



**The lived experience of women  
newly diagnosed with Gestational  
Diabetes (GDM) and the influence  
of attending a group structured  
education session compared to  
individual education sessions  
using Max van Manen's life  
existentials**

**Thesis submitted in accordance with the requirements of  
the University of Liverpool for the degree of Doctor of  
Medicine**



**DEEPA SD BEEHARRY**

**April 2023**

# Contents

<b>Declaration</b> .....	<b>6</b>
<b>Acknowledgements</b> .....	<b>7</b>
<b>List of Abbreviations</b> .....	<b>8</b>
<b>List of Tables</b> .....	<b>10</b>
<b>List of Figures</b> .....	<b>11</b>
<b>Abstract</b> .....	<b>12</b>
<b>Chapter 1 Gestational Diabetes Mellitus</b> .....	<b>14</b>
<b>1.1 Introduction</b> .....	<b>14</b>
<b>1.2 Gestational Diabetes Definition</b> .....	<b>15</b>
<b>1.3 Historical perspective</b> .....	<b>17</b>
1.3.1 The Hyperglycaemia and Pregnancy Outcome (HAPO) Study .....	20
1.3.2 International Association of Diabetes and Pregnancy Study (IADPSG) .....	20
1.3.3 American Diabetes Association (ADA) criteria .....	21
1.3.4 Diagnostic Criteria and Classification of Hyperglycaemia First Detected in Pregnancy [WHO 2013] .....	21
<b>1.4 Testing in UK</b> .....	<b>22</b>
<b>1.5 Screening and diagnosis of GDM in UK</b> .....	<b>22</b>
<b>1.6 Risk Factors</b> .....	<b>23</b>
<b>1.7 Pathophysiology of Gestational Diabetes Mellitus</b> .....	<b>24</b>
<b>1.8 Prevalence of GDM</b> .....	<b>26</b>
<b>1.9 Screening of GDM</b> .....	<b>26</b>
<b>1.10 Complications</b> .....	<b>27</b>
<b>1.11 Cardiometabolic Complications of gestational diabetes</b> .....	<b>28</b>
1.11.1 GDM and risk of CVD events .....	28
1.11.2 GDM and hypertension .....	30
<b>1.12 Glucose Intolerance post GDM</b> .....	<b>31</b>
1.12.1 GDM and the risk of developing T2DM .....	32
<b>1.13 Cardiometabolic effects on the fetus</b> .....	<b>33</b>
<b>1.14 Financial burden</b> .....	<b>36</b>
<b>1.15 Summary</b> .....	<b>36</b>
<b>Chapter 2 Literature Reviews</b> .....	<b>38</b>
<b>2.1 Psychological Impact of GDM</b> .....	<b>39</b>
2.1.1 Maternal problems during pregnancy .....	39
2.1.2 Antenatal Psychosocial stress .....	42
2.1.3 Antenatal depression .....	42
2.1.4 Anxiety and Depression during pregnancy .....	44
2.1.5 Stress in Pregnancy .....	44
2.1.6 Pregnancy anxiety .....	45
2.1.7 Anxiety, Depression and GDM .....	45
2.1.8 Women’s Experiences of GDM .....	47
<b>2.2 GDM and Education</b> .....	<b>50</b>
2.2.1 Health Education .....	58
2.2.2 Health Promotion .....	59

2.2.3	Health Education models.....	61
2.2.4	Health Belief model.....	61
2.2.5	Social Learning Theory (SLT) .....	61
2.2.6	Social Network Theory.....	62
2.2.7	One-to-One communication used in health education and promotion .....	63
2.2.8	Group communication used in health education and promotion.....	63
2.2.9	Adult Learning theory .....	63
2.2.10	Self-Management .....	64
2.2.11	Behaviour Change in GDM.....	64
2.2.12	GDM and Health Belief Model (HBM) .....	65
2.2.13	GDM and Social Cognitive theory .....	66
2.2.14	The Theoretical domains Framework (TDF) .....	67
2.2.15	The Behaviour Change Wheel (BCW).....	68
2.2.16	The Capability, Opportunity, Motivation (COM-B) model of behaviour change. 69	69
2.2.17	The PRIME Theory of motivation .....	71
2.2.18	Theory used in diabetes education and interventions.....	73
2.2.19	Rationale for study and methodology.....	74
2.2.20	Study Aims .....	77
<b>2.3</b>	<b>Summary .....</b>	<b>79</b>
<b>Chapter 3</b>	<b>Methodological Perspectives .....</b>	<b>81</b>
<b>3.1</b>	<b>Quantitative methodology .....</b>	<b>81</b>
3.1.1	Quantitative GDM studies .....	82
3.1.2	Mixed method GDM studies .....	82
<b>3.2</b>	<b>Qualitative Methodology .....</b>	<b>83</b>
<b>3.3</b>	<b>Theoretical Framework/Philosophies .....</b>	<b>84</b>
3.3.1	Ethnography .....	85
3.3.2	Grounded Theory.....	85
3.3.3	Content Analysis .....	86
3.3.4	Introduction to Phenomenology .....	87
3.3.4.1	<i>Transcendental Phenomenology (Descriptive)</i> .....	87
3.3.5	Intentionality.....	88
3.3.6	Bracketing or Epoche .....	89
3.3.6.1	<i>Phenomenological Reduction</i> .....	89
3.3.7	GDM studies using thematic analysis .....	90
<b>3.4</b>	<b>Max van Manen’s Phenomenology of Practice .....</b>	<b>91</b>
3.4.1	Turning to the nature of lived experience.....	92
3.4.2	Investigate the experience as we live it rather than pre-conceptualize it .....	93
3.4.3	Reflecting on the essential themes which characterize the phenomenon: formulating the phenomenological question .....	94
3.4.4	Describing the phenomenon though the art of writing and rewriting .....	96
3.4.5	Balancing the research context by considering parts and the whole. ....	98
<b>3.5</b>	<b>Van Manen’s life existentials .....</b>	<b>98</b>
3.5.1	Lived space (Spatiality).....	99
3.5.2	Lived body (Corporeality).....	100
3.5.3	Lived time (Temporality) .....	101
3.5.4	Lived other (Relationality) .....	102
3.5.5	Lived Technology (Lived cyborg Relations) .....	102
<b>3.6</b>	<b>Approach to thematic analysis.....</b>	<b>103</b>

