) contribute towards insulin resistance. Progesterone and oestrogen increase insulin resistance by modulating glucose metabolism in tissues (Plows et al., 2018), whilst hPL increases insulin resistance through impairing glucose uptake and increasing lipolysis, resulting in increased levels of free fatty acids (Rassie et al., 2022). The steady increase in cortisol levels during pregnancy is another contributing factor to insulin resistance, as cortisol can enhance hepatic gluconeogenesis causing an increase in blood glucose levels (Kampmann et al., 2015). This mechanism helps prioritise glucose delivery to the developing fetus to support its growth. In most pregnancies, maternal blood glucose levels remain within normal range due to a compensatory increase in insulin secretion. In a GDM-affected pregnancy, this insulin resistance is coupled with beta cell dysfunction. This results in the pancreas being unable to produce enough insulin to regulate blood glucose levels, in combination with the increased insulin resistance, this results in hyperglycaemia (Choudhury & Devi Rajeswari, 2021; Plows et al., 2018). The development of GDM during pregnancy signals an underlying metabolic vulnerability, making it a strong predictor of future chronic diseases, particularly T2DM and CVD (Mittal et al., 2025).

2.1.1 Risk Factors for the Development of GDM

In New Zealand, diagnosis of GDM usually occurs between 24-28 weeks of gestation. Women who had a HbA1c of 41-49 mmol/mol at their antenatal appointment (<20 weeks of gestation) are considered high risk for GDM and will be offered further screening at 24-28 weeks (Ministry of Health, 2014a). The screening involves either a glucose challenge test or an OGTT depending on early pregnancy HbA2c result. Risk factors for GDM include obesity, physical inactivity, ethnicity, family history of T2DM, advanced maternal age, a history of GDM in previous pregnancies, and chronic diseases such as polycystic ovary syndrome (Amiri et al., 2021; Choudhury & Devi Rajeswari, 2021). Socioeconomic deprivation has also been identified as a key factor, with women of higher socioeconomic deprivation more likely to develop GDM (Daly et al., 2024).

Women who are overweight or obese at the time of conception are more likely to develop GDM (Chu et al., 2007; Lewandowska et al., 2020; Pirjani et al., 2017). A meta-analysis showed overweight pregnant women are 3.56 times more likely to develop GDM when compared with women with a body mass index (BMI) within the healthy range, whilst obese pregnant women are 8.56 times more likely (Chu et al., 2007). Obesity increases the risk of developing GDM through promoting insulin resistance as a result of elevated free fatty acids and pro-inflammatory adipokines, impairing insulin signaling in muscle and the liver (Wondmkun, 2020). Placental hormones exacerbate this resistance during pregnancy, overwhelming pancreatic beta cell function and resulting in glucose intolerance (Šimják et al., 2018).

Ethnicity is associated with variation in GDM prevalence, with certain populations disproportionately affected. A retrospective study conducted in the Waikato region of New Zealand during 2018 which included 4970 screened pregnancies, found significant variations in GDM prevalence by ethnicity (Chepulis et al., 2022). Asian women had the highest rate of GDM at 16.2%, followed by Pacific women at 8.6%, Māori women at 4.2%, and New Zealand European women at 3.4% (Chepulis et al., 2022). These findings align with national data where a case control study of over 600,000 pregnancies from 2001–2010 reported adjusted odds ratios of 3.60 for Asian, 2.76 for Pacific, and 1.23 for Māori women compared to European/other women (Daly et al., 2024), highlighting non-European ethnic groups are disproportionately affected.

Prevention of GDM is key, and focuses on lifestyle modifications, such as maintaining a balanced diet and engaging in regular physical activity, which have been shown to reduce the risk of developing GDM (Song et al., 2016; Takele et al., 2024). Dietary factors can influence the development of GDM, with a high consumption of ultra-processed foods such as sugary beverages, processed meats, packaged snacks, and refined grains being associated with a greater risk of developing GDM (Leone et al., 2021). While increased intake of minimally processed, nutrient-rich foods like fruits, vegetables, legumes, and whole grains were associated with a reduction in GDM risk (Zareei et al., 2018). A 2023 systematic review, including 44 research studies, identified several dietary behaviours associated with an increased risk of developing GDM (Lambert et al., 2023). The study noted that adherence to a Western dietary pattern, characterised by frequent consumption of red and processed meats, sweets, and fried foods, was strongly correlated with impaired glucose regulation and a higher likelihood of GDM (Lambert et al., 2023).

Women who engage in regular physical activity are at a decreased risk of developing GDM (Zhang et al., 2006), with exercise of 140 minutes per week reducing the risk of developing GDM by up to 25% (Davenport et al., 2018). A case-control study involving 155 women with GDM and 386 non-diabetic pregnant women found that regular exercise in the first 20 weeks of pregnancy was associated with reduced risk of GDM (Dempsey et al., 2004), with another study reporting a 13% GDM risk reduction in women who engage in regular physical activity during their first trimester of pregnancy (Xie et al., 2024). Physical activity can also prove beneficial in GDM prevention in later stages of pregnancy. A randomised controlled trial involving 456 women found moderate aerobic exercise for 50-55 minutes for three days per week, through the third trimester of pregnancy, helped to reduce incidence of GDM down to 2.6% when compared with the 6.8% of those who did not exercise (Barakat et al., 2019).

2.2 Associated Risks and Long-term Consequences

Women who experience GDM are at risk of multiple pregnancy-related complications. In a retrospective cohort study of 1,185 women with GDM, 81% of participants experienced at least one maternal complication, and 18% of participants were affected by one or more neonatal complication (Absalom et al., 2023). Pre-eclampsia and pre-term birth are complications which have higher incidence in women with GDM (Sheiner, 2020). Women who experienced GDM in their first pregnancy are also at an increased risk of developing pre-eclampsia in their second pregnancy (Wainstock et al., 2020).

Macrosomia is defined as a birth weight of 4,000 grams or more (Sousa et al., 2024), and occurs in 15 - 45% of GDM-affected pregnancies (Kc, 2015) compared with 3 - 15% of non-GDM pregnancies (Asplund et al., 2008). Consequences associated with macrosomic babies include a longer labour process with greater risk of obstructed labour, and may require an instrumental delivery or an emergency caesarean section (Nakshine, 2023; Sousa et al., 2024; Turkmen et al., 2018). Mothers giving birth to macrosomic babies have a greater risk for perineal tearing, heavy bleeding and post-partum haemorrhage (Alsammani & Ahmed, 2012).

While GDM usually resolves on its own following delivery or the end of pregnancy (Waters et al., 2020), women are left facing increased risk of developing chronic diseases including

T2DM, and CVD (Bellamy et al., 2009; Kramer et al., 2019; Noctor, 2015). Studies have found between 20 - 60% of women with a history of GDM will be diagnosed with T2DM during their lifetime (Buchanan et al., 2012; Li et al., 2020; Song et al., 2018). In addition to T2DM risk, women who have experienced a GDM-affected pregnancy are also at a 50% increased risk of developing CVD and its associated risk factors, such as hypertension, dyslipidaemia, obesity, and metabolic syndrome (Kramer et al., 2019; Sheiner, 2020). Additionally, women who have previously experienced a GDM-affected pregnancy, are at an increased risk of developing GDM in a subsequent pregnancy, with a 2025 meta-analysis finding a recurrence rate of 48% (Lu et al., 2025).

2.2.1 Type 2 Diabetes Mellitus

One of the most significant long-term health concerns for women who have experienced a GDM-affected pregnancy is the substantially increased risk of developing T2DM (Bellamy et al., 2009). T2DM is a chronic condition characterised by elevated levels of blood glucose, which affects approximately 10.5% of the global adult population, and approximately 350,000 New Zealanders (IDF Diabetes Atlas, 2021; Te Whatu Ora Health New Zealand, 2024). In addition to GDM, most prominent risk factors for development of T2DM include a family history of diabetes mellitus, age, obesity, and physical inactivity (Fletcher et al., 2002). Diagnostic criteria for T2DM involves testing blood glucose concentrations most commonly using an HbA1c blood test or fasting glucose test. T2DM is diagnosed in New Zealand through a blood glucose concentration of ≥50 mmol/mol, or a fasting glucose of >7 mmol/L, whilst pre-diabetes is diagnosed as 41-49 mmol/mol or a fasting glucose level of 6.1-6.9 mmol/L (Diabetes New Zealand, 2023).

T2DM develops as a result of chronic insulin resistance and impaired insulin secretion caused by beta cell dysfunction (Galicia-Garcia et al., 2020; Lu et al., 2024). Insulin resistance occurs when insulin sensitive tissues have a reduced response to insulin. A diminished insulin response causes a rise in blood glucose levels as a result of decreased glucose uptake in muscles, an increase in lipolysis, and unregulated production of hepatic glucose. Pancreatic beta cells are responsible for insulin secretion and will increase the rate of insulin secretion according to blood glucose levels. Chronic hyperglycaemia and elevated free fatty acids cause

beta cell dysfunction, resulting in inadequate insulin production (Galicia-Garcia et al., 2020; Lu et al., 2024).

Consequences of T2DM include both acute and chronic conditions. Acute conditions include; severe hyperglycaemia, diabetic ketoacidosis, and coma, whilst the chronic conditions include; macroangiopathy, retinopathy, nephropathy, neuropathy, amputations, and weakened immunity (Farmaki et al., 2020). According to the International Diabetes Federation, T2DM and its complications were responsible for 6.7 million deaths in 2021 worldwide, and 4,719 deaths in New Zealand (IDF Diabetes Atlas, 2021).

Prevention for T2DM involves dietary and lifestyle intervention. Diets high in processed foods, red meat, and refined carbohydrates have been associated with an increased risk of T2DM, while diets high in leafy green vegetables, whole grains and fresh fruits are associated with a reduction in T2DM risk (Muraki et al., 2013; Uusitupa et al., 2019). Weight loss has been strongly associated with a reduced incidence of T2DM, and those with a BMI >24 kg/m² are encouraged to lose weight to help reduce their T2DM risk (Hamman et al., 2006). Physical activity can also reduce the risk of developing T2DM, and as such, should be included each day to mitigate this risk (Laaksonen et al., 2005). Where T2DM develops, diet and lifestyle intervention are the first line of treatment, with diets such as those high in fibre and low in refined carbohydrates lowering blood glucose levels and reducing risk of developing T2DM complications (Whiteley et al., 2023). However, if blood glucose targets are not reached, pharmacotherapy may be required, with Metformin being the most widely used treatment both globally (Weinberg Sibony et al., 2023), and in New Zealand (Guo et al., 2021).

2.2.2 Cardiovascular Disease and Metabolic Syndrome

Women who have previously experienced a GDM-affected pregnancy are at an increased risk of developing CVD (Kramer et al., 2019). Studies show that women with a history of GDM have an estimated 50% higher risk of cardiovascular events compared to those without, regardless of subsequent diabetes status (Chen et al., 2024; Kramer et al., 2019; Minhas et al., 2024). A cross-sectional study involving 254 women with a history of GDM found those with prior GDM were more likely to have thicker left ventricular walls, impaired diastolic parameters and impairments in microvascular function within 10 years of their GDM affected

pregnancy when compared with women with no GDM history (Minhas et al., 2024). Elevated glucose levels and insulin resistance, coupled with increased inflammation during a GDM affected pregnancy may also be contributors to CVD risk in these women (Minhas et al., 2024).

CVD is the leading cause of morbidity and mortality globally, and encompasses conditions such as coronary artery disease, stroke, and heart failure (World Health Organization, 2025a). According to the World Health Organization, as of 2022, 32% of global deaths were caused by CVD accounting for approximately 19.8 million deaths worldwide (World Health Organization, 2025a). CVD affects around 180,000 New Zealanders, and in 2024, CVD and its associated conditions were the cause of approximately one in three deaths in the country (Heart Foundation, 2023). Prevention of CVD involves dietary and lifestyle changes such as reducing saturated fat and sodium intake, increasing fibre consumption, engaging in regular physical activity and smoking cessation (Heart Foundation, 2025a). The New Zealand Heart Foundation recommends increasing fruit, vegetable and wholegrains intake and partaking in at least 150 minutes of moderate physical activity each week to lower CVD risk (Heart Foundation, 2025a, 2025b).

Metabolic syndrome is a condition which encompasses multiple conditions such as abdominal obesity, hypertension, insulin resistance, and dyslipidaemia, which collectively elevate the risk of both CVD and T2DM (Dhondge et al., 2024; Rochlani et al., 2017). GDM and metabolic syndrome share underlying mechanisms including insulin resistance and chronic inflammation, and as such, women with GDM are at increased risk of developing metabolic syndrome in the post-partum period (Nguyen et al., 2024; Pathirana et al., 2021). Metabolic syndrome has been linked to increased mortality rates associated with CVD or T2DM when compared to those without (Li et al., 2023). Additionally, women who have metabolic syndrome prior to pregnancy are at increased risk of developing GDM during pregnancy, as well as T2DM later in life (Nguyen et al., 2024).

2.2.3 Consequences to Offspring

Although GDM has a significant influence on women's long term health outcomes, it also carries immediate and long-term health implications for their offspring. In the immediate

neonatal period, infants born to mothers with GDM are at increased risk of multiple complications including shoulder dystocia and neonatal hypoglycaemia (Nakshine, 2023; Pham et al., 2024).

Shoulder dystocia is a medical emergency where during the birthing process, the head of the neonate is delivered, but the shoulders become obstructed in the vaginal canal (Hill et al., 2020). As a result, shoulder dystocia can lead to brachial plexus injuries, hypoxia, or clavicular and humeral fractures in the neonate (Hill et al., 2020).

Infants born to mothers affected by GDM have an increased risk of developing neonatal hypoglycaemia (De Angelis et al., 2021; Kole et al., 2020). Neonatal hypoglycaemia is most likely to occur in the hours following birth, as the baby transitions from receiving a continuous supply of glucose from the mother, to receiving glucose intermittently through feedings (Jane et al., 2024). . Hypoglycaemia in infancy, when left untreated, can lead to neurodevelopmental delay, seizures, visual processing problems, and without adequate treatment it can be fatal (De Angelis et al., 2021; Rosenfeld & Thornton, 2000).

Children born to mothers with GDM also face long-term health risks for chronic disease. In these children, instances of structural cardiac differences have been observed, including a thicker posterior left ventricular wall, reduced ventricular volume, and decreased aortic and pulmonary valve function (Di Bernardo et al., 2023). These cardiac alterations may contribute to an increased risk of cardiovascular complications later in life. Additionally, exposure to maternal hyperglycaemia in utero is associated with a higher risk of developing obesity and metabolic syndrome during childhood and adolescence (Pathirana et al., 2021), further increasing the likelihood of developing T2DM and CVD in adulthood (Echeverria et al., 2020; Fraser & Lawlor, 2014).

2.3 Management of GDM

Where GDM is diagnosed, women in New Zealand are typically referred to a ‘Diabetes in Pregnancy’ multidisciplinary team, which may include dietitians, diabetes midwives, obstetricians, and endocrinologists (Ministry of Health, 2014b). As a first-line of treatment,

GDM is often managed using medical nutrition therapy and physical activity (American Diabetes Association, 2016), and involves dietary interventions such as a low-glycaemic index diet, reducing saturated fats, consuming lean protein, and maintaining a healthy weight during pregnancy (Ministry of Health, 2014a). Where lifestyle measures fail to achieve glycaemic targets, pharmacological treatments such as insulin or metformin are introduced, due to their safety for use in pregnancy (Ministry of Health, 2014a).