3.7	Reflexivity - My personal experience .....	104
3.8	Summary .....	106
<b>Chapter 4 Methods.....</b>		<b>108</b>
4.1	Study Design .....	108
4.2	Ethics .....	109
4.3	Study site .....	110
4.4	Study Population .....	110
4.5	Sample size .....	110
4.6	Duration of Study .....	111
4.7	Recruitment .....	111
4.7.1	Identification of patients.....	111
4.7.2	Discussion of Study with women with GDM.....	112
4.7.3	Provision of information.....	112
4.8	Consent Process.....	113
4.9	Randomisation process .....	113
4.10	Intervention .....	114
4.10.1	‘Group’ Education Session.....	114
4.10.2	‘One-to-One’ Education session.....	115
4.11	Questionnaire Choice and Design.....	115
4.11.1	Piloting of Questionnaires .....	116
4.12	Interviews.....	116
4.13	Interview schedule.....	117
4.13.1	Interview 1.....	117
4.13.2	Interview 2.....	118
4.13.3	Interview 3.....	118
4.13.4	Interview 4.....	118
4.14	Patient Safety .....	118
4.15	Confidentialty during interviews .....	120
4.16	Data Storage .....	120
4.17	Validity of Study.....	120
4.18	Thematic Analysis .....	121
4.19	Summary .....	122
<b>Chapter 5 Quantitative Data Analysis .....</b>		<b>123</b>
5.1	Demographics .....	123
5.2	GDM Knowledge and Self-Management Questionnaire Analysis ....	127
5.2.1	All participants data at Baseline, Follow-up 3 and 4.....	127
5.2.2	Participants data by education intervention, ‘Group’ or ‘One-to-One’, at Baseline, Follow-up 3 and 4.....	131
5.3	Impact of the Diagnosis of GDM Questionnaire .....	136
5.4	Summary .....	141
<b>Chapter 6 Qualitative Interview Analysis.....</b>		<b>142</b>
6.1	Before Education Session (Interview 1) .....	144
6.1.1	Lived experience of being newly diagnosed with GDM.....	144

6.1.1.1	<i>Diagnosis informed over the phone</i> .....	146
6.1.1.2	<i>Inconsistent information</i> .....	148
6.1.1.3	<i>Awareness about the reason for undertaking OGTT</i> .....	150
6.1.2	Lived emotional reaction to being diagnosed with GDM. ....	151
6.1.2.1	<i>Negative Emotions: “worry”, “upset”, “shock” and “guilt or self-blame”</i> . 151	
6.1.2.2	<i>Positive emotions: “easy going” attitude</i> .....	154
6.1.2.3	<i>Rationalisation of emotions</i> .....	156
6.1.3	Lived experience of behavioural changes following diagnosis of GDM ...	157
6.1.3.1	<i>Self-made Dietary changes</i> .....	157
6.1.4	Lived experience of seeking and dealing with information about GDM. ..	159
6.1.4.1	<i>Feelings of uncertainty</i> .....	159
6.1.4.2	<i>Information inducing Scare factor</i> .....	161
6.1.4.3	<i>Lack of information</i> .....	162
6.1.4.4	<i>Need for more information</i> .....	164
6.1.4.5	<i>Family and Friends’ support</i> .....	165
6.1.4.6	<i>Suggestions made by participants</i> .....	168
<b>6.2</b>	<b>One week after education session (Interview 2) .....</b>	<b>171</b>
6.2.1	Lived emotional experience of education session .....	172
6.2.1.1	<i>Shift from negative to positive emotions about GDM</i> .....	173
6.2.1.2	<i>Feeling of togetherness - Being in the same boat</i> .....	175
6.2.1.3	<i>Still enjoying pregnancy</i> .....	176
6.2.2	Lived experience of behavioural changes .....	178
6.2.2.1	<i>Confidence post education session</i> .....	178
6.2.2.2	<i>Feelings of “being in control”</i> .....	180
6.2.2.3	<i>Positive dietary changes</i> .....	181
6.2.2.4	<i>Glucose challenge and concerns</i> .....	184
6.2.3	Lived experience of acquiring information .....	187
6.2.3.1	<i>Good and Informative session</i> .....	187
<b>6.3</b>	<b>Four to six weeks post education session (Interview 3) .....</b>	<b>190</b>
6.3.1	Lived experiences of behavioural changes.....	191
6.3.1.1	<i>Glucose management</i> .....	192
6.3.1.2	<i>Positive Dietary change</i> .....	194
6.3.2	Lived emotional experience of GDM.....	196
6.3.2.1	<i>Control and confidence</i> .....	196
6.3.2.2	<i>Baby concern</i> .....	198
6.3.2.3	<i>“Feeling good despite...”</i> .....	199
6.3.3	Lived experience of interaction with Healthcare Professionals .....	201
6.3.3.1	<i>Education session</i> .....	201
6.3.3.2	<i>Interaction with Healthcare Professionals</i> .....	203
<b>6.4</b>	<b>Post-Natal (Interview 4).....</b>	<b>206</b>
6.4.1	Lived experience of behavioural changes .....	207
6.4.1.1	<i>Glucose Management</i> .....	208
6.4.1.2	<i>Lived Post-natal dietary Experience</i> .....	210
6.4.2	Lived perception of post-natal risk of T2DM.....	212
6.4.2.1	<i>Some awareness of T2DM risk</i> .....	212
6.4.3	Lived post-natal GDM experience .....	214
<b>6.5</b>	<b>Summary .....</b>	<b>216</b>
<b>Chapter 7</b>	<b>Discussion.....</b>	<b>218</b>
<b>7.1</b>	<b>Essential themes and subthemes .....</b>	<b>220</b>

<b>7.2</b>	<b>Theme: Lived experience of dealing with information (or lack of) ...</b>	<b>222</b>
7.2.1	Lack of information at the time of diagnosis.....	222
7.2.2	Dealing with uncertainty of online and 3 <sup>rd</sup> party information .....	223
<b>7.3</b>	<b>Theme: Lived emotional experience post diagnosis of GDM.....</b>	<b>226</b>
7.3.1	Initial feelings of shock worry and guilt.....	226
7.3.2	Rationalisation of emotions .....	227
<b>7.4</b>	<b>Theme: Lived experience after attending education session.....</b>	<b>228</b>
7.4.1	Educational and informative education session .....	228
7.4.2	Shift from negative to positive feelings about GDM .....	229
7.4.3	Dietary experience post education session .....	231
<b>7.5</b>	<b>Theme: Lived experience of glucose management.....</b>	<b>233</b>
7.5.1	Glucose control, concerns, and challenges.....	233
7.5.2	Relationship with Health Care Professionals .....	235
<b>7.6</b>	<b>Theme: Lived post-natal GDM experience.....</b>	<b>235</b>
7.6.1	Shift from Scare to Stability .....	236
7.6.2	Post-gestational dietary changes - variable .....	237
7.6.3	Awareness of T2DM risk in post-natal period - partial.....	238
<b>7.7</b>	<b>Limitations .....</b>	<b>239</b>
<b>7.8</b>	<b>Recommendations for clinical Practice .....</b>	<b>241</b>
<b>7.9</b>	<b>Proposed model of care for GDM.....</b>	<b>249</b>
<b>7.10</b>	<b>Conclusion.....</b>	<b>251</b>
	<b>References .....</b>	<b>252</b>
	<b>Appendix A - Gestational Diabetes (GDM) Knowledge and Self- Management Questionnaire .....</b>	<b>281</b>
	<b>Appendix B - Impact of the diagnosis of Gestational Diabetes (GDM) Questionnaire .....</b>	<b>284</b>
	<b>Appendix C - Study Ethics Approval document .....</b>	<b>287</b>
	<b>Appendix D - Patient Information Leaflet .....</b>	<b>291</b>
	<b>Appendix E - GDM Education Session PowerPoint Presentation content .....</b>	<b>294</b>

## **Declaration**

This thesis is as a result of work performed whilst registered as a candidate for the degree of Doctor of Medicine at the University of Liverpool. The interviews obtained from the women with Gestational Diabetes took place at the Countess of Chester Hospital between February 2016 to December 2016. I was involved in the design, interviewing processes and the analysis of results in this study. I declare that no portion of the original work presented in this thesis has been submitted in support of an application for another degree or qualification of this to any other university or institute of learning.

Deepa Beeharry

## **Acknowledgements**

I would like to thank my three supervisors Professor John Wilding, Dr Mark Goodall and Professor Frank Joseph for their supervision, support, and expertise throughout my research and after completion of the study. I am grateful for Professor Joseph for giving me the opportunity to conduct this research project. I am especially thankful to Professor Wilding for his brilliant guidance, supervision, and moral support during the various phases of my study. I would particularly, like to thank Dr Mark Goodall for his constant support, patience, and optimism whilst I have been analysing and writing this thesis. His input has been instrumental in the completion of my thesis.

I would also like to thank the Diabetes Research Specialist nurses Susan Seal and Hoyee Cheung from the Countess of Chester Hospital for their help and support at different stages of my research. I am thankful to the dieticians and the diabetes specialist nurses who were involved in my project at the Countess of Chester Hospital. I would like to thank my friends Kerrie, Kalianee, and Maria for their patience and support. A special thanks to Dr Dushyant Sharma, the clinical director at my workplace, who was also very supportive.