Data from the Growing Up in New Zealand study showed that a greater proportion of women with GDM received dietary advice from a dietitian, nutritionist, or obstetrician compared to women without GDM (Lawrence et al., 2020). Despite this, a study assessing adherence to guidelines in women with GDM found less than 4% of women with a GDM diagnosis adhered to dietary recommendations, though poor adherence was also found in women with no GDM diagnosis (Lawrence et al., 2022). While women with GDM are more likely to be seen by a dietitian, a survey involving 33 dietitians who provide dietary advice to women with GDM in New Zealand found little more than half of the participating dietitians provided dietary advice specific to the post-partum period (Lawrence et al., 2017).

Following a GDM-affected pregnancy, post-partum follow-up to monitor blood glucose levels for early detection of T2DM is recommended, with HbA1C testing 3 months post-partum being best practice in New Zealand (Ministry of Health, 2014a; Ohene-Agyei et al., 2024). However, despite the increased risk of developing chronic disease post-GDM, and the evidence supporting diet and lifestyle intervention in prevention of chronic disease (Adam et al., 2023; Kanaley et al., 2022; Wang et al., 2024), there are currently no standardised pathways for dietary and lifestyle support for women following a GDM-affected pregnancy in New Zealand. The Ministry of Health Guidelines for the management of GDM state women are able to return to a 'normal diet' (Ministry of Health, 2014b), and to mitigate risk of chronic disease following GDM, dietary recommendations emphasise whole foods, including vegetables, fruits, whole grains, and lean proteins, while replacing saturated fats with unsaturated fats, including little to no added sugar or salt, and prioritising unprocessed foods (Ministry of Health, 2020b). The Ministry of Health also recommends at least 150 minutes of moderate-intensity aerobic activity per week for adults, which has been shown to support weight management and reduce the risk of developing T2DM (Ministry of Health, 2020b).

Ongoing support and lifestyle intervention during the post-partum period is regarded as an opportune time to empower women to develop long-term behavioural changes (Gustavsen et

al., 2024). Lifestyle interventions during this stage may also reduce the likelihood of GDM in subsequent pregnancies by targeting modifiable risk factors early (Takele et al., 2024). A 2018 Finnish study explored the impact of lifestyle counselling on blood glucose regulation among 200 women who were in early pregnancy with either a BMI over 30 kg/m², or had experienced GDM in a previous pregnancy (Huvinen et al., 2018). Participants in the intervention group received individualised dietary and physical activity counselling throughout pregnancy, as well as continued follow-up at 6 weeks, 6 months, and 12 months post-partum, whilst the control group received only standard information leaflets. The findings of this study revealed notable differences between the two groups, with only 1% of the intervention group showing impaired glucose regulation at 6 weeks post-partum, compared to 7.2% in the control group. This trend continued at 12 months, where 2.4% of the intervention group were affected, versus 9.5% of those in the control group. (Huvinen et al., 2018). These findings suggest that regular, individualised lifestyle support plays a significant role in improving longer-term metabolic outcomes for women following a GDM-affected pregnancy.

2.4 Post-partum Support Services for Women

Managing GDM during pregnancy encourages healthy behaviours such as improved diet and physical activity, which can support long-term health. However, the focus is usually on short-term outcomes such as keeping blood glucose in range and monitoring for early detection and treatment of pregnancy complications. Qualitative research has found that many women see GDM as a temporary condition that ceases following the end of pregnancy (Lawrence et al., 2021). A noticeable reduction in healthcare support after pregnancy may reinforce this perception, as many women report feeling abandoned once prenatal care ceases, and few receive proactive follow-up to address future health risks (Parsons et al., 2018).

Support services for women who have experienced a GDM-affected pregnancy are important in reducing rates of progression to T2DM or CVD post-partum (Jowell et al., 2022; Wang et al., 2024). Post-partum care services such as follow-up screening for T2DM may help prevent this progression by enabling early detection and intervention (American Diabetes Association, 2015). However, studies have shown that while women with GDM often receive comprehensive care during pregnancy, support and follow-up in the post-partum period is often

inadequate (Marschner et al., 2024; Sise et al., 2022). The post-partum period is also a time of major adjustment, where women's attention may shift to caring for their baby (Bennett et al., 2011; Gustavsen et al., 2024). Providing accessible services such as lifestyle support and follow-up screening for T2DM may encourage women to continue to look after their own health alongside the needs of their family.

Post-partum support services for women with a history of GDM in New Zealand remain poorly characterised, with limited research evaluating their structure, delivery, or effectiveness. The Ministry of Health's guidelines for the management of GDM recommend that women with previous GDM receive post-partum follow-up, including early postnatal screening for T2DM, and ongoing monitoring by primary care providers (Ministry of Health, 2014b). However, there is little evidence to show whether these guidelines are consistently implemented in practice.

Gaining insight into how health professionals perceive and manage post-partum GDM care is essential for understanding the services and level of care women receive after pregnancy. Health professionals are responsible for much of the education, monitoring, and follow-up that supports women in reducing their long-term risk of chronic disease, yet their knowledge and confidence in this area can vary significantly (Dunne et al., 2024; Nielsen et al., 2022). To gather a better understanding, a 2024 study in Ireland recruited 127 health professionals (general practitioners, endocrinologists, nurses, dietitians, obstetricians, and midwives) to participate in a survey investigating their knowledge of GDM and its' associated risks, guidelines and treatment recommendations, and screening rates in their professional practice (Dunne et al., 2024). While nearly all participants recognised at least one GDM risk factor, fewer (27.6%) acknowledged key contributors such as BMI > 25 kg/m², suggesting possible gaps in understanding of metabolic risk. The study also showed that, although most professionals (92.9%) were aware of the link between GDM and T2DM, less than half recognised the connection with CVD (Dunne et al., 2024). This gap in knowledge may reduce the urgency conveyed during post-partum counselling and affect how clearly future health risks are communicated to women with GDM. Screening practices also differed, with some health professionals relying on OGTT and others on HbA1c testing, which may impact consistency in follow-up care. Additionally, while many health professionals felt a responsibility to discuss future health risks, only 21.3% of participants believed their systems allowed them to provide adequate post-partum support (Dunne et al., 2024). Similar findings were reflected in a Danish study, where interviews with health professionals revealed a widespread lack of knowledge

about the link between GDM and future risk of T2DM (Nielsen et al., 2022). While some participants were aware of the increased risk, few understood the recommended follow-up processes, such as appropriate screening or the benefits of early detection. Many believed that responsibility for seeking care lay with the GDM-affected women themselves (Nielsen et al., 2022). These findings highlight important concerns about the post-partum care women with GDM may receive, as gaps in health professionals' knowledge, confidence, and access to clear systems could limit their ability to provide appropriate support and follow-up.

2.4.1 Barriers to Post-partum Recovery and Health

Women often face multiple barriers when accessing post-partum care following a GDM-affected pregnancy. Practical challenges such as transport, lack of childcare, cost, and time off work can make it difficult to attend follow-up appointments (Sinha et al., 2022; Whyler et al., 2024). Additionally, logistical issues such as a fragmented transition between primary and secondary care can further reduce the likelihood of follow-up care (Lithgow et al., 2021; Sinha et al., 2022). In this transition, it is not always clear who is responsible for ongoing follow-up, and often women are lost in the system through these gaps.

A 2022 study that interviewed 36 women about their experiences following a GDM-affected pregnancy in the United States identified several key barriers to accessing post-partum follow-up care (Sinha, 2022). Women reported experiencing interpersonal barriers such as previous negative experiences with healthcare professionals, including cultural challenges, communication challenges, and feeling a lack of compassion or support during their care. Limited support at home was found to be a significant barrier to managing GDM and reducing the risk of developing T2DM. Women described feeling unsupported and alone, with some stating their families did not support the healthy diet or physical activity changes they were trying to make, which made it harder to continue with these positive behaviours (Sinha et al., 2022).

In addition to these practical and interpersonal challenges, emotional and psychological factors also play a role. Many women report feeling physically and emotionally exhausted after pregnancy, and describe being too overwhelmed or focused on their infant's needs to prioritise

their own health (Bennett et al., 2011; Gustavsen et al., 2024; Sinha et al., 2022). Despite awareness of their increased risk of developing T2DM or CVD, some women may delay or avoid follow-up simply because they do not have the capacity to engage with lifestyle services or medical monitoring in the early post-partum period. The sense of burnout and pressure to care for others often leaves little room for self-care (Gustavsen et al., 2024).

Importantly, these barriers to post-partum recovery are compounded by longstanding inequities within the healthcare system. In New Zealand, Māori, Pacific, and Asian women are disproportionately affected by GDM and are less likely to receive timely screening or adequate post-partum follow-up compared to New Zealand European women (Daly et al., 2024; Sise et al., 2022). A study conducted over 2005 - 2015 with 14,000 women affected by GDM found that post-partum screening rates for T2DM remain low overall, with Māori women being the least likely to be screened within six months of delivery (Sise et al., 2022).

2.5. Economic Impact

The large prevalence of GDM both globally and in New Zealand has significant implications for healthcare systems. While often managed during pregnancy, GDM is associated with an increased risk of several short and long-term health complications. These can include the increased requirement for caesarean section births (Sheiner, 2020; Turkmen et al., 2018), which, although not solely attributable to GDM, are more likely to occur in women with the condition. In New Zealand, caesarean births are more costly than vaginal births (Anderson et al., 2025) and most recent data from 2017/18 shows caesarean sections are estimated to cost NZD$11,421 per case (Te Whatu Ora Counties Manukau, 2019) and accumulated a total cost of NZD$121,097,005 in the year 2017/18 in publicly funded hospital discharges (Ministry of Health, 2020a).

Long-term, one of the most significant consequences of GDM for the mother is the increased likelihood of developing metabolic diseases such as T2DM and CVD. T2DM affects approximately 228,000 New Zealanders (PwC, 2021), and its complications cost the New Zealand health system approximately $2.1B annually, accounting for an estimated 10% of the total healthcare budget (Holder-Pearson & Chase, 2022; PwC, 2021). The lifetime cost of a

New Zealander diagnosed with T2DM is between NZD $44,000 and NZD $565,000 depending on their age at the time of diagnosis, with those diagnosed at a younger age accumulating more costs over their lifetime (PwC, 2021). Medications used to manage T2DM are also a large contributor to healthcare costs, with an estimated NZD $197 million spent annually (Hapai Te Hauora, 2021). In addition, individuals with T2DM incur healthcare costs that are NZD $3,359 higher per year on average compared to those without the condition. CVD, which is also more prevalent in women with previous GDM, is the leading cause of morbidity in New Zealand and worldwide (World Health Organization, 2025a). An estimated 180,000 New Zealanders are living with heart disease (Heart Foundation, 2023), and the total cost of CVD to the healthcare system was estimated at USD $2.3 billion (NZD $3.3 billion) per year (Blakely et al., 2019; Wilson et al., 2023). These figures reflect not only the direct costs associated with treatment and hospital care, but also the wider impact on workforce productivity and long-term disability.

GDM can also contribute to intergenerational health issues. Children born to women with GDM are more likely to develop obesity, which significantly increases their future risk of both T2DM and CVD (Fraser & Lawlor, 2014). Obesity-related healthcare costs in New Zealand exceed NZD $2 billion annually (Hapai Te Hauora, 2021) suggesting that the financial impact of GDM extends beyond the affected woman and into the next generation.

While the costs of these conditions cannot be solely attributed to GDM, the risk of developing them is significantly higher among women with a history of GDM. As a result, GDM is likely to contribute indirectly to the pressures on New Zealand's healthcare system. However, through targeted post-partum services, GDM should be viewed as an opportunity for early detection of these chronic conditions, allowing for timely intervention and preventative care, possibly resulting in reduced long-term healthcare costs.

2.6 Conclusion

GDM is associated with significant long-term health risks for both women and their children. Women with a history of GDM face a significantly increased risk of developing T2DM and CVD later in life, while their children are more likely to experience obesity and metabolic conditions. While most women receive extensive care during pregnancy, the months following

pregnancy often focus more on the baby, leaving mothers with less support despite being a critical window for intervention. In the absence of structured follow-up and clear communication of ongoing risks, adherence to lifestyle changes and screening recommendations can be difficult for women to maintain during this period.

While post-partum services are available, many women face barriers that hinder their ability to access or utilise them. Women frequently face logistical challenges such as cost, transport, and time constraints, particularly in the early stages of motherhood. Emotional and interpersonal factors, including exhaustion and a lack of support systems at home, also influence their ability to engage in follow-up care. These barriers are not experienced equitably, with Māori and Pacific women, as well as women living with socio-economic deprivation facing more significant challenges and being less likely to receive adequate support in a timely manner.

The evidence highlights a pressing need for closer attention as to how services are delivered following a pregnancy affected by GDM. Identifying where gaps exist can help inform future strategies to ensure all women receive the care they need during this time. Accessible and equitable post-partum support would not only facilitate a reduction in chronic disease and costs to the healthcare system, but also promote positive lifestyle behaviours leading to long-term wellbeing for both women and their children.

Chapter 3: Manuscript

3.0 Abstract

Background: Gestational diabetes mellitus (GDM) affects approximately 6.2% of pregnancies in New Zealand and increases the risk of both immediate pregnancy-related complications and long-term health outcomes for mothers and their children. Women with a history of GDM face elevated risks of developing type 2 diabetes (T2DM), cardiovascular disease (CVD), and recurrence of GDM in subsequent pregnancies, while their children are at increased risk of obesity and metabolic disease later in life. Diet and lifestyle interventions are crucial in mitigating these risks, yet little is known about what post-GDM diet and lifestyle services exist within New Zealand, and how women with a history of GDM access these services. This study aimed to determine the availability of, and characterise, the diet and lifestyle services provided to women in New Zealand following a GDM-affected pregnancy.

Methods: A cross-sectional study was conducted using an online survey, involving both multiple-choice and open-ended questions. Respondents included health professionals who offer services to post-GDM women across New Zealand. Qualitative and quantitative descriptive analysis was conducted by a single researcher using Microsoft Excel.

Results: A total of 62 respondents were involved in this study including nurses (29%, 18/62), dietitians (21%, 13/62), general practitioners (21%, 12/62), midwives (8%, 5/62), obstetricians (5%, 3/62), nutritionists (5%, 3/62), health coaches (5%, 3/62), and exercise physiologists (2%, 1/62) from all major regions of New Zealand. Dietary advice was offered by 41% (21/51) of healthcare professionals, lifestyle advice by 16% (8/51), and exercise advice by 4% (2/51). Other services included diabetes management or monitoring (43%, 22/51), education (14%, 7/51), antenatal care (12%, 6/51), perinatal care (6%, 3/51), lactation support (4%, 2/51), and CVD risk assessment (4%, 2/51). Almost all respondents (90%, 47/52) offered in-person services, with telephone (79%, 41/52) or online service (35%, 18/52) as other delivery options. Services were most commonly accessed through self-referral (52%, 28/52) or GP referral (50%, 26/52). Costs to services were reported by 37% (18/49) of respondents, with most (76%, 13/17) reporting a range of NZD $50–100, though 47% (8/17) of those reporting a cost accepted community service cards, reducing fees to NZD $19.50. Over half (53%, 25/47) described

offering Māori-specific services, most commonly Māori providers (56%, 14/25) or free or reduced-cost services (24%, 6/25). Forty-three percent (20/47) of respondents reported offering tailored services for other cultural groups, particularly Pacific (85%, 17/20) and South Asian (40%, 8/20) populations. Gaps in care were outlined, including limited patient education on future risks (9%, 3/34) and prevention (12%, 4/34), under-resourced services (42%, 8/19), and inadequate support for South Asian women (12%, 4/34).