I am grateful to all the women who participated in my study and provided their views on what mattered to them. I appreciated their patience during the interview process. Finally, I would like to thank my parents and my brothers for their support and patience during the conduction of this study. I would like to especially thank my mother who has been a constant source of inspiration and support during the conduction of this study.



## List of Abbreviations

<b>Abbreviation</b>	<b>Name</b>
<b>ACHOIS</b>	Australian Carbohydrate Intolerance Study In Pregnant Women
<b>ACOG</b>	American College of Obstetricians and Gynaecologists
<b>ADA</b>	American Diabetes Association
<b>BCW</b>	Behaviour Change Wheel
<b>COM-B</b>	Capability Opportunity Motivation Behaviour
<b>DKA</b>	Diabetic Keto Acidosis
<b>DSN</b>	Diabetes Specialist Nurse
<b>EASD</b>	European Association for the Study of Diabetes
<b>GCT</b>	Glucose Challenge Test
<b>GH</b>	Gestational Hypertension
<b>GLUT- 4</b>	Glucose Transporter- 4
<b>GDM</b>	Gestational Diabetes Mellitus
<b>HAPO</b>	Hyperglycaemia and Pregnancy Outcome
<b>HBM</b>	Health Belief Model
<b>IRS -1</b>	Insulin Receptor Substrate – 1
<b>IFG</b>	Impaired Fasting Hyperglycaemia
<b>IGT</b>	Impaired Glucose Tolerance
<b>IADPSG</b>	International Association of Diabetes and Pregnancy Study Groups
<b>MeSH</b>	Medical Subject Headings
<b>MFMU</b>	Multicentre Randomised Trial of Treatment of Mild Gestational Diabetes
<b>NCEP (ATP III)</b>	National Cholesterol Education Program (NCEP) Adult Treatment Panel III
<b>NICE</b>	National Institute for Health and Clinical Excellence
<b>NDDG</b>	National Diabetes Data Group
<b>OGTT</b>	Oral Glucose Tolerance Test
<b>PI-3 K</b>	Phosphatidylinositol 3- Kinase 3
<b>PHG</b>	Public Health Guideline
<b>PDG</b>	Programme Development Group
<b>SMBG</b>	Self - Monitoring of Blood Glucose

<b>SCT</b>	Social Cognitive Theory
<b>T1DM/T2DM</b>	Type 1 Diabetes Mellitus/ Type 2 Diabetes Mellitus
<b>TDF</b>	Theoretic Domains Framework
<b>WHO</b>	World Health Organisation

## List of Tables

<b>Table 1:</b> The evolution of the criteria to diagnose GDM .....	18
<b>Table 2:</b> Main nutritional recommendations from international guidelines .....	54
<b>Table 3:</b> Participant demographics by intervention ('Group' and 'One-to-One') ..	125
<b>Table 4:</b> Indications for OGTT in women attending 'Group' and 'One-to-One' sessions.....	126
<b>Table 5:</b> Proportion of women providing correct answers to the GDM Knowledge and Self- Management Questionnaire .....	128
<b>Table 6:</b> Proportion of women in 'Group' versus 'One-to-One' session providing correct answers to the GDM Knowledge and Self- Management Questionnaire ....	132
<b>Table 7:</b> Emerging themes and subthemes .....	221

## List of Figures

<b>Figure 1:</b> Diagnostic criteria for diabetes mellitus in pregnant and non- pregnant individuals based on 75g 2-hours OGTT .....	16
<b>Figure 2:</b> Diagnostic criteria for GDM based on 75g 2-hours OGTT during pregnancy only .....	16
<b>Figure 3:</b> Education programmes designed for people with diabetes .....	51
<b>Figure 4:</b> The Behaviour Change Wheel (283) .....	69
<b>Figure 5:</b> Interconnected components of the COM-B model (286) .....	71
<b>Figure 6:</b> The two aims of the Study .....	78
<b>Figure 7:</b> Types of reflexivity used in research.....	105
<b>Figure 8:</b> Flow Chart of interview and questionnaire schedule .....	109
<b>Figure 9:</b> Study Inclusion and Exclusion Criteria.....	110
<b>Figure 10:</b> Steps involved in thematic analysis using NVivo software .....	122
<b>Figure 11:</b> Consort Flow diagram showing recruitment, randomisation and number of participants remaining at each stage .....	124
<b>Figure 12:</b> Emerging themes describing the ‘lived experiences’ of women following a diagnosis of GDM (Interview 1) .....	146
<b>Figure 13:</b> Common emerging themes describing the ‘lived experiences’ post ‘Group’ and ‘One-to-One’ Education Session (Interview 2).....	172
<b>Figure 14:</b> Common themes emerging following the ‘Group’ and ‘One-to-One’ education session (Interview 3).....	191
<b>Figure 15:</b> Themes emerging from post-natal interview (Interview 4).....	207
<b>Figure 16:</b> Proposed model of care for GDM: .....	250

# **Abstract**

## **Background**

Approximately 700,000 women give birth in England and Wales annually and up to 5% of these women have pre-existing diabetes or Gestational Diabetes (GDM). Amongst women who have diabetes during pregnancy, 87.5% have GDM, 5% have Type 2 diabetes (T2DM), and 7.5% have Type 1 diabetes. GDM, preventable with effective management, is associated with adverse maternal and foetal complications. Women with a new diagnosis of GDM can experience anxiety, fear, and depression. Education is an integral part in the management of GDM but most importantly provides an opportunity to positively influence future health behaviour of these women who are at increased risk of developing T2DM.

## **Aims**

A qualitative method using Max van Manen's phenomenology of practice was used to investigate the two aims of the study to: (i) explore and describe the lived experiences of women newly diagnosed with GDM and (ii) evaluate the effects of attending a 'Group' structured education session in these women compared to 'One-to-One' sessions.

## **Methodology**

Purposive sampling was used to select and randomise 32 women with a new diagnosis of GDM to a 'Group' or 'One-to-One' education session. Two questionnaires, GDM knowledge and psychological impact, were completed. Semi-structured interviews were conducted within a week of the diagnosis, within a week of the education session, 4 to 6 weeks post education session, and 6 to 8 weeks post-partum. Thematic analysis guided by van Manen's four life existentials was conducted to explore the phenomenon of 'lived experience of GDM' and an 'education intervention'.

## **Results**

The women had a mean age of 31.9 years (SD 5.4), BMI of 30.1 (SD 8.9), and a median gravida 2. 75% of the women were Caucasian. No superiority in GDM knowledge was demonstrated in the 'Group' over the 'One-to-One' attenders. A significant reduction in 'worry' levels was shown in the post-partum period. Thematic analysis identified multiple themes. Emergent themes post diagnosis were: 'Lack of information at time of diagnosis'; 'Inconsistent information', 'Feelings of shock,

worry and guilt', 'Rationalisation of emotions'. Post education themes were: 'Shift from negative to positive emotions', 'educational and informative', 'Glucose concerns and challenges'. Post-natal themes included: 'Shift from scare to stability'; 'Some awareness of risk of T2DM' and 'Variable post-natal dietary change'.

## **Conclusions**

The findings emphasise the importance of providing adequate, consistent, and timely information in the care of women with GDM. Structured group or individual education sessions are effective in managing GDM, influencing long term dietary behavioural changes, and risk awareness of developing T2DM. The recommendations are: (i) the emotional aspect of GDM should become an integral part of the clinical management including associated support; (ii) behavioural change models should be embedded to improve the effectiveness of education sessions; (iii) post-natal women with GDM should have longer term follow-up.

# Chapter 1 Gestational Diabetes Mellitus

## 1.1 Introduction

Pregnancy is an important phase in the life of a woman whereby she transitions to motherhood (1). Pregnancy is also expected to be an enjoyable state, which can become more challenging following the diagnosis of a medical disorder such as GDM. Pregnant women undergo physiological as well as psycho-social changes during pregnancy (2).

Gestational diabetes is diagnosed when high blood sugar levels are first detected during pregnancy and various diagnostic thresholds have emerged in last few decades (3, 4). GDM can occur during any stage of pregnancy but is more common during the second and third trimester. Hyperglycaemia during pregnancy occurs because of a combination of pre-existing risk factors as well as physiological changes and metabolic stresses during pregnancy. There is impaired function of the insulin producing pancreatic beta cells as well as insulin resistance due to various maternal and placental hormones (5). Important risk factors for GDM include obesity, advanced maternal age, race/ethnicity, parity, family history of type 2 diabetes (T2DM) and previous macrosomia (6).

It is important to note that hyperglycaemia first presenting during pregnancy could also manifest as Type 1 diabetes (T1DM), T2DM or pre-existing undiagnosed T2DM. T1DM describes a state of insulin deficiency and can present with osmotic symptoms and weight loss, or a state of emergency called Diabetic Keto Acidosis (DKA). T2DM can present silently (without any symptoms), with osmotic symptoms in individuals who tend to be overweight or obese or, can be precipitated by pregnancy. GDM is associated with perinatal complications such as macrosomia, stillbirth, birth trauma, prematurity, neonatal hypoglycaemia, and shoulder dystocia (7).

GDM also has long term complications in the mother and the baby (7). Women who have GDM have a higher relative risk (2.7 to 47%) of developing T2DM in the future depending in which population (8-12). Babies born to women with GDM have a higher risk of developing childhood obesity and T2DM later in life and cardiovascular problems (13-16).

The increased prevalence of gestational diabetes and obesity is a major challenge to public health and acute care worldwide (17, 18). The management of GDM offers a unique opportunity not only to intervene during the current pregnancy but also influence future health of the whole family. The education provided to women is fundamental in managing GDM. Dietary information but also dietary behavioural changes if appropriately taught can become the foundation of future healthy eating households which can reduce the risk of developing T2DM.

This dissertation was the result of a qualitative study that investigated the psychological impact of a new diagnosis of GDM and the influence of an educational intervention. Chapter 1 will provide a detailed background information on GDM which is central to the current study. The importance of a diagnostic criteria for GDM will be discussed including its historical perspective. The pathophysiology, prevalence, and maternal and foetal complications will be explained to gain a better understanding of GDM. The screening process for women based on multiple risk factors for GDM will be highlighted. The increased importance of GDM worldwide due to its increasing prevalence and the risk of developing T2DM following GDM will be emphasized.