Conclusion: The findings offer an overview of service types, accessibility, delivery, costs, cultural responsiveness, barriers, and the characteristics of those delivering care to women with a history of GDM, identifying limitations within current post-GDM care in New Zealand. While a range of health professionals offer services for those post-GDM, fewer than half provide dietary advice, and only a small proportion provide lifestyle advice, while access, cost, and cultural support vary between services. The variability in service provision may result in women with a history of GDM not being optimally supported to mitigate their increased risk of chronic conditions such as T2DM and CVD. Establishing clear pathways for post-GDM care in New Zealand may help to address these inconsistencies.

3.1 Introduction

GDM is a significant health concern, affecting approximately 6.2% of pregnancies in New Zealand (Lawrence et al., 2019). In most cases where a woman has been diagnosed with GDM in pregnancy, hyperglycaemia resolves after birth and there is no longer any requirement for pharmacotherapy to keep blood glucose levels in target range (Mittal et al., 2025; Moyce & Dolinsky, 2018). Although GDM resolves, it is associated with an increased risk of future health issues for both mother and child. Women who have experienced GDM are at increased risk of developing chronic conditions such as T2DM, CVD, and metabolic syndrome (Bellamy et al., 2009; Kramer et al., 2019; Lu et al., 2025). Their children are also more likely to experience adverse health outcomes, including obesity and impaired glucose metabolism later in life (Echeverria et al., 2020; Pathirana et al., 2021; Sheiner, 2020).

T2DM and CVD are among the leading causes of morbidity in New Zealand, and are associated with significant healthcare costs (Heart Foundation, 2023; Holder-Pearson & Chase, 2022; World Health Organization, 2025b). It is estimated between 20 to 60% of women will develop T2DM in the five to ten years following a GDM-affected pregnancy (Buchanan et al., 2012; Li et al., 2020; Song et al., 2018). Disproportionately affected are Māori, Pacific and South Asian populations, who face further increased risk of developing T2DM and CVD post-GDM when compared with other ethnicities (Daly et al., 2024; Holder-Pearson & Chase, 2022; Karter et al., 2013; Selak et al., 2020). Early dietary and lifestyle interventions after a GDM-affected pregnancy can reduce the risk of adverse long-term health outcomes, and recurrence of GDM in subsequent pregnancies (American Diabetes Association, 2015; Jowell et al., 2022; Takele et al., 2024; Wang et al., 2024). However, there is limited research regarding the post-partum services available to women in New Zealand, or how accessible these services are during this crucial period. While diabetes care during pregnancy is well-structured with women receiving referrals to ‘Diabetes in Pregnancy’ multidisciplinary teams in New Zealand (Ministry of Health, 2014b), care in the post-partum period is often described as fragmented, and women with a history of GDM often describe feeling abandoned during this period (Parsons et al., 2018). Optimisation of accessible post-partum and continued diet and lifestyle services for women with a history of GDM has the potential to reduce the incidence of both T2DM and CVD, reducing social and economic costs while promoting long-term health.

Ministry of Health guidelines recommend post-partum HbA1c screening and encourage healthy dietary and physical activity behaviours (Ministry of Health, 2014a, 2014b, 2020b). However, it is not clear within the guidelines who is or should be responsible for providing these services and support, or how they are accessed. Despite being recommended, HbA1c screening rates for women who experienced a GDM-affected pregnancy are low, with less than half of these women receiving an HbA1C test within three months post-partum (Sise et al., 2022). This suggests women may not be aware of their increased risk of chronic disease or there are other barriers in accessing post-partum screening and care. The post-partum period presents a window of opportunity for health education and intervention (Gustavsen et al., 2024), as women are actively engaged with healthcare services and may be more receptive to support during this time. Defining clear guidelines and pathways for this period could ensure women receive the appropriate care and guidance to make informed choices and could strengthen preventative efforts and improve long-term health outcomes.

This research aims to identify and characterise the services available to women in New Zealand following a GDM-affected pregnancy, focusing on services that provide dietary and lifestyle advice to support long-term health and reduce the risk of developing chronic disease. Through exploring what services exist and identifying any gaps in care, this research will help contribute to a clearer understanding of the services available to this high-risk population in New Zealand. The findings from this study may help inform future improvements in service delivery, and support better long-term health outcomes for both women and their children.

3.2 Methodology

3.2.1 Study Design

A cross-sectional study design was used to investigate diet and lifestyle services provided by healthcare professionals aimed towards women with a history of GDM in New Zealand. Qualitative and quantitative data were collected through an online survey consisting of open and closed questions via the web-based programme Qualtrics. Data collection occurred between July 2025 and August 2025 for a total period of 33 days (4 weeks 4 days).

3.2.2 Survey Development

A review of existing literature revealed minimal descriptions and no pre-existing survey evaluating the characteristics of services available to women with a history of GDM in New Zealand. A draft survey was developed by the master's student and supervisors, informed by the research aims, objectives, and relevant literature on GDM and the subsequent development of chronic health conditions. The survey featured open and closed questions with multiple choice questions including an 'Other (please specify)' and open comment option.

The survey was pretested by two registered dietitians and three nutritionists from diverse cultural backgrounds including Māori, Pacific Islands and Asian, with a range of clinical experiences including GDM, T2DM and CVD. Pre-testing was requested and declined from an additional five health professionals with differing backgrounds. Pre-testers were asked to complete the survey and then complete the additional questionnaire seeking feedback on the survey (Appendix A). The questionnaire consisted of nine questions which would help to inform changes for the final survey. The questions focused on readability, logistics, time-taken to complete the survey and asked pre-testers for any additional suggestions or feedback. Adjustments were made to the survey based on feedback received from pre-testers. This included the addition of a question regarding community services that may support women with a history of GDM, such as church, marae or community-based mentors who may not necessarily be health professionals. Formatting refinements were also implemented, including improvements to survey flow and question numbering. All changes were made using the

Qualtrics platform and subsequently reviewed by the academic supervisors, who provided final approval prior to distribution.

The final survey (Appendix B) structure consisted of four main sections: demographics, GDM service characteristics, professional and personal factors, GDM service barriers, and an additional fifth section was included for any additional comments. The survey consisted of a total 28 questions, with an additional 11 possible sub-questions depending on the respondents answer to a previous question. The beginning of the survey included two additional compulsory questions to acquire informed consent. These questions included asking if they had read and understood the participant information sheet (link provided), and an outline of all requirements for participation confirming they meet the criteria. The end of the survey included a link which would take them to an optional, and entirely separate Qualtrics survey to safely enter their details into the prize draw if they wished.

3.2.3 Survey Distribution

For the primary data collection phase, a Microsoft Excel document was created to record key details for each organisation (Appendix C). A list of relevant organisations was compiled from supervisor recommendations, professional contacts, and targeted web searches and were added in to this document with the organisation name and contact details. The initial list consisted of 64 organisations through differing regions of New Zealand, with additional organisations contacted throughout distribution as they were recommended or identified, resulting in a total of 71 contacted organisations. Each organisation was individually contacted by email or web enquiry using a template outlining the research, providing the participant information sheet and asking if they would like to take part in distribution of the survey. Correspondence was monitored by email, and organisation responses were recorded in the Microsoft Excel document. Organisations mentioned their preferred method of distribution (e.g. newsletter, email chain) and this was noted in the Microsoft Excel document to be considered in the survey distribution. Some organisations forwarded the email on to their members of staff, which allowed staff to reach out to the researcher directly showing their interest in participating in the research. In this case, these contacts were added to the Microsoft Excel document under the corresponding organisation to be emailed the survey directly once distribution began. Additionally, some participating organisations shared the survey invitation with other

organisations in their networks. As these additional organisations were not directly contacted by the researcher, the total number of organisations reached by the survey is unknown. One final reminder email was sent two weeks after the initial email to organisations who had not yet responded. One week following the reminder, the active link to the final survey was emailed to consenting organisations. A total of 22 organisations agreed to participate in the distribution of the research.

A link to the final survey was distributed on Monday 14 July to all organisations that had agreed to participate in the survey distribution. The survey was open for a total of 33 days, with a reminder email sent two weeks in to the distribution period to the consenting organisations. Distribution was carried out via one of two email templates, catering to the organisations preferred method of distribution. Each email expressed appreciation for the organisation's interest, the active survey link, and information regarding the surveys closing date. Attachments included a Microsoft Word document containing the survey advertisement and link, a JPG formatted for Instagram comprising three slides advertising the research (Appendix D), and a one-page PDF with a clickable survey link (Appendix D). Advertisements used for distribution purposes of this research were made using the online graphic design programme Canva.

All survey responses were compiled and saved directly as Microsoft Excel spreadsheets to be used in the statistical analysis.

3.2.4 Funding

This research was funded by the Massey postgraduate fund and included five NZD $100 grocery vouchers for a respondent prize draw, and an additional NZD $50 grocery voucher for each pre-tester to show appreciation for their contribution.

3.2.5 Prize Draw

The prize draw consisted of a short two question survey made using Qualtrics and asked for the respondent's name and their contact information. This was kept separate from survey data

to ensure data provided within the research survey could not be linked to personal identifiers. A total of 40 respondents entered the prize draw, and using Google's online randomiser tool, five winners were selected. The winning respondents were contacted individually via email, notifying them of their win.

3.2.6 Inclusion Criteria

Respondents in this study involved healthcare professionals in New Zealand who self-reported provision of diet and lifestyle services to women with a history of GDM. Recruitment targeted a broad range of professionals, including dietitians, midwives, nurses, general practitioners, nutritionists, and others involved in maternity or diabetes-related care. Eligibility criteria required that respondents needed to be currently practicing in a relevant field in New Zealand, and providing diet, lifestyle, or motivational advice to women with a history of GDM as part of their professional role. Respondents were also required to be over the age of 16 years and able to read and write in English.

3.2.7 Ethical considerations

Ethical approval for this project was granted by the Massey University Human Ethics Committee Ohu Matarika 1, application OM1 25/05 (Appendix E). All respondents were provided with an electronic participant information sheet (Appendix F) prior to commencing the survey, outlining the study's purpose, procedures, potential risks, and benefits. As outlined in the participant information sheet, respondents were informed of their right to decline to answer any question and to withdraw from the study at any stage. All data collected remained anonymous, with respondents accessing an anonymous survey link, and an optional separate survey link to enter their personal details for the prize draw.

It is not possible to confirm that all relevant organisations or healthcare professionals providing diet and lifestyle advice to women with a history of GDM were reached or adequately represented. To mitigate this, the survey was disseminated through multiple channels, including professional networks, organisational mailing lists, and relevant social media

platforms, with the aim of reaching a broad and diverse sample. However, the potential for sampling bias remains, and the results may not fully reflect the views or practices of the wider population of professionals working in this area.

3.2.8 Data Analysis

Statistical analysis was performed using Microsoft Excel for Mac (2025 version). Qualitative analysis was conducted by a single researcher (KC), who manually input responses into Microsoft Excel and coded them into categorical data. Data were displayed in tables created in Microsoft Word. Descriptive statistics were used to present respondent and service characteristics. Categorical data are presented as n (%). Where qualitative responses showed substantial variation, these were coded (Appendix G) and themes were presented in text-form. Open-ended responses were extracted into Microsoft Excel and content analysis was used by a single researcher (KC) to categorise the data. Example quotes with brief narrative summaries were included in relevant sections to provide context and meaning to the closed question responses. Not all qualitative data were presented in the final results; responses which did not directly answer the question were excluded from analysis.

3.3 Results

Following the distribution of the survey via 22 organisations, a total of 62 healthcare professionals responded to the survey (**Figure 1**).

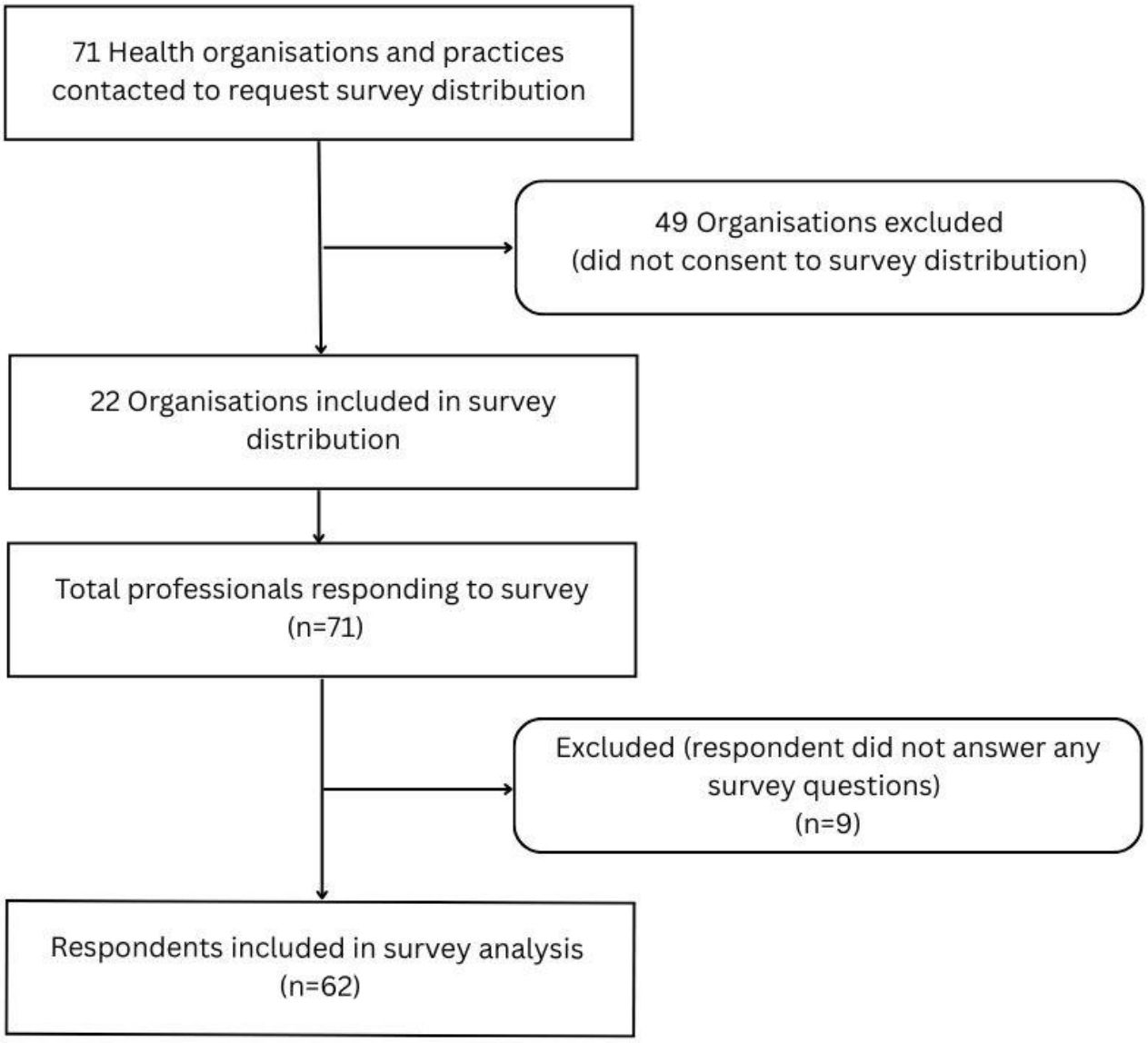

Figure 1: *PRISMA flow chart illustrating survey respondent recruitment and exclusion criteria for the survey of diet and lifestyle services for women with a history of GDM in New Zealand*