## **1.2 Gestational Diabetes Definition**

In 2013 the World Health Organisation (WHO) updated its 1999 guidelines (19) regarding the diagnostic criteria of GDM based on more recent evidence (7, 20-22). The WHO 2013 guidelines define GDM as ‘hyperglycaemia first detected during pregnancy’ and it should be classified either as (23):

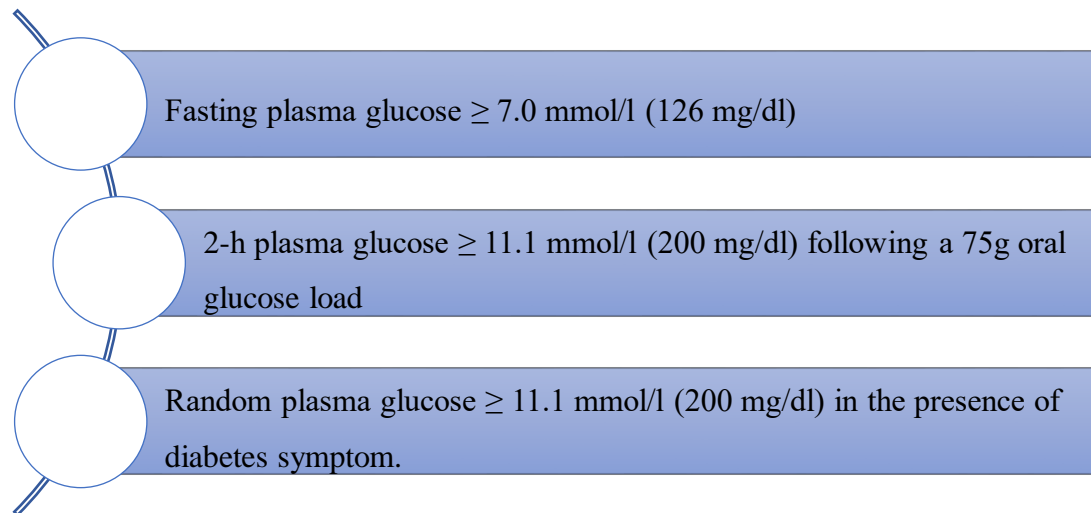
- Diabetes Mellitus in pregnancy
- Gestational Diabetes Mellitus

Hyperglycaemia or glucose intolerance in non-pregnant individuals can be detected as Impaired Glucose Tolerance (IGT) or Impaired Fasting Hyperglycaemia (IFG). Including such a wide range of glucose abnormality and higher blood sugar levels defining diabetes in the definition of GDM would be challenging in the management of GDM and its follow up post-natal period (23). Lack of quality epidemiological data and randomised controlled trials at the time made it difficult to draw any conclusions



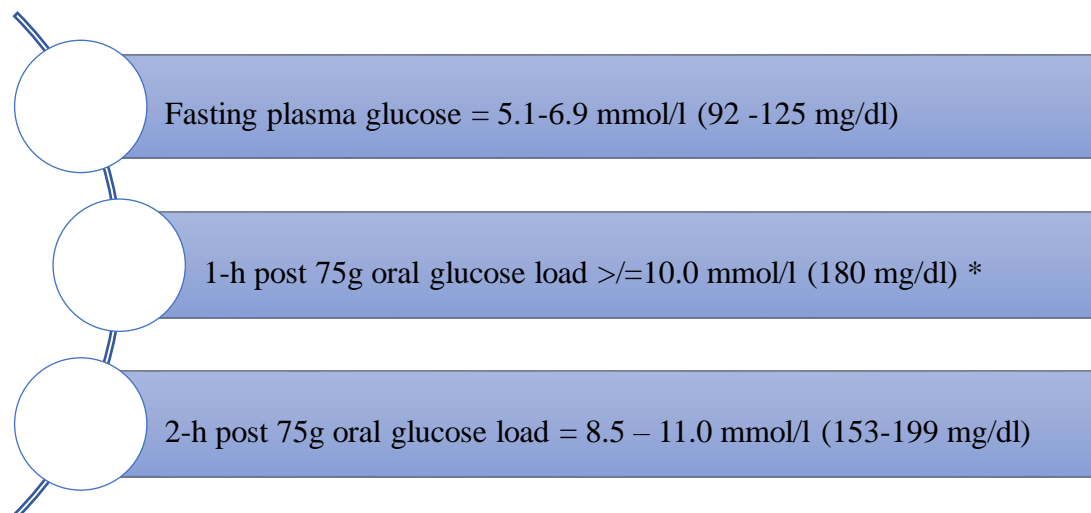
about diagnostic criteria (23). As more evidence became available, the WHO 2013 updated the diagnostic criteria for GDM (23).

The WHO 2013 guidelines state **diabetes in pregnancy** should be diagnosed using the 2006 WHO criteria used for diabetes if one or more of the following criteria are met (**Figure 1**) (23, 24):



**Figure 1:** Diagnostic criteria for diabetes mellitus in pregnant and non- pregnant individuals based on 75g 2-hours OGTT

**Gestational diabetes mellitus** at any time during pregnancy should be diagnosed if one or more of the following criteria are met (**Figure 2**) (23):



**Figure 2:** Diagnostic criteria for GDM based on 75g 2-hours OGTT during pregnancy only

\* The 1-hour post load value is not used in the diagnosis of diabetes.

### 1.3 Historical perspective

The screening and diagnosis of gestational diabetes has historically been controversial and continues to be debated. Attempts to diagnose diabetes during pregnancy started more than 50 years ago. Oral glucose tolerance test (OGTT) was used to diagnose diabetes in both non-pregnant and pregnant populations. There were no specific criteria to diagnose glucose intolerance during pregnancy. In an attempt to further elucidate this matter, O'Sullivan in 1964 evaluated the distribution of plasma glucose values in the second and third trimester of 752 unselected and asymptomatic pregnant women using 3 hour 100g OGTTs (4). The results of this study described the first, second and third upper limits of glucose values which became the statistically accepted criteria defining the upper limit of normal glucose levels in pregnancy (4). The 2-hours and 3-hours blood glucose values were higher compared to those in non-pregnant women confirming a degree of glucose impairment in the pregnant state as compared to the non-pregnant state (4). The 3 hour OGTT, also known as the O'Sullivan and Mahan criteria used whole blood for glucose analysis using the Somogyi–Nelson method (25). Although these arbitrary criteria were initially used for predicting future development of diabetes following pregnancy, they became widely accepted criteria to diagnose GDM (**Table 1**). The two threshold glucose values in the 3 hr OGTT formed the basis for various diagnostic approaches for decades to come.

In addition to validating these criteria against the risk of future development of diabetes in the mothers, O'Sullivan et al also investigated the effects of GDM on pregnancy outcomes (26). In a randomised controlled trial they reported lower rate of macrosomia (4.1%) in women with GDM treated with a specific diet (approximately 30 calories per kilogram ideal body weight: with 40% of total calories from carbohydrates) and insulin compared to women who remained on the habitual diet (13.1%) (26). The study also reported higher perinatal mortality in infants of women with GDM based on their diagnostic criteria, compared to women without GDM. However, they acknowledged other confounding factors (age, parity and weight) in addition to hyperglycaemia that may have led to increased perinatal mortality (25). In 1973, O'Sullivan subjected the same pregnant women who underwent a 3 hr OGTT to a 50g glucose load as a way to screen for gestational diabetes. He used the Somogyi–Nelson method and introduced a glucose threshold of 130 mg/dL (7.2 mmol/L) and

above following which pregnant women would undergo a diagnostic 3 hour OGTT (25).

**Table 1: The evolution of the criteria to diagnose GDM**

Criteria	Year	Approach 1 or 2 steps	Glucose load (g)	Glucose threshold (mmol/L)			
				Fasting	1 hour	2 hours	3 hours
<b>O'Sullivan</b>	1964	2	100	5.0	9.2	8.1	6.9
<b>National Diabetes Data Group (NDDG)</b>	1979	2	100	5.8	10.6	9.2	8.1
<b>Carpenter and Coustan</b>	1982	2	100	5.3	10.0	8.6	7.8
<b>European Association for the Study of Diabetes (EASD)</b>	1996	1	75	6.0	-	9.0	-
<b>World Health Organisation (WHO)</b>	1999	1	75	7.0	-	7.8	-
<b>American Diabetes Association (ADA)</b>	2004	2	100	5.3	10.0	8.6	7.8
<b>International Association of the Diabetes and Pregnancy Study Groups (IADPSG)</b>	2010	2	75	5.1	10.0	8.5	-
<b>World Health Organisation (WHO)</b>	2013	2	75	5.1	10.0	8.5	-

In 1979, the National Diabetes Data Group (NDDG) recommended clinicians continued to use the 3 hour OGTT (27). However, NDDG advocated use of plasma for glucose analysis (instead of whole blood) and increased the cut off values to diagnose GDM, since the glucose concentrations in plasma are approximately 11% higher than in whole blood (27). The American Diabetes Association (ADA) and several other medical organisations also used the 3-hour OGTT but chose different glucose threshold values for diagnosing glucose abnormalities during pregnancy. This

variability in glucose cut offs was mainly due to practical challenges in converting whole blood glucose values used by O'Sullivan into the plasma glucose values analysed by modern analytic methods (23).

Carpenter and Coustan in 1982 proposed a different criteria using the 3 hour OGTT by reducing the cut off glucose values to diagnose GDM (28). They used a special formula to convert O'Sullivan's glucose values which were determined through colorimetric assays to reflect new enzymatic assays (28). They also proposed a 50g 1-hour glucose challenge test to screen pregnant women before further diagnostic testing using O'Sullivan's 3 hour OGTT (28). This method was adopted by many countries for the last three decades (23).

Over the following decades several international workshops were held to debate the screening and diagnosis of diabetes and GDM. The international panels in 1979-1980 recommended the 2hr 75g OGTT to diagnose glucose intolerance and diabetes mellitus (27). This criteria was adopted by WHO which also recommended its use in the pregnant population (29). Although the OGTT was universally used for diagnosing GDM there was no universal consensus on the use of glucose load i.e. 100g over 3 hours or 75g over 2 hours or the use of 1 or 2 high values as cut offs (23).