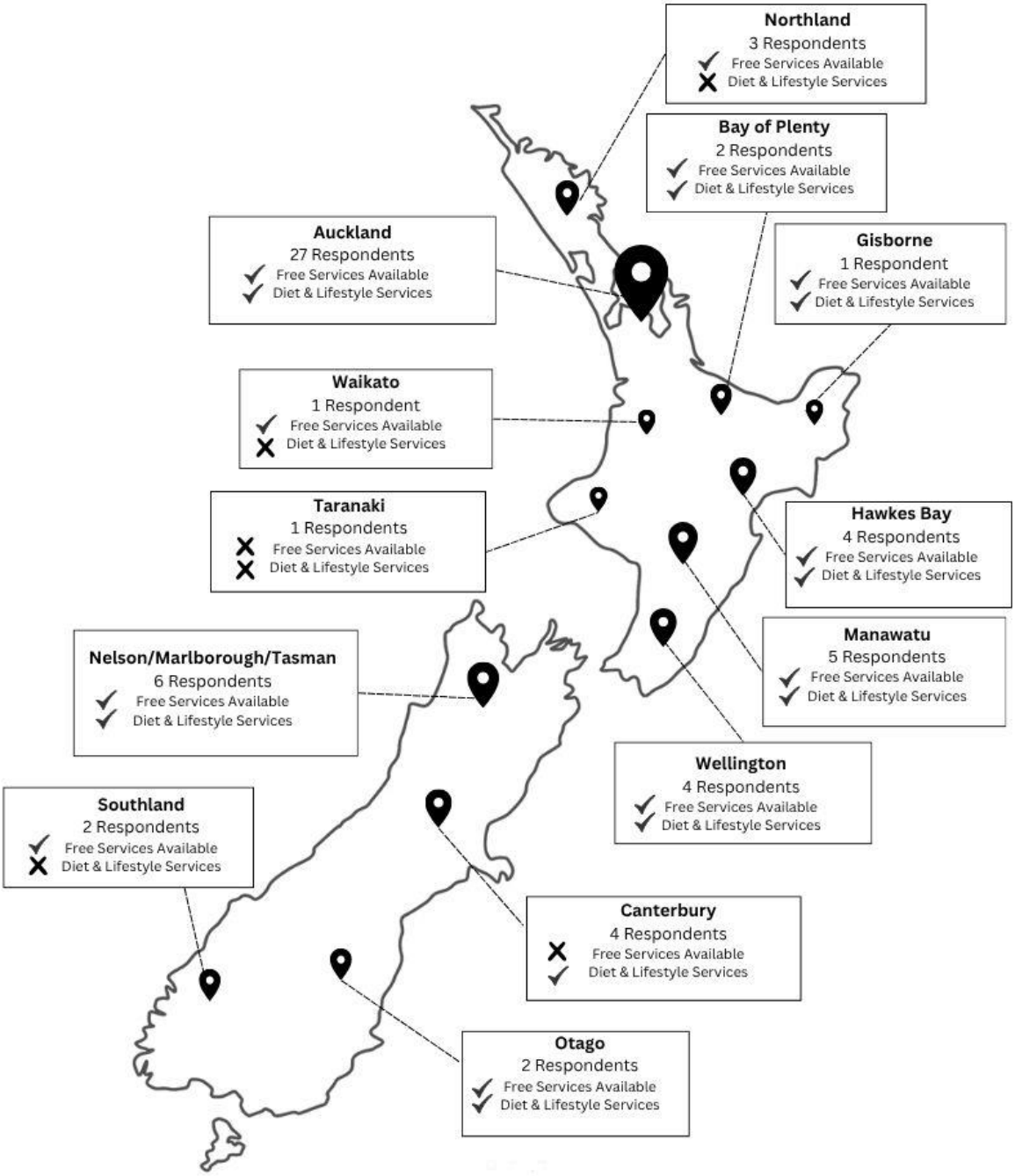

Figure 2: *Map displaying geographical location of respondents and regional availability of free services and diet and lifestyle service offerings based on survey respondent reporting*

3.3.1 Survey Respondent Demographics

The professional roles and characteristics of survey respondents are displayed in Table 3.2. Healthcare professionals completing the survey included nurses (29%, 18/62), dietitians (21%, 13/62), general practitioners (19%, 12/62), midwives (8%, 5/62), obstetricians (5%, 3/62), nutritionists (5%, 3/62), health coaches (5%, 3/62), exercise physiologists (2%, 1/62) and a further 6% (4/62) of respondents selected 'Other' and specified roles such as lactation consultant (2%, 1/62), clinical nurse specialist (2%, 1/62), health improvement practitioner (2%, 1/62), and kaiawhina mate huka (diabetes community coordinator) (2%, 1/62). Respondents worked in professional areas such as general clinical (47%, 29/62), diabetes (39%, 24/62), antenatal or obstetrics (13%, 8/62), community nutrition (11%, 7/62), public nutrition (5%, 3/62), and a further 16% (10/62) of respondents selected 'Other' and specified areas such as mental health (2%, 1/62), education (2%, 1/62), lifestyle support (2%, 1/62), motivational interviewing (2%, 1/62), primary care (2%, 1/62), women's health (2%, 1/62), clinical exercise physiology (2%, 1/62), and diabetes in pregnancy (2%, 1/62). Of the respondents, 51% (31/62) worked in primary care clinics, and 38% (23/62) worked in public hospitals, the remaining 23% (14/62) of respondents worked among private hospitals or private practices (11%, 7/62), community health centres (10%, 6/62), or charitable trusts (2%, 1/62).

The geographical locations of respondents are displayed in **Figure 2**. Auckland was the region with highest number of respondents (44%, 27/62) followed by Manawatū (8%, 5/62), while the regions with the lowest healthcare professionals participating is this study were Waikato, Gisborne, and Taranaki with one respondent (2%, 1/62) from each, other responses (4%, 2/62) included telehealth (2%, 1/62) and online (2%, 1/62) as their geographical location. Respondents were able to select multiple ethnicities to which they identified with, the majority of respondents identified as NZ European ethnicity (66%, 41/62), followed by Māori (16%, 10/62), Pacific (11%, 7/62), East or Southeast Asian (6%, 4/62), South Asian (3%, 2/62), and a further 21% (13/62) of respondents specified 'Other' and described ethnicities such as British (6%, 4/62), European (3%, 2/62), Australian (2%, 1/62), Sri Lankan (2%, 1/62), and Fijian Indian (2%, 1/62).

Table 3.2: Demographics of health professionals responding to the survey on diet and lifestyle services for women with a history of GDM in New Zealand

	n	%
Professional role (n=62)		
Nurse	18	29
Dietitian	13	21
General Practitioner (GP)	12	19
Midwife	5	8
Obstetrician	3	5
Nutritionist	3	5
Health Coach	3	5
Exercise Physiologist	1	2
Other	4	6
Ethnicity (n=62)		
Māori	10	16
Pacific	7	11
East or Southeast Asian	4	6
South Asian	2	3
NZ European	41	66
Other	13	21
Primary area of practice (n=62)		
General clinical	29	47
Diabetes	24	39
Antenatal/Obestrics	8	13
Community nutrition	7	11
Public nutrition	3	5
Other	10	16
Specific GDM-related training (n=62)		
Yes	35	56
No	27	44
If yes (specify): (n=35)		
University/course	20	57
Work experience	8	23
Online study	2	6
Other	5	14
Years experience in current profession (n=62)		

0-2	13	21
3-5	8	13
6-8	6	10
9+	35	56
Healthcare setting (n=61)		
Public hospital	23	38
Private hospital	1	2
Primary care clinic	31	51
Community health centre	6	10
Private practice	5	8
Other	2	3
Region of practice (n=62)		
Auckland	27	44
Waikato	1	2
Northland	3	5
Bay of Plenty	2	3
Gisborne	1	2
Taranaki	1	2
Manawatu	5	8
Hawkes Bay	4	6
Wellington	4	6
Canterbury	4	6
Otago	2	3
Southland	2	3
Nelson/Marlborough/Tasman	4	6
Other	2	4

Data are presented as number of respondents (n) and percentage (%). Percentages may not total 100% where respondents were able to select multiple options. Missing data have been excluded from percentage calculations

3.3.2 GDM Service Characteristics

The description of services provided by healthcare professionals for women with a history of GDM are presented in Table 3.2. Respondents described providing services involving diabetes management or monitoring (43%, 22/51), dietary advice (41%, 21/51), lifestyle advice (16%, 8/51), education (14%, 7/51), antenatal care (12%, 6/51), perinatal care (6%, 3/51), lactation

support (4%, 2/51), CVD risk assessment (4%, 2/51), and exercise support (4%, 2/51). Fifty-four percent (28/52) of respondents described women accessing services through self-referral, 50% (26/52) were through GP referral, 37% (19/52) were referred by independent midwife or obstetrician, 35% (18/52) were referred by diabetes in pregnancy service, and a further 23% (12/52) specified access to their service was achieved through being a currently enrolled patient (8%, 4/52), via referral from nurses (2%, 1/52), community referral (2%, 1/52), or through GDM referral services (2%, 1/52). Sixty percent (31/52) of respondents reported criteria to access their service and described requirements such as a diagnosis or history of GDM (39%, 12/31), have an abnormal OGTT test or elevated HbA1c result (26%, 8/31), be a registered patient (13%, 4/31), be a local resident (10%, 3/31), or 'Other' (19%, 6/31) which included criteria such as being of Indian descent (6%, 2/31), be a New Zealand citizen (3%, 1/31), have a diagnosed health condition (3%, 1/31), or be currently pregnant or planning pregnancy (3%, 1/31).

Service delivery included 90% (47/52) of respondents offering in-person appointments, 79% (41/52) offering telephone appointments, 35% (18/52) offering online appointments, and 21% (11/52) offering services through one or more other channels such as email (8%, 4/52), text messaging (6%, 3/52), online sessions (6%, 3/52), community engagement (2%, 1/52), and inpatient care (2%, 1/52). Eight percent (4/52) of respondents reported that their services were delivered in-person only. Follow-up services were offered by 94% (49/52) of respondents including in-person, telephone, email text messaging, online, group sessions, letters, antenatal diabetes clinics, through health coaches or patient outreach (Table 3.2). Eighty-eight percent (45/51) of respondents reported referring patients on to other healthcare professionals, with 68% (30/44) referring to diabetes specialist nurses, 64% (28/44) referring to dietitians, 43% (19/44) referring to obstetricians, 36% (16/44) referring to endocrinologists, 36% (16/44) referring to nurses, 25% (11/44) referring to psychologists, 20% (9/44) referring to social workers, and 14% (6/44) referring to nutritionists. A further 45% (20/44) of respondents reported referring to one or more services such as green prescription (11%, 5/44), health improvement practitioners (9%, 4/44), health coaches (7%, 3/44), community support (5%, 2/44), pharmacists (5%, 2/44), physiotherapists (5%, 2/44), lactation consultants (5%, 2/44), cultural support services (3%, 1/44), social workers (3%, 1/44), podiatrists (3%, 1/44), and general practitioners (3%, 1/44).

Regarding HbA1C testing, 96% (49/51) of respondents reported discussing this with patients in their service, with 59% (27/46) of respondents explaining the HbA1C testing process, 43% (20/46) of respondents discussing how to understand the HbA1C results, 41% (19/46) of respondents explaining what HbA1C is, 20% (9/46) of respondents explaining the complications of a high HbA1C result, 15% (7/46) explaining the risk of T2DM, and 4% (2/46) of respondents using the traffic light system with the patient as a tool for HbA1C diagnosis and interpretation.

Respondents most commonly (58%, 28/48) report seeing between zero to five woman with a history of GDM each month, with 17% (8/48) seeing 6-10 women, 10% (5/48) seeing 11-20, and 7% (15/48) seeing over 20 women each month. Regarding follow-up services, 12% (6/49) of respondents reported they never see the same patient again for follow-up, whilst 64% (32/49) reported they see the same patient again at least once, and 22% (11/49) responded 'Other' which included seeing patients for follow-up as required (6%, 3/49), a variable amount depending on patient-specific needs (4%, 2/49), for ongoing care (2%, 1/49), or upon patient request (2%, 1/49).

Over a third of respondents (37%, 18/49) reported a cost to be associated with their service. Of those reporting a cost, the cost was most often between NZD $50-100 for the service (76%, 13/17). Just under half (47%, 8/17) of respondents reporting a cost associated with their service stated they accept community service cards of which the original fee will be reduced to NZD $19.50. Sixty-three percent (31/49) of respondents reported no cost to their services; the regional availability of these free services is illustrated in **Figure 2**.

Table 3: Service characteristics described by health professionals for women with a history of GDM in New Zealand

	n	%
Services provided to women with history of GDM (n=51)		
Diabetes management/monitoring	22	43
Dietary advice	21	41
Lifestyle advice	8	16
Education (GDM long-term consequences and associated risks)	7	14
Antenatal care	6	12
Perinatal services	3	6
Exercise support	2	4

CVD risk assessment	2	4
Discuss HbA1C with patients (n=51)		
Yes	49	96
No	2	4
If yes (specify): (n=46)		
HbA1C testing process	27	59
Understanding HbA1C result	20	43
What is HbA1C	19	41
Complications of high HbA1C	9	20
T2DM risk	7	15
Diagnostic tool	2	4
If yes (specify): (n=31)		
GDM diagnosis/history	12	39
Abnormal GTT test/high HbA1c result	8	26
Registered patient	4	13
Local residency	3	10
Other	6	19
Service delivery (n=52)		
In-person appointments	47	90
Telephone appointments	41	79
Online appointments	18	35
Other	11	21
In-person only services (n=52)		
Yes	4	8
No	48	92
Follow-up services (n=52)		
Yes	49	94
No	3	6
How are the services offered (n=48)		
In-person follow-up	43	90
Telephone follow-up	42	88
Email follow-up	30	63
Text follow-up	24	50
Online follow-up	14	29
Group session follow-up	3	6
Other	5	10

Refer to other healthcare professionals (n=51)		
Yes	45	88
No	6	12
Healthcare professionals for referral (n=44)		
Diabetes specialist nurse	30	68
Dietitian	28	64
Obstetrician	19	43
Endocrinologist	16	36
Nurse	16	36
Psychologist	11	25
Social worker	9	20
Nutritionist	6	14
Other	20	45
Number of patients with GDM history seen each month (n=48)		
0-5	28	58
6-10	8	17
11-20	5	10
20+	7	15
See same patient for follow-up (n=49)		
Never	6	12
Once	12	24
Twice	9	18
More than twice	11	22
Other	11	22
Cost to service (n=49)		
Yes	18	37
No	31	63
Initial appointment cost (n=17)		
$50-100	13	76
$19.50 community service card holders only	8	47
$0-50	5	29
Outcome measures used to evaluate service (n=49)		
Yes	25	51
No	24	49

If yes (specify): (n=24)

Clinical/biometric outcomes	14	58
Patient-reported outcomes and wellbeing	5	21
Patient experience and feedback	4	17
Annual patient report	1	4

Data are presented as number of respondents (n) and percentage (%). Percentages may not total 100% where respondents were able to select multiple options. Missing data have been excluded from percentage calculations

3.3.3 Professional and Individual Factors

Professional and individual factors influencing service provision are presented in Table 3.3. Respondents were asked to rate how important they believed diet and lifestyle services are in the prevention of chronic disease on a 5-point Likert scale. Almost all (98%, 46/47) respondents answering this question rated diet and lifestyle services as "Very important", whilst two percent (1/47) of respondents answered "Somewhat not important". Respondents were asked about their confidence in their ability to provide diet and lifestyle services for women with a history of GDM. Over half (60%, 28/47) of respondents stated they were very confident, 34% (16/47) of respondents stated they were somewhat confident, and 6% (3/47) of respondents stated they were not confident in their ability to provide these services. Of these three respondents who were not confident, two had received specific training in the GDM area. Sufficient staff resourcing, training and time appeared to be key issues impacting confidence in healthcare professionals' ability to provide diet and lifestyle services, as demonstrated in the quotes of two respondents:

Respondent 47: *"The reason I don't feel confident in my ability to provide diet and lifestyle advice is because there is not enough FTE and therefore, I am swamped. We have cut and cut our services as much as we can but we are only able to offer the bare minimum which is really worrying and disheartening."*

Respondent 21: *"If I am to give more education and diet or lifestyle intervention, I would need more time with patients as well as training on things such as motivational interviewing."*

When respondents were asked what additional resources they believed would improve the quality of services available for women with a history of GDM, 74% (34/46) of respondents selected both support for addressing psychological barriers, and community-based diabetes prevention programmes, a further 50% (23/46) answered access to patient education materials, 46% (21/46) answered more training on GDM management, 41% (19/46) answered easier referral pathways to specialists, 24% (11/46) answered improved clinical guidelines, and 26% (12/46) selected 'Other'. 'Other' included suggestions such as increased staffing (7%, 3/46), funded services or programmes (4%, 2/46), longer session duration (4%, 2/46), reduced wait-list times (2%, 1/46), culturally inclusive resources (2%, 1/46), further training (1/46), and an increased awareness among health professionals of risks associated with GDM (2%, 1/46).

Table 3.4: Factors influencing service provision for women with a history of GDM

	n	%
Importance of diet & lifestyle services in chronic disease prevention (n=47)		
Very important	46	98
Somewhat not important	1	2
Confidence in ability to provide diet & lifestyle services for women with GDM (n=47)		
Yes, very confident	28	60
Somewhat confident	16	34
Not confident	3	6
Additional resources or support to improve care (n=46)		
Support for addressing psychological barriers	34	74
Community-based diabetes prevention programmes	34	74
Access to patient education materials	23	50
More training on GDM management	21	46
Easier referral pathways to specialists	19	41
Improved clinical guidelines	11	24
Other	12	26

Data are presented as number of respondents (n) and percentage (%). Percentages may not total 100% where respondents were able to select multiple options. Missing data have been excluded from percentage calculations

3.3.4 GDM Service Barriers

When asked if respondents believed women face barriers when accessing appropriate GDM-related care (Table 3.4), 81% (38/47) of respondents agreed they do. Respondents described barriers they believe women face. Fifty-five percent (21/38) of respondents described financial barriers, 47% (18/38) mentioned appointment times which were often at inconvenient times where mothers would have work commitments, or would need to find childcare. Twenty-six percent (10/38) of respondents discussed cultural and religious barriers, 24% (9/38) stated knowledge and health literacy as a barrier, with some women not understanding the importance of attending these services. Sixteen percent (6/38) of respondents stated accessibility to the service itself as a barrier, including transport or the ability to receive referral, and a further 13% (5/38) of respondents stated emotional psychological barriers, such as women who express feelings of guilt or shame regarding their GDM diagnosis. Free-text responses reiterated that that there were a broad range of barriers to accessing post-partum GDM care, from accessibility and timing of appointments:

Respondent 17: *"Accessibility in terms of cost, transport, childcare and time (can be hard to prioritise your health when looking after a newborn)"*

Respondent 15*: "…Other barriers include clinics are only held in work hours which can be difficult for families to get time off work for appointments…"*

To health literacy and education:

Respondent 30: *"Not being made aware that GDM predisposes them for other chronic health conditions"*

Respondent 3: *"…The demographic of people who are overrepresented with GDM (and uncontrolled GDM) are Pacific, Maaori and Indian who often have barriers to accessing healthcare and may have poor health literacy…"*

And to structural and institutional racism:

Respondent 47: *"…I have seen in my practice people from certain ethnicities (e.g., Māori, Pasifika) are not supported enough to get HbA1c done post-natally, are not informed of pre-diabetes diagnoses as much, and not provided with as much education because of pre-conceived racial prejudices in primary care.*

3.3.5 Culturally Responsive Services

Over half (53%, 25/47) of respondents reported providing specific services designed to address the healthcare needs of Māori (Table 3.4). When asked to provide further detail, respondents reported to offer Māori specific services and providers (or referral to these services) (56%, 14/25), financial support and reduced costs (24%, 6/25), community engagement and support services (16%, 4/25), Māori specific resources (16%, 4/25), and following Māori models of care in their services (12%, 3/25). Just under half (43%, 20/47) of respondents reported offering specific services for other cultures including Pacific (85%, 17/20), South Asian (40%, 8/20), East or Southeast Asian (30%, 6/20), Middle Eastern/African/Latin American (30%, 6/20), NZ European (20%, 4/20), and 'Other' (20%, 4/20), of which included refugees (10%, 2/20) or unspecified responses (10%, 2/20).

Table 3.5: Barriers to GDM service provision and cultural responsiveness of services reported by health professionals

	n	%
Do women face barriers when accessing care (n=47)		
Yes	38	81
No	9	19
If yes (specify): (n=38)		
Financial	21	55
Appointment times (work/childcare)	18	47
Cultural and religious	10	26
Knowledge and health literacy	9	24

Accessibility to service	6	16
Emotional and psychological	5	13
Provide services designed to address needs of Māori (n=47)		
Yes	25	53
No	22	47
If yes (specify): (n=25)		
Māori specific services and providers (or referral to these services)	14	56
Financial support and reduced costs	6	24
Community engagement and support	4	16
Māori specific resources	4	16
Māori models of care	3	12
Provide specified services for other cultures (n=47)		
Yes	20	43
No	27	57
If yes (specify): (n=20)		
Pacific	17	85
East or Southeast Asian	6	30
South Asian	8	40
Middle Eastern, African, Latin American	6	30
NZ European/European	4	20
Other	4	20
Services offered to these groups: (n=19)		
Culturally specific services and support (or referral to these services)	8	42
Language and communication support	6	32
Education and information	3	16
Financial support	3	16
Community engagement and support	4	21

Data are presented as number of respondents (n) and percentage (%). Percentages may not total 100% where respondents were able to select multiple options. Missing data have been excluded from percentage calculations

3.3.6 Service Gaps

Thirty-four respondents responded to the question asking for a description of gaps in care they believe women currently face after a diagnosis of GDM. Responses described themes of cultural, financial, educational and systemic gaps in the care these women receive. Some respondents (9%, 3/34) described factors around patient education and understanding of future risks associated with GDM, others discussed a lack of GDM prevention (12%, 4/34). Respondents mentioned women do not always understand their future risk, and little is being done through educational means to reduce this gap.

Respondents described follow-up services to monitor women post-GDM as lacking, with no automatic HbA1C recall systems in place, and that opportunities for follow-up were often missed.

Respondent 16: *Not having auto-recall systems in place for automatic HbA1c recall…"*

Respondents described cultural concerns regarding a lack of services provided to specific populations. Highlighted were South Asian populations, with 12% (4/34) of respondents specifically mentioning a lack of culturally appropriate resources for this group when providing GDM-related care.

Respondent 47: *"More culturally appropriate patient education materials (have a large South Asian demographic patient population but not really appropriate resources), easier access to interpreting services, more FTE so patients can be provided more in-depth consults as well as post-natal input."*

Other respondents (12%, 4/34) generalise ethnicity and culture and mention a lack in resources specific to suit the needs of different cultural backgrounds. While one respondent (3%, 1/34) felt Māori and Pasifika women are often lost in the system.

Respondent 2: *"Wahini Māori and Pasifika women often are lost to follow up"*

Respondents (6%, 2/34) described potential misinformation affecting patients, as many women have false understanding of carbohydrates and have often removed them from their diet prior to seeing these health professionals. Respondents (12%, 4/34) also discussed cost as a common barrier to care, with funded support or services lacking for women with a history of GDM. Respondents (18%, 6/34) mentioned these women should be seen in the years following birth

for follow-up or continued support services, though due to previously outlined barriers this is not often the case. Respondents (9%, 3/34) described support or services around exercise in pregnancy as often lacking or unfunded.

Respondent 17: *"I think in terms of exercise it could be helpful to have funded support services or groups…"*

Lastly, respondents (3%, 1/34) describe a lack of community-based incentives or support systems as a contributor to the gaps in healthcare women with a history of GDM face.

When asked for additional comments relating to the care women with a history of GDM in New Zealand receive, respondents (n=19) highlighted several key factors. One such factor, is the rising need for culturally responsive care particularly for those with Indian backgrounds, which is a currently growing population in New Zealand, among whom face an increased risk of GDM and T2DM.

Respondent 1: *"…Given the demographic shifts and the high prevalence of diabetes among Indian immigrants, strengthening early intervention and culturally tailored services for GDM is essential. Such efforts will play a pivotal role in advancing both social and economic equity across New Zealand's increasingly diverse population"*

Thirty-two percent (6/19) of respondents described a lack of patient education in services. Respondents also described an unmet need for preventative measures and addressing GDM through early intervention to reduce the risk of developing chronic disease, as well as an increase in community support aimed at high-risk populations. Forty-two percent (8/19) of respondents expressed concern with the current state of services as a result of a lack of resourcing or staffing.

Respondent 47: *"There needs to be more of an emphasis on support to people post-natally - encouragement to get HbA1c checked, dietetic consults post-natally and support to practice sufficient self-care. There needs to be more FTE so healthcare providers can provide this support."*

Respondents also stated they believe GDM is often an "overlooked" area, and education and awareness are often lacking for both health professionals and patients.

Respondent 8: *"Often overlooked area. Education and follow up are important."*

Respondents described the need for clear monitoring pathways, and addressing barriers to access, improving equity, awareness, and continuity of care as key for improving services available to women with a history of GDM in New Zealand.

Respondent 30: *"It would be great if there was a clear monitoring pathway for clients post GDM, including a pathway for management of weight, diet, etc for future pregnancies which might be impacted by GDM"*

3.4 Discussion

This study aimed to determine the availability of, and characterise, the diet and lifestyle services available to women in New Zealand following a pregnancy affected by GDM. The findings of this study provide an overview of service types, accessibility, delivery, costs, cultural responsiveness, barriers, and the professional and individual characteristics of those providing the services. The study included a total of 62 health professionals from all regions of New Zealand, including nurses, dietitians, general practitioners, midwives, obstetricians, nutritionists, health coaches, and exercise physiologists. Respondents were from diverse cultural backgrounds, and offered a range of services, with diabetes management or monitoring and dietary advice being the most common services. The results of this research identify a range of services available to women with a history of GDM as well as the limitations and gaps within the current care women receive, which may help to inform future research and guide recommendations for the enhancement of services.

3.4.1 Service Provision, Follow-up, and Continuity of Care

Women with GDM are at increased risk of developing GDM again in subsequent pregnancies as well as future cardiometabolic conditions such as T2DM and CVD (Bellamy et al., 2009; Kramer et al., 2019; Lu et al., 2025). While diet and lifestyle advice is provided during pregnancy for the management of GDM (Ministry of Health, 2014b), research shows that early dietary intervention for women post-GDM can help reduce the risk of developing these chronic diseases later in life (American Diabetes Association, 2015; Jowell et al., 2022; Liu et al., 2024; Takele et al., 2024). Forty-one percent of healthcare professionals responding to this survey reported to provide dietary advice. However, some reported limited confidence in doing so. Respondents also described a lack in availability of services focused on physical activity and lifestyle support. This was also evident in the limited number of respondents offering some variant of these services (lifestyle advice, exercise support), with only 9% of respondents offering these services exclusively, and just 20% of respondents providing these services in addition to their primary service. Only 4% of the survey respondents reported referring patients to any physical activity related services. Physical activity has been shown to improve insulin

resistance, systolic blood pressure and VO2 max (Boulé et al., 2003; Kadoglou et al., 2007), and is recommended to help lower the risk of recurrent GDM and long-term health conditions (Kanaley et al., 2022; Ministry of Health, 2020b). As only a limited number of respondents report offering any physical activity-related service, this suggests exercise provision may be a significant gap in follow-up care currently available for women with a history of GDM.

Respondents describe multiple referral pathways to gain access to their services, with over half (54%) of respondents reporting that patients often access their services through self-referral. Leaving the responsibility of referrals on the patient may result in some women not receiving the necessary care if they have not advocated for their own health. This is particularly problematic given that studies show many women in the post-partum period are focused on caring for their families and may not prioritise their own health (Bennett et al., 2011; Gustavsen et al., 2024; Sinha et al., 2022). This may be a barrier to accessing appropriate post-partum and long-term care, and without defined pathways for referral after a GDM affected pregnancy, many women may not receive the care they need. In addition, after the intensity of medical input during a GDM-affected pregnancy, women with a history of GDM report feeling abandoned once pregnancy-related care ends, leaving them uncertain of how to manage their ongoing risk of chronic disease (Morrison et al., 2014; Parsons et al., 2018). This highlights the importance of structured referral pathways and clear clinical guidelines to ensure women with a history of GDM receive appropriate post-partum care, education and ongoing support to manage their long-term health risks.

Where appropriate, respondents report referring patients to other health professionals for further care, with 68% and 64% of referrals going to diabetes specialist nurse and dietitians respectively. While it is encouraging to see most patients be referred for dietary support, there are few referrals directed towards lifestyle services. Only 14% of respondents report referring patients to lifestyle services (health coach, health improvement practitioner), with only a further 2% of respondents referring to any community-based services, an area where respondents mention services are often lacking.

More than half of respondents (58%) saw five or fewer women with a history of GDM per month, suggesting underutilisation of post-partum services. Survey respondents reported most commonly delivering their services in-person, with 90% of respondents offering face-to-face appointments. However, 96% of these respondents also offered alternative methods of delivery where in-person services weren't accessible or convenient for the patient. Only 4% of

respondents reported in-person delivery as their sole method of service provision. This suggests that while in-person care is the most common, there is flexibility in types of service delivery to help improve accessibility, especially for women who may face barriers such as transport or childcare. In-person appointments are particularly beneficial, as they allow for clear communication and better relationship-building between the health professional and the patient (Crook et al., 2022). Better relationships between patient and healthcare provider can lead to building trust, increased engagement, and improved long-term outcomes (Cramm & Nieboer, 2015; Lawrence et al., 2021). Despite this, some respondents expressed frustration at the limited time or number of sessions they were able to have with each patient, making it difficult to establish rapport or provide ongoing care. Over half (64%) of respondents said they saw their patients more than once in the post-partum period, while others (12%) reported they only ever see patients for an initial consultation, or only follow up if the patient specifically requests it (6%). Considering 36% of respondents do not see their patients more than once, this suggests opportunities for continuity of care may be missed, reducing the ability of health professionals to build trust with the patient and provide tailored support over time for long-term chronic disease prevention.

In New Zealand, the Ministry of Health recommends women receive post-partum HbA1c testing at 3 months post-partum (Ministry of Health, 2014a). Most respondents (96%) reported discussing HbA1C testing with patients in their service, most often discussing the HbA1C testing process (59%), explaining the significance of the HbA1c result to the patient (43%), or explaining what HbA1c is (41%). Some respondents shared concerns around the absence of an automated recall system for follow-up HbA1C testing, as without a formal system in place, women may be lost to follow-up and may not receive adequate screening or preventative care. In New Zealand, only 40.9% of women with a history of GDM attended their three-month post-partum HbA1C appointment, with this figure only slightly increasing to 53.3% at 6 months (Sise et al., 2022). These findings reinforce the importance of recall and reminder systems to ensure women receive appropriate screening to monitor risk of T2DM after a GDM-affected pregnancy.

3.4.3 Cultural Responsiveness in Service Provision

Given the inequity of both GDM and T2DM among some ethnicities, the availability of culturally specific services is particularly important. Culturally responsive services, particularly those tailored for Māori women, are essential for promoting equitable healthcare outcomes. Māori women are disproportionately affected by GDM and T2DM and are considered a high-risk population (Chepulis et al., 2022; Daly et al., 2024). Providing services that are culturally responsive may help to make services more accessible and acceptable to Māori and ensure that Māori women receive care that is both culturally respectful and aligns with their values. Studies have shown the importance of Māori specific models in healthcare (Wilson et al., 2021), and that Māori women are more likely to show engagement in interventions if these are specifically tailored towards their culture (Barrett et al., 2025). However, little over half of the respondents reported offering culturally specific services for Māori women. Where specific services were offered, these included access to Māori providers, incorporation of Māori models of care, and provision of complimentary appointments or financial support. Limited availability of such services may prevent Māori women from fully engaging with care, possibly reducing opportunities for early intervention and support. Literature shows Māori women are often lost to follow up, which can result in development of preventable chronic disease (Reid et al., 2018), this was a concern also voiced by survey respondents.