The European Association for the Study of Diabetes (EASD) published diagnostic criteria for GDM in 1999 (30). EASD proposed the use of the 75-g OGTT to diagnose gestational diabetes at 24 to 28 weeks if either of the following glucose thresholds were met (30):

- **Fasting Plasma Glucose  $\geq 6.0$  mmol/L**
- or
- **2-hours plasma venous glucose  $\geq 9.0$  mmol/L**

The screening and diagnosis of gestational diabetes remained controversial for many years. Several international workshops between 1979 and 2005 were held to discuss GDM but no universal consensus on the best method to diagnose 'any degree of glucose intolerance' was reached (31). There is a large variability regarding the screening and diagnosis of GDM in countries around the world but also between diabetes and obstetric organizations within countries (32).

In UK, the 2002 National Institute for Health and Clinical Excellence (NICE) Health Technology Assessment acknowledged that maternal hyperglycaemia can result in adverse foetal outcomes including macrosomia, shoulder dystocia and stillbirth, however did not advocate universal screening in pregnancy due to insufficient evidence (33).

International guidelines and national guidelines in various countries changed as new evidence became available. For instance, NICE in 2008 published a detailed guideline recommending biochemical screening in women with risk factors (34). As recent studies related to GDM were published the choice of test for diagnostic criteria and screening of GDM changed internationally.

### **1.3.1 The Hyperglycaemia and Pregnancy Outcome**

#### **(HAPO) Study**

A landmark study which influenced international guidelines regarding screening and diagnosis of GDM was the Hyperglycaemia and Pregnancy Outcome (HAPO) study (21). This was a multinational international multicentre study involving a cohort of 25,505 pregnant women who were tested with a 2-h 75g OGTT at 24 to 32 weeks of gestation and followed throughout pregnancy. This study highlighted the relationship of maternal hyperglycaemia in neonatal outcomes (21). The HAPO study demonstrated a linear relationship between maternal fasting plasma glucose and the 1- and 2-hours glucose values of the OGTT with birthweight above the 90th percentile (21). It also showed a similar linear relationship between maternal glucose and infant adiposity (35). However, the HAPO study did not show any apparent threshold effect between maternal glycaemia and pregnancy outcomes that could provide accurate diagnostic values for gestational diabetes (21).

### **1.3.2 International Association of Diabetes and Pregnancy**

#### **Study (IADPSG)**

In 1998, delegates from more than forty countries created the International Association of Diabetes and Pregnancy Study Groups (IADPSG) to discuss a national and international consensus around diabetes in pregnancy. The IADPSG discussed the results of the HAPO study and subsequently published a consensus report in 2010 where it reconsidered the diagnosis and screening of GDM based on the HAPO results

(20). It recommended the diagnostic criteria for GDM [Table 1]. The cut offs proposed by IADPSG represent the average glucose levels at which the birth weight, cord C peptide and neonatal percent body fat > 90th percentile are increased 1.75-fold over the mean for the HAPO study population (20, 21). The 75-g OGTT as recommended by IADPSG led to universal screening of all pregnant women (20).

### **1.3.3 American Diabetes Association (ADA) criteria**

The United States, Canada, and Mexico use the ADA criteria. In the 1960s, the ADA adopted the O' Sullivan and Mahan criteria for the diagnosis of GDM (4). In 2000, the ADA made new recommendations where they adopted the Carpenter and Coustan glucose thresholds for the 100g, 3 hours OGTT for diagnosing GDM (5, 28). The ADA published a position statement in 2003 where it recommended either a one step or two step approach [Table 1] for screening and diagnosis of GDM (36). These recommendations were based on the evidence reviewed and published in the 'Report of the expert committee on the diagnosis and classification of diabetes mellitus' (37). The two-step approach involved a 50-g Glucose Challenge Test (GCT) screening followed by 100-g OGTT if the screen GCT was positive. The one-step approach used the 75-g OGTT to screen and diagnose GDM more specifically in high-risk populations (5, 38). The ADA accepted the IADPSG recommendations in 2011, i.e. the single use of the 75g OGTT in pregnant women without the need for screening (20). In 2014, ADA endorsed the American College of Obstetricians and Gynaecologists (ACOG) guidelines (39) and reverted to its previous recommendations of using either the one step or two step approach to screen and diagnose GDM (5, 38). These recommendations were similar to IADPSG (20).

### **1.3.4 Diagnostic Criteria and Classification of**

#### **Hyperglycaemia First Detected in Pregnancy [WHO 2013]**

Since the first guideline on diabetes mellitus published by the WHO Expert Committee on Diabetes Mellitus in 1965 which defined gestational diabetes as "hyperglycaemia of diabetic levels occurring during pregnancy" several follow up guidelines have provided numerous definitions for GDM (19, 23, 29, 40).

The 1999 WHO report entitled 'Definition, Diagnosis and Classification of Diabetes

Mellitus and its Complications defined gestational diabetes as a carbohydrate intolerance resulting in variable hyperglycaemia with onset or first recognized during pregnancy (19). This report recommended formal testing of women for GDM between 24 and 28 weeks of gestation using the 2-hour 75g OGTT. GDM was diagnosed in pregnant women if they met the WHO criteria for diabetes mellitus or impaired glucose tolerance (IGT) (19). A 75g OGTT was recommended at or after six weeks following delivery to clarify if they had normal glucose tolerance, diabetes mellitus, IGT or Impaired Fasting Glycaemia (IFG) (19). A further 75g OGTT was recommended in those who had IFG (19).

The 1999 WHO criteria to diagnose hyperglycaemia in pregnancy were more than a decade old and were not evidence