Tailored services for other ethnic groups were limited, with only 43% of respondents providing specific services to other ethnic groups. Respondents expressed concern for the lack of culturally responsive care and resources, particularly for those of South Asian background, a population which is disproportionately affected by GDM and T2DM (Daly et al., 2024; Karter et al., 2013; Pham et al., 2019). Respondents described women from these populations often being overlooked, and expressed the need for more resources such as translators, language specific physical resources, culturally responsive practices and food choices. According to the 2023 census, Asian populations make up 17.3% of New Zealand, with this figure growing annually (Stats NZ, 2023). Despite this, less than half (30%, 14/47) of respondents claimed to provide specifically tailored services for these women. This suggests a growing gap in care for these populations, and a missed opportunity for early intervention in prevention of chronic disease. While the most common response from respondents regarding other cultures they provide specific services for was Pacific populations (85%, 17/20), this accounted for little over one third (36%, 17/47) of the health professionals who answered this section of the survey, despite Pacific populations also facing heightened risk of GDM and T2DM (Daly et al., 2024;

Karter et al., 2013). As Pacific populations make up an estimated 8.9% of New Zealand (Stats NZ, 2023), these findings highlight a significant gap in current care models and reinforce the need for more culturally responsive services and resources.

3.4.4 Barriers to Service Accessibility

Respondents described several barriers they felt were commonly faced by women with a history of GDM when accessing their services. Financial constraints was identified as a frequent concern. While antenatal diabetes in pregnancy services are publicly funded, post-partum GDM services often lack equivalent funding, making cost a factor in accessibility. Although over half of services (63%) are offered to patients at no cost, others require payment, most commonly between NZD $50–100 (76%). For those eligible for subsidies, such as the Community Services Card, fees are reduced to NZD $19.50 (47%). Financial problems as a barrier to accessing healthcare appears to be a trend across other sectors of care across New Zealand (Jeffreys et al., 2024). For women already facing financial barriers to care, and with the additional costs associated with caring for another child, these fees may reduce the likelihood of engagement with health services. This is concerning given that women with a history of GDM are at a significantly elevated risk of developing T2DM, with evidence suggesting 20 to 60% of these women will go on to develop T2DM without appropriate intervention (Buchanan et al., 2012; Li et al., 2020; Song et al., 2018). Preventative lifestyle interventions have been shown to reduce this risk, however the lack of funding around this area may result in these opportunities being missed.

In addition to financial limitations, several practical and logistical barriers were described by respondents. Respondents reported inflexible appointment times as a barrier to attending care services, particularly for women managing work commitments or caring for young children. The requirement for childcare was highlighted as a barrier also, with some women unable to attend appointments without additional support. Lack of reliable transport and cost of transport were also mentioned as a barrier for accessing services. While 96% of respondents explained they offered other methods of service delivery rather than just in-person, some services such as post-partum HbA1C testing requires a physical appointment. These logistical challenges can significantly reduce a woman's ability to engage in ongoing care. Respondents mentioned

health literacy as another key concern, with respondents reporting that some women were unaware of their increased risk of developing chronic disease later in life or the importance of post-GDM follow-up and the purpose of diet and lifestyle interventions. This can lead to missed opportunities for early intervention and prevention, particularly when women do not perceive themselves to be at risk, highlighting a gap in patient education-based services.

Emotional and psychological barriers were also identified, with some respondents reporting that women may experience feelings of guilt, shame, or fear following a GDM diagnosis. These emotions may discourage engagement with services, particularly if women feel they are being judged or blamed for their diagnosis. Similar findings have been shown in other literature, where respondents described feelings of anxiety, guilt, or abandonment following GDM, with emotional stress, stigma, and perceived judgement acting as deterrents to women receiving appropriate care or engaging in interventions (Nicklas et al., 2011; Parsons et al., 2018). These findings highlight the importance of empathetic care in post-partum services to encourage engagement, help women feel understood and supported, and improve long-term health outcomes.

3.4.5 Systemic Gaps and Resource Limitations

Availability of healthcare professionals who provide services for women with a history of GDM is a significant barrier to promoting long-term health outcomes for these women. Comments from survey respondents describe factors affecting their work professionally, one factor is a lack of staff members as respondents find themselves often unable to see patients in a timely manner, without the capacity to see patients for a follow-up session, or unable to spend long enough with a patient as the duration of the sessions are not long enough to cover everything needed. Respondents also described being unable to build rapport with patients, and in this situation, they find women were less likely to engage in interventions. Additionally, survey respondents voiced concerns around patient waitlist times and the challenges they believe patients face in receiving referral to appropriate services.

Regarding the knowledge of those delivering services to women with a history of GDM, more than half of respondents (56%) described having received training specific to this area, either through formal education or work-based learning opportunities. Almost all respondents (98%)

agreed diet and lifestyle services were very important in the prevention and management of chronic disease. However, the confidence of respondents to deliver effective diet and lifestyle support varied considerably. Most respondents (60%) expressed they were confident in their service provision, though over a third (34%) of respondents stated they were only somewhat confident, with a further 6% of respondents stating they were not confident. The level of confidence health professionals have in providing their services is significant in characterising these services and may highlight an issue regarding staff training and resourcing. Some respondents stated that existing understaffing issues left little room to pursue professional development, as workloads were already under pressure. The lack of confidence among some professionals suggests a need for improved workforce training and resources that support consistent, evidence-based care across services.

Many respondents highlighted broader systemic issues that limit their ability to deliver effective care. Several respondents outlined the need for early intervention and more proactive approaches to reduce the long-term risk of chronic disease following a GDM-affected pregnancy. Respondents also discussed the need for increased investment in public health initiatives and services specifically targeted towards high-risk populations. Notably, 42% (8/19) of respondents expressed dissatisfaction with the current state of services, largely due to inadequate staffing and a general lack of resourcing across the area. This reflects results from a New Zealand survey of dietitians providing dietary advice to women with GDM, where 28% of professionals reported feeling their services were inadequate (Lawrence et al., 2017), suggesting a possible pattern of under-resourcing across related services. Respondents described post-partum GDM care as an overlooked area within women's health, where both public and professional awareness are often limited. Respondents highlighted the need for improved access pathways, greater continuity of care, and a stronger focus on health equity.

3.4.7 Strengths and Limitations

To the best of our knowledge, this is the first study in New Zealand to explore and characterise the diet and lifestyle services available to women with a history of GDM, and as such it provides valuable insight into current practice and service delivery in New Zealand. Respondents were recruited from a wide range of professional backgrounds from different

regions of the country to provide a broad overview of services available. Specific questions around services tailored to different cultures were included within the survey to gain an understanding of how culturally specific services are delivered or identifying where gaps may exist. The survey was piloted and pre-tested by health professionals from diverse cultural backgrounds, helping to ensure clarity, relevance, and cultural awareness of the questions.

Limitations of this study involved recruitment bias; recruitment of respondents was carried out nationally, however the majority of respondents were based in Auckland. This may be attributed to the researchers own location, professional contacts, the use of regional search results when identifying organisations, or that Auckland boasts a large population. Additionally, while the sample size was appropriate for an exploratory study, there is the possibility that not all services for women with a history of GDM in New Zealand are accurately represented in the results of this study. While respondents described differences in the availability of services for women with a history of GDM, these accounts may reflect individual perspectives rather than distinct service variations. It is also possible there were respondents involved in this study who were not the target demographic, as once distributed to organisations, there was little control over who the survey reached, and it may have reached professionals who care for women in the gestational period rather than post-partum. Lastly, open-ended responses were analysed using content analysis by one researcher, and although careful consideration was given to interpreting responses, there is a risk that some may have been misinterpreted or have lost their original meaning.

3.4.8 Conclusion

The health professionals involved in this study describe a variety of services available to women with a history of GDM in New Zealand, however there are notable differences in how these services are accessed or delivered. Services often focus on diabetes monitoring and dietary advice but provide limited attention to areas such as physical activity, lifestyle support, and long-term preventative care. From a healthcare professional's perspective, respondents reported that many women with a history of GDM face barriers including cost, lack of follow-up, and lack of availability of culturally responsive services, which may significantly impact their ability to access appropriate care. Although health professionals understand the

importance of supporting women through diet and lifestyle interventions after GDM, the level of confidence and professional training in delivering these services varies. Concerns were expressed about the absence of routine recall systems for follow-up, the lack of culturally tailored resources, inadequate staffing and resources, and the under-prioritisation of GDM-related services within the healthcare system. These issues contribute to significant gaps in service provision and may leave women at higher risk of developing chronic conditions such as T2DM and CVD in the years following a GDM-affected pregnancy. The findings of this study highlight the need for more long-term, culturally responsive and educational services for women with a history of GDM across New Zealand.

Chapter 4: Conclusions

4.1 Summary

This study explored the availability and characteristics of diet and lifestyle services targeted towards women with a history of GDM in New Zealand. Survey findings showed fewer than half of respondents reported providing dietary advice, with less than one fifth providing lifestyle advice, and only a small proportion offering physical activity-related care. While a range of services were identified, there was notable variation in cost, accessibility, and referral pathways. Just over half of respondents provided Māori-specific services, though support for Pacific and South Asian women was less common, and gaps were identified in resources, patient education, and culturally responsive care.

4.2 Achievements of Aims and Objectives

This study aimed to determine the availability of and characterise diet and lifestyle services available to women in New Zealand following a pregnancy affected by GDM. The research achieved this aim through a survey focused on exploration of service types, accessibility, costs, cultural responsiveness and provider qualifications and experience. One of the primary objectives was to describe and characterise the modality, frequency, duration, location, and availability of services, which was achieved by gathering data from a wide range of health professionals across the country. The findings revealed that while dietary services are commonly available with 41% of respondents reporting the provision of dietary support, services focused on physical activity and lifestyle interventions are consistently lacking. Only 20% of respondents offered any form of lifestyle advice or exercise support as part of their service. Notably, only 4% of respondents reported referring to any exercise related services. The lack of services in these areas is particularly concerning given the link between physical activity and lifestyle interventions in the prevention of chronic disease following a GDM-affected pregnancy (Kanaley et al., 2022; Ministry of Health, 2020b).

In terms of service accessibility, results from this study found that in-person consultations are the primary type of delivery, though many providers also offer other formats such as phone and online consultations to improve accessibility to their services. Despite this, respondents believed women still face barriers when accessing these services, and described possible logistical challenges such as transport, inflexible appointment times, and lack of childcare. The objective to evaluate the costs to patients associated with services was also achieved as the results found that while some services are free or subsidised through government schemes such as the Community Services Card, most others involve direct patient costs, with the most common cost of service ranging between NZD $50-100 per appointment.

The final objective focused on understanding the professional qualifications of those delivering these services. Respondents in this research included nurses, dietitians, general practitioners, midwives, obstetricians, nutritionists, health coaches, and exercise physiologists. The data revealed that 56% of respondents had received GDM-specific training, with 23% of respondents developing their skills through work experience and 57% through university courses or other forms of further education. Additionally, it was found that levels of confidence in delivering these services varied widely. Only 60% of respondents described themselves as being confident in adequately delivering diet and lifestyle services to women with a history of GDM. Limited access to ongoing training opportunities, resources, and time constraints were described as contributing factors to lower levels of confidence. These findings successfully describe the qualifications of service providers in addition to the structural challenges they face in delivering their services.

Finally, one of the study's hypotheses were proven true, in that respondents outlined a variety of services available to women with a history of GDM in New Zealand. However, the remaining hypothesis to determine regional variance in services could not be effectively evaluated, as although survey respondents were across all regions of New Zealand, due to a low number of respondents in some areas, the data collected was insufficient to allow for a meaningful comparison. As a result, no analysis was conducted to assess differences in services between regions, and it is not possible to definitively conclude that there is regional variance in post-partum GDM services in New Zealand.

4.3 Research Impact

The findings from this study offer insight into both the services available and health professionals' perspectives on the services available to women with a history of GDM in New Zealand. The study identifies gaps and highlights opportunities in the provision of post-partum GDM care, with important implications in the prevention of chronic disease. This research contributes to the evidence base for GDM-related services in New Zealand, and can serve as a foundation for future studies, and inform the development of service frameworks and guidelines to address existing gaps, helping to improve outcomes for women following a GDM-affected pregnancy.

4.4 Strengths

As far as we know, this is the first study in New Zealand to explore the availability and delivery of diet and lifestyle services for women with a history of GDM, and as such, it provides insight into current practices, professional perspectives, and gaps in services. The inclusion of both quantitative and qualitative data allowed for a detailed overview of structural factors and lived experiences that influence service accessibility, providing a clearer understanding of the current services available. Additionally, a key strength of this study is the diversity of respondents, who represented a wide range of professional roles, cultural backgrounds, and regions across the country. Another strength of this study is the exploration of cultural responsiveness in these post-partum GDM services. By specifically examining services for Māori, Pacific, and other culturally diverse populations, the research outlines how equity and cultural inclusivity are addressed in practice and identifies where further development is needed. The inclusion of culturally diverse perspectives in the survey design, as well as pre-testing with respondents from different backgrounds, helped ensure the clarity, relevance, and cultural awareness of the questions. These elements strengthen the findings of this study and offer a meaningful contribution to future service improvements for this high-risk population.

4.5 Limitations

Limitations of this study include the regional distribution in the sample of respondents. Despite efforts to reduce this bias, including the use of regionally specified search terms to target other regions, there is the possibility of regional bias in the recruitment of this study, due to the researcher's own location when using search engines or their awareness of local organisations. This may be reflected by the high number of respondents from the Auckland region. While the sample size was adequate for the purposes of this study, it is also possible that the recruitment process did not accurately represent all professions and services involved in post-GDM care in New Zealand. Some professions and services appeared to be lacking in this area, for example nutritionists, physical activity practitioners, and Well Child service providers. However, this may be a result of the survey not reaching these professionals, rather than a true absence of service provision. This limitation is further reflected in that respondents were largely recruited through professional organisations, with limited recruitment from independent practices. It is possible there are services available for these women which may fall under private providers or smaller organisations that were not directly contacted for participation in this study. Another limitation is the potential inclusion of respondents who were not part of the intended target group, this was highlighted through responses from some respondents indicating they were involved in antenatal or diabetes in pregnancy care with no explicit mention of provision of care after pregnancy. These respondents were included in the study sample as while the criteria for inclusion of the study involved being a healthcare professional currently seeing women with a history of GDM and providing diet, lifestyle and/or motivational or mindset advice, respondents may have considered themselves to fit this criteria in their service provision. The inclusion of these respondents may result in an inaccurate representation of the amount of diet and lifestyle services. Additionally, some answers to open-text survey questions also mentioned eligibility criteria unrelated to GDM, or described services offered during the gestational period without any reference to ongoing post-partum care. It is not clear whether these respondents also provided services to women in the post-partum period and introduces uncertainty regarding how clearly responses reflect post-GDM service provision, specifically focused on diet and lifestyle advice. This limitation may have influenced some of the reported findings, particularly in relation to follow-up care and referral pathways. Another limitation is that the findings of this study may reflect the respondents' personal views or perspectives within a service and may not be representative of other health professionals in the same service.

The length of the survey (30 minutes) may have been a limiting factor in participation, as many health professionals already work under significant time constraints. Taking time to complete the survey may not have been feasible in this case, meaning experiences of some health professionals may have been missed. Finally, open-ended responses were analysed by a single researcher using content analysis. Despite the thorough attention given to interpreting the responses, there is potential that some may have been misinterpreted, possibly altering their intended meaning.

4.6 Recommendations

The findings of this study highlight several areas that would benefit from improvement, both in research and in the types and availability of services for women following a GDM-affected pregnancy. One of the gaps identified was the lack of physical activity and lifestyle support services available to these women. While many providers offered dietary advice, both physical activity and lifestyle-based services were rarely offered or referred to, despite evidence supporting their effectiveness in the prevention of chronic disease (Adam et al., 2023; Wang et al., 2024). Future service development should include a greater emphasis on integrating physical activity and lifestyle support into routine care for women following a GDM-affected pregnancy. This could include increasing the availability and funding of health coaches, exercise professionals, and group-based or community lifestyle programmes targeted towards women after pregnancy.

Culturally responsive care was highlighted in the results as another area where there is space for improvement. Just over half of service providers reported offering services specifically catered towards Māori women, and services for other high-risk populations such as South and Southeast Asian women were even more limited. Services were reported to be lacking in cultural resources, including the use of translated materials, culturally appropriate food guidance, and awareness of cultural traditions or models of health. Without cultural considerations in current care practices, women risk missing the opportunity for early intervention in chronic disease. Strengthening cultural responsiveness across the health system through relevant courses, greater cultural resourcing, and culture-specific health providers will help to improve this inequity.

Another recommendation is the use of formal recall systems to support follow-up care after a GDM-affected pregnancy. Respondents raised concerns about women being lost to follow-up after their initial contact with services, particularly when no automated system was in place. Future service improvements should include structured recall systems for post-partum HbA1c testing and diet and lifestyle follow-up. These systems would help ensure women receive the care they need without being responsible for initiating it themselves, especially during a time where personal health is often not prioritised (Bennett et al., 2011; Gustavsen et al., 2024; Sinha et al., 2022).

Improving access to training and professional development for providers is also important. While some respondents had received specific training related to GDM, others expressed only moderate or low confidence in delivering effective care in the period after a GDM-affected pregnancy. Future initiatives could include training programmes or workshops focused on post-GDM care, covering areas such as diet, physical activity, diabetes prevention, culturally responsive care, behaviour change, and health literacy.

Future research is needed to strengthen and gain better understanding of post-GDM services available in New Zealand. Research could aim to explore women's lived experiences with current services and perspectives on what type of services would be beneficial post-GDM in New Zealand. This study explored the perspectives of healthcare professionals on the services they provide, however, understanding the barriers, motivators, and preferences from the women's point of view will provide greater insight into how services can be better structured and delivered.

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Appendices

Appendix A: Pre-testing Participant Questionnaire

Pre-test Participant Questionnaire

Thank you for taking the time to complete the survey!

Please answer the following questions with your honest feedback, this section should take around 10 minutes to complete.

1. Approximately how long did it take you to complete the survey?

2. Was the survey length appropriate?

3. Did the survey flow logically from one question to the next?

4. Did any of the questions feel unnecessary? If so, which ones and why?

5. Did you feel uncomfortable answering any of the questions? If so, which ones and why?

6. Were any questions unclear? If so, which ones and why?

7. Where additional comments were required, was there adequate space to write an answer?

8. Did you have any technical issues completing the survey?

9. Are there any questions you believe should be added to the survey? If so, please specify.

Additional comments/suggestions:

If you have any further suggestions you would like to discuss in detail, please email Katrina at kcrisford@massey.ac.nz to arrange a time for a phone call or meeting.

Thank you for your participation in the pre-testing of this survey, your feedback is greatly appreciated!

Appendix B: GDM Services Survey

GDM Services Survey

Start of Block:

Thank you for your interest in our research. Have you read and understood the information provided in the Participant Information Sheet?

- ○ Yes
- ○ No

In order to participate in this research you must be:

- A healthcare professional currently seeing people with a history of GDM and providing diet, lifestyle and/or motivational/mindset advice in your professional role
- Offer these services in Aotearoa New Zealand
- Over the age of 16 years
- Able to read and write in English. Do you confirm that you meet the above criteria?

- ○ Yes
- ○ No

If you have any questions about this research or wish to discuss anything before deciding to participate, please contact Katrina Crisford, k.crisford@massey.ac.nz We anticipate the survey should take you no more than 30 minutes to complete.

End of Block:

Start of Block: Demographics

Q1 What is your professional role? (Select one)

- ○ Obstetrician
- ○ Midwife
- ○ Dietitian
- ○ General Practitioner (GP)
- ○ Endocrinologist
- ○ Nutritionist
- ○ Paediatrician
- ○ Health coach
- ○ Nurse
- ○ Exercise Physiologist
- ○ Psychologist
- ○ Counsellor
- ○ Other (please specify) _____

Q2 What is your primary area of practice? (Check all that apply)

- [ ] General clinical
- [ ] Diabetes
- [ ] Antenatal/Obstetrics
- [ ] Community nutrition
- [ ] Public nutrition
- [ ] Other (please specify) _____

Q3 Do you have any specific training related to GDM or diabetes management?

- ○ Yes (please specify) _____
- ○ No

Q4 How many years of experience do you have working in your profession? (Select one)

- ○ 0-2
- ○ 3-5
- ○ 6-8
- ○ 9+

Q5 Within which healthcare setting do you see people with a history of GDM? (Check all that apply)

- ☐ Public hospital
- ☐ Private hospital
- ☐ Primary care clinic
- ☐ Community health centre
- ☐ Private practice
- ☐ Other (please specify)

_____

Q6 What region do you currently practice in? (Select one)

- ○ Auckland
- ○ Waikato
- ○ Northland
- ○ Bay of Plenty
- ○ Gisborne
- ○ Taranaki
- ○ Manawatu
- ○ Hawkes Bay
- ○ Wellington
- ○ West Coast
- ○ Canterbury
- ○ Otago
- ○ Southland
- ○ Other (please specify) _____

Q7 What ethnicity do you identify as? (Check all that apply)

- ☐ Māori
- ☐ Pacific
- ☐ East or South East Asian
- ☐ South Asian
- ☐ Middle Eastern/Latin American/African
- ☐ NZ European
- ☐ Other (please specify)

_____

End of Block: Demographics

Start of Block: GDM Service Characteristics

Q8 What services do you provide to people with a history of GDM?

_____

_____

_____

_____

_____

Q9 How do people with a history of GDM access your service? (Check all that apply)

- [ ] Referred by diabetes in pregnancy service
- [ ] Referred by independent midwife or obstetrician
- [ ] Referred by GP
- [ ] Self-referred
- [ ] Other (please describe)

_____

Q10 Are there any criteria people need to meet in order to access your service?

- ○ Yes (please explain) _____
- ○ No

Q11 How do you deliver your services? (Check all that apply)

- [ ] In-person appointments
- [ ] Telephone appointments
- [ ] Online appointments
- [ ] Other (please describe)

_____

Q12 Are your services in-person only?

- [ ] Yes
- [ ] No

Display this question:
If Q12 = Yes

Q12 How would you describe the area which your practice is located?

- ○ Metropolitan / Urban (population >100,000)
- ○ Regional / Suburban
- ○ Rural / Remote
- ○ Other (please specify) _____

Q13 Do you offer any follow-up services following your initial consultation?

- ○ Yes
- ○ No

Display this question:
If Q13 = Yes

Q13 How are these services offered? (Check all that apply)

- ☐ In-person follow-up
- ☐ Group session follow-up
- ☐ Telephone follow-up
- ☐ Online follow-up
- ☐ Email follow-up
- ☐ Text follow-up
- ☐ Other (please specify)

_____

Q14 Do you refer patients to other healthcare professionals?

- ○ Yes
- ○ No

Display this question:
If Q14 = Yes

Q14 Please select all team members which apply

- ☐ Dietitian
- ☐ Nutritionist
- ☐ Obstetrician
- ☐ Diabetes specialist nurse
- ☐ Endocrinologist
- ☐ Psychologist
- ☐ Nurse
- ☐ Social worker
- ☐ Other (please specify)

_____

Q15 Do you refer patients to other services, for example those run by community groups?

- ○ Yes
- ○ No

Display this question:

If Q15 = Yes

Q15 Please describe the type of services

_____

_____

_____

_____

_____

Q16 In your practice, do you discuss HbA1C testing with your patients?

- ○ Yes
- ○ No

Display this question:

If Q16 = Yes

Q16 What specifically do you discuss in relation to HbA1C testing?

_____

_____

_____

_____

_____

Q17 Approximately how many people with a history of GDM do you see each month? (Select one)

- ○ 0-5
- ○ 6-10
- ○ 11-20
- ○ More than 20

Q18 In most cases, how often would you see the same patient again for a follow up session? (Select one)

- ○ Never
- ○ Once
- ○ Twice
- ○ More than twice
- ○ Other (please specify) _____

Q19 Is there a cost to access your service?

- ○ Yes
- ○ No

Display this question:

If Q19 = Yes

Q19 What is the initial appointment cost to the client?

_____

_____

_____

_____

_____

Q20 Are any outcome measures used to evaluate your service?

- ○ Yes
- ○ No

Display this question:
If Q20 = Yes

Q20 Please describe what outcome measures are used to evaluate the services you provide for people with a history of GDM

_____

_____

_____

_____

_____

End of Block: GDM Service Characteristics

Start of Block: Professional & Personal Factors

Q21 On a scale of 1-5 with 1 being not very important and 5 being very important, how important do you think diet and lifestyle services are for preventing or managing long term health conditions such as type 2 diabetes or cardiovascular disease in people with a history of GDM? (Select one)

- ○ 1 (Not very important)
- ○ 2 (Somewhat not important)
- ○ 3 (Neutral)
- ○ 4 (Somewhat important)
- ○ 5 (Very important)

Q22 Do you feel confident in your ability to provide effective diet and lifestyle advice for people with a history of GDM? (Select one)

- ○ Yes, very confident
- ○ Somewhat confident
- ○ Not confident

Q23 What additional resources or support would help you provide better care to people with a history of GDM? (Check all that apply)

- ☐ More training on GDM management
- ☐ Access to patient education materials
- ☐ Easier referral pathways to specialists
- ☐ Improved clinical guidelines
- ☐ Support for addressing psychosocial barriers
- ☐ Community-based diabetes prevention programmes
- ☐ Other (please specify) _____

Q24 Are there any specific gaps in care for people with a history of GDM that you feel need attention?

_____

_____

_____

_____

_____

End of Block: Professional & Personal Factors

Start of Block: GDM Service Barriers

Q25 Do you believe people with a history of GDM face barriers when accessing care services?

- ○ Yes
- ○ No

Display this question:

If Q25 = Yes

Q25 What barriers do you believe people face most?

_____

_____

_____

_____

_____

Q26 Do you provide any services or support specifically designed to address the healthcare needs of Māori in your professional role?

- ○ Yes
- ○ No

Display this question:

If Q26 = Yes

Q26 What specific services or support do you provide to Māori?

_____

_____

_____

_____

_____

Q27 Does your service provide any specific support or services for other cultural or ethnic groups?

- ○ Yes
- ○ No

Display this question:
If Q27 = Yes

Q27 Which cultural or ethnic groups do you provide specific support or services for? (Check all that apply)

- ☐ Pacific
- ☐ East or South East Asian (e.g. Chinese, Japanese, Korean, Malaysian)
- ☐ South Asian (e.g. Indian, Pakistani, Bangladeshi, Sri Lankan)
- ☐ Middle Eastern, African or Latin American
- ☐ NZ European/European
- ☐ Other (please specify)

_____

Display this question:
If Q27 = Yes

Q27 What type of support or services do you offer for these groups?

_____

_____

_____

_____

_____

End of Block: GDM Service Barriers

Start of Block: Additional Comments

Q28 Please provide any additional comments regarding services available to people with a history of GDM in New Zealand

_____

_____

_____

_____

_____

End of Block: Additional Comments

Appendix C: List of Contacted Organisations

Organisation
New Zealand Society for the Study of Diabetes
NZCOM Auckland
NZCOM BOP
NZCOM Nelson/Marlborough
NZCOM Northland
NZCOM Otago
NZCOM Canterbury
NZCOM Central
NZCOM Southland
NZCOM Waikato
NZCOM Wellington
Dietitians NZ
Dietitians NZ Womens Health Special Interest Group Convenor
Dietitians NZ, Diabetes Special interest Group Convenor
Royal NZ College of General Practitioners
Aotearoa College of Diabetes Nurses
National Womens Health
Te Toka Tumai Diabetes in Pregnancy Clinic
Te Whatu Ora (general enquiry)
ProCare
Womens Health Action
Ascot Central Womens Gynaecology Clinic
Te Rito Ora
Turuki Health Care
Toi Tangata
South Seas Healthcare
Society of Obestric Medicine of Australia and New Zealand
Aotearoa Diabetes Collective
Plunket (Northland/Auckland)
Plunket (Central)
Plunket (South island)
Health Hawkes bay
Nutrition Society of NZ
Te Whatu Ora Diabetes Service - Canterbury
Comprehensive Care
College of Nurses Aotearoa
Lactation consultants of Australia and New Zealand
Rotorua Area primary health service

General Practice New Zealand
Hauora Taiwhenua Rural Health Network
General Practitioners Aotearoa
Te Pou
Total Healthcare PHO
Health Literacy NZ
Clinical Nutritionists Aotearoa
Western bay of plenty PHO
Tu Ora
Sport Auckland
Nuku Ora
Sport Otago
Sport Manawatu
The Fono
National Hauora Coalition
Pacific Heart Beat
Perinatal Society of New Zealand
Wahine Charitable Trust
THINK Hauora
Te Kōhao Health
Te Puna Ora
Pasifika Medical Association
Te Awakairangi Health Network
Langimalie Health Centre/Tongan Health Society
Vaka Tautua
Asian Network Inc
Asian Family Services
Marlborough PHO
Nelson bays primary health
WellSouth primary health network
Harbour Sport (Green prescription)
Midwives NZ
Pinnacle Midlands

Appendix D: Resources for distribution

Advertisement Post 1

What Happens After Gestational Diabetes?

Gestational diabetes mellitus (GDM) affects approximately 8-10% of all pregnancies in New Zealand each year and significantly increases the risk of developing future health issues, including type 2 diabetes and cardiovascular disease. Targeted diet and lifestyle advice may be an effective strategy to reduce these risks, however, there is little research in to what services are available for people in New Zealand following a GDM affected pregnancy. This study aims to identify and characterise the diet and lifestyle services provided to people following a GDM-affected pregnancy. The findings of this study will provide a foundation for developing targeted interventions and strategies to improve care for people who have experienced GDM, and hopes to reduce the risk of future health problems.

Katrina Crisford is a Masters student at Massey University and is looking for health professionals who provide diet and lifestyle services to people following a GDM affected pregnancy. Participation involves filling out an anonymous online survey, which should take no longer than 30 minutes to complete. Your participation in this survey is greatly appreciated and will be able to further our understanding on the current care these people receive.

The survey is available to be completed **here** and will be available until 11/08/2025

If you are a healthcare professional (e.g. doctor, nurse, dietitian, nutritionist, health coach, exercise physiologist, psychologist or other) and provide any type of diet or lifestyle advice to people following a GDM pregnancy, you may be eligible. For more information please contact Katrina by emailing kcrisford@massey.ac.nz

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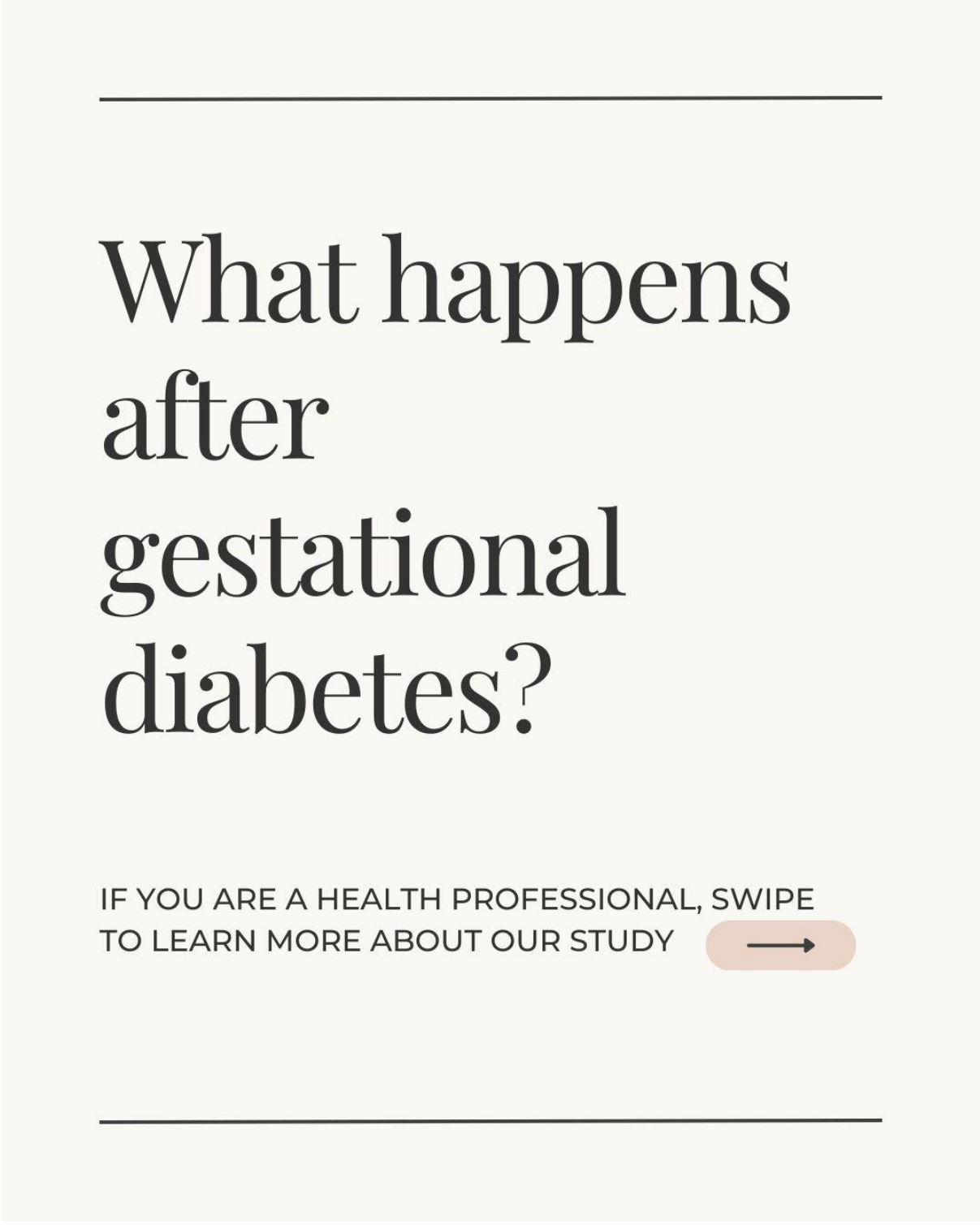

Advertisement Post 2

Advertisement Post 2

Katrina Crisford is a Masters student at Massey University and is looking for health professionals who provide diet and lifestyle services to people following a GDM affected pregnancy. Participation involves filling out an anonymous online survey, which should take no longer than 30 minutes to complete. Your participation in this survey is greatly appreciated and will be able to further our understanding on the current care these people receive.

The survey is available to complete until 11/08/2025

If you are a healthcare professional (e.g. doctor, nurse, dietitian, nutritionist, health coach, exercise physiologist, psychologist or other) and provide any type of diet or lifestyle advice to people following a GDM pregnancy, you may be eligible. For more information please contact Katrina by emailing kcrisford@massey.ac.nz

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Appendix E: Ethics approval

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

25/03/2025

Dear: Dr Robyn Lawrence

Re: Ethics Application - OM1 25/05 - Survey of diet and lifestyle services available for people with a history of gestational diabetes mellitus (GDM) in New Zealand

Thank you for the above application that was considered by the Massey University Human Ethics Committee:

Ohu Matatika 1 at their meeting held on **Tuesday, 11 February 2025**

On behalf of the Committee I am pleased to advise you that the ethics of your application are approved.

Approval is for three years. If this project has not been completed within three years from the date of this letter, reapproval must be requested.

If the nature, content, location, procedures or personnel of your approved application change, please advise the Secretary of the Committee.

Yours sincerely

Professor Tracy Riley,
Acting Chair, Research Ethics Chair's Committee

Research Ethics Office, Research and Enterprise
Massey University, Private Bag 11 222, Palmerston North, 4442, New Zealand T 06 951 6841; 06 95106840
E humanethics@massey.ac.nz; animalethics@massey.ac.nz; gtc@massey.ac.nz

Appendix F: Participant Information Sheet

Participant Information Sheet

Diet and lifestyle services after GDM

A survey of health services

Lead Researcher: Dr Robyn Lawrence

Study Site: School of Sport, Exercise and Nutrition, Massey University, Albany

Contact phone number: (64-9) 213 6032

Ethics committee ref.: OM1 25/05

You are invited to take part in a study investigating what diet and lifestyle services are available to people with a history of gestational diabetes mellitus (GDM). Whether or not you take part is your choice.

This Participant Information Sheet will help you decide if you'd like to take part. It sets out why we are doing the study, what your participation would involve, what the benefits and risks to you might be, and what would happen after the study ends. You do not have to decide today whether or not you will participate in this study. Before you decide you may want to talk about the study with other people, such as family, whānau, friends, or colleagues. Feel free to do this.

This form is 5 pages. Please make sure you have read and understood all the pages.

Voluntary Participation and Withdrawal From This Study

Participation in this study is completely voluntary. You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- Decline to answer any particular questions
- Stop the survey at any time
- Ask any questions about the study at any time during participation
- Provide information on the understanding that any potential identifiable information will not be used in the presentation of results
- Be given access to a summary of the study findings when it is concluded

What is the purpose of the study?

GDM affects approximately 8-10% of pregnancies in Aotearoa New Zealand with prevalence increasing over time. People with a history of GDM have an almost 10-fold increased risk of developing type 2 diabetes (T2D) and are at increased risk of other chronic disease such as cardiovascular disease in later life. This has significant social, health and financial cost implications. Diet and lifestyle interventions are effective strategies for the prevention of T2D and cardiovascular disease. Given people with a history of GDM are at increased risk of developing conditions such as T2D and cardiovascular disease, support to optimise diet and lifestyle after GDM may serve to reduce the risk of later chronic disease. However, currently access to diet and lifestyle services after GDM is fragmented. Anecdotally, some localities have established referral pathways to diet and lifestyle advice after GDM affected pregnancies whereas others do not, resulting in inequitable access to healthcare. This study aims to identify and characterise what diet and lifestyle services are currently available to support people with a history of GDM. The study focuses on care provided at any time following a GDM-affected pregnancy, ranging from the immediate post-partum period to years later. The findings of this study may identify gaps in services currently provided and provide a foundation for developing targeted interventions and strategies to improve care for people who have experienced GDM. This could potentially improve the health and well-being of these people, whilst also reducing the risk of developing future health issues such as T2D and cardiovascular disease.

WHO IS CONDUCTING THIS RESEARCH?

Katrina Crisford is a Masters student at Massey University and undertaking this research study. This research is being overseen by Dr Robyn Lawrence, a lecturer at Massey University, and Dr Charlotte Oyston, a senior lecturer at The University of Auckland.

HOW IS THE STUDY DESIGNED?

Data on current diet and lifestyle services for people with a history of GDM in Aotearoa New Zealand will be collected through an online survey of **healthcare professionals**. The survey has been informed by the current research literature, consultation with healthcare professionals working in New Zealand, developed by the research team and pre-tested on other healthcare professionals.

WHO CAN TAKE PART IN THE STUDY?

New Zealand healthcare professionals who provide diet and lifestyle advice or services for those who have a history of GDM in past pregnancies. This may include health professionals such as; general practitioners, dietitians, nutritionists, endocrinologists, obstetricians, midwives, paediatricians, health coaches, nurses, psychologists, exercise physiologists, counsellors or others.

To participate, you must be:

- A healthcare professional currently seeing people with a history of GDM and providing diet, lifestyle and/or motivational/mindset advice in your professional role
- Offer these services in Aotearoa New Zealand
- Over the age of 16 years
- Able to read and write in English.

What will my participation in the study involve?

If you decide to take part in this study, after you have read and had time to consider the information in this information sheet, you will be asked to complete an online survey which should take no longer than

30 minutes. The survey has a mix of open and closed questions and is available to complete until 11/08/2025. A link to the online survey is available within the email containing this information sheet or within the newsletter or social media post in which you accessed this information sheet.

At the end of the survey, you can choose to take part in a random prize draw for your chance to win one of five $100 grocery vouchers. It is your choice whether you choose to do this. Contact details collected for the prize draw are collected through a link to a form separate to your survey data.

Completion of the survey implies consent. You have the right to decline to answer any particular question.

What are the possible risks of this study?

As the survey can be completed at a time and location that is most convenient to you there are no anticipated physical risks to you.
Although efforts will be made to protect your privacy, absolute confidentiality of your information cannot be guaranteed. Even with coded and anonymised information, there is no guarantee that you cannot be identified. The risk of people accessing and misusing your information (e.g. making it harder for you to get or keep a job or health insurance) is currently very small but may increase in the future as people find new ways of tracing information.

WHAT ARE THE POSSIBLE BENEFITS OF THIS STUDY?

This research will identify the availability of diet and lifestyle services for people with a history of GDM to reduce their risk of associated chronic disease such as T2D. Greater awareness of the availability of such services among healthcare professionals and consumers may enable better access to these services and in turn positively contribute to the health of people with a history of GDM. The research may also identify gaps in services available, for example, in terms of locality or cultural considerations. Identification of these gaps could serve as the first step in working towards addressing these gaps to better meet the needs of people with a history of GDM.

Completion of the survey may serve as an evaluation exercise and may help you to identify areas within the services you currently provide that are working well or others that are not working well.

Will any costs be reimbursed?

Participants will not incur any costs as part of being involved in the study as all participation is online. If you choose to participate and would like to enter the prize draw, you have the chance to win one of five $100 grocery vouchers.

What will happen to my information?

During this study you can choose to provide as much or as little information as you wish. If you choose to provide any identifying information such as your name, organisation or contact details, these details will be stored securely and separately to the data required to answer the research questions. If you choose to enter the random prize draw for a chance to win one of five $100 grocery vouchers, your contact details will be required to contact you if you are randomly selected as a prize winner. Contact information for the prize draw is collected through a link provided at the end of the survey to an online form separate from your survey data. This information will be stored in a secure, separate location to any other data collected.

Identifiable Information

Identifiable information is any data that could identify you (e.g. your name, organisation or contact details). The following groups may have access to your identifiable information:

- The Masters student undertaking this research project (to arrange dispatch of the grocery vouchers to winners of the prize draw)
- Government agencies, like HDEC, ACC and its representatives, **if** you make a compensation claim for study-related injury. Identifiable information is required in order to assess your claim.

De-identified (Coded) Information

To make sure your personal information is kept confidential, information that identifies you will not be included in any report generated by the researchers. Instead, you will be identified by a code. The researcher will keep a list linking your code with your name, so that you can be identified by your coded data if needed.

The results of the study may be published or presented, but not in a form that would reasonably be expected to identify you.

Anonymised Information

Data collected through the survey will be anonymous. This means the research team will not know who provided the data in the survey.

Security and Storage of Your Information

Any identifiable information you choose to provide will be held at Massey University during the study. After the study it is transferred to a secure archiving site and stored for at least 10 years, then destroyed. Your coded information will be entered into electronic spreadsheet. Coded study information will be kept in secure, cloud-based storage indefinitely. All storage will comply with local and/or international data security guidelines. The linked data in this study will be destroyed at the end of the study.

WHAT HAPPENS AFTER THE STUDY OR IF I CHANGE MY MIND?

If you have provided identifiable information and wish to withdraw from the study, please inform one of the research team. Information and data collected after two weeks of survey completion will continue to be used and included in the study. This is to protect the quality of the study and meet research deadlines. If you have not provided any identifiable information, there is no way for researchers to identify which information belongs to you and therefore this data cannot be withdrawn.

Only investigators and administrators of the study will have access to personal information, and this will be kept secure and strictly confidential. Participants will be identified only by a study identification number. Results of this research may be published or presented at conferences or seminars. Results will be presented in a way to ensure no individuals will reasonably be able to be identified.

At the end of this study the list of participants and their study identification number will be disposed of. Any raw data on which the results of the project depend will be retained in secure storage for 10 years, after which it will be destroyed.

CAN I FIND OUT THE RESULTS OF THE STUDY?

All participants or those involved in dissemination of information about the study can request a summary of the project findings when it is completed. If you wish to receive a copy of the research findings please do so by emailing Katrina Crisford, at the address kcrisford@massey.ac.nz. This information will be stored separately to study data and not linked to data in any way.

WHO IS FUNDING THE STUDY?

This study is funded by Massey University. Participants will not incur any costs for taking part in this study.

WHO HAS APPROVED THE STUDY?

This project has been reviewed and approved by the Massey University Human Ethics Ohu Matarika 1, Application OM1 25/05.

Who do I contact for more information or if I have concerns?

If you have any questions, concerns or complaints about the study at any stage, you can contact:

Katrina Crisford Masters Student Massey University kcrisford@massey.ac.nz +6421537078	Dr Robyn Lawrence Lead investigator Massey University robyn.lawrence@massey.ac.nz +6492136032

The other members of the research team include Dr Charlotte Oyston from the University of Auckland

If you have any concerns about the conduct of this research, please contact the Chairperson, Massey University Human Ethics Ohu Matatika 1.

Email: humanethics1@massey.ac.nz.

If you want to talk to someone who isn't involved with the study, you can contact an independent health and disability advocate on:

Phone: 0800 555 050
Fax: 0800 2 SUPPORT (0800 2787 7678)
Email: advocacy@advocacy.org.nz
Website: https://www.advocacy.org.nz/

Appendix G: Coding of Qualitative Survey Data

Free-text responses for Q24 (gaps in care) and Q28 (any additional comments)

Coded response ***(Gaps in Care) (n=34)***	**N (%)**
Cultural	4 (12)
South Asian women	4 (12)
Financial	5 (15)
Education	3 (9)
Prevention	4 (12)
Follow-up services	6 (18)
Misinformation	2 (6)
Continuity of care	1 (3)
Exercise	2 (6)
Community support	2 (6)
Social work	1 (3)
Environmental barrier	2 (6)
No gaps	2 (6)
Emotional	1 (3)
Resources	3 (9)
Waitlist	1 (3)
Communication/relationship-building	1 (3)
(Any additional comments) (n=19)	
Cultural	1 (5)
South Asian women	1 (5)
Prevention	1 (5)
Equity	1 (5)
Resources	8 (42)
Community support	2 (11)
Overlooked area	2 (11)
Education	6 (32)
Encouragement	1 (5)
Clear pathways	1 (5)
Personalised services	1 (5)
Diabetes management	1 (5)
Other (general information about self or workplace)	3 (16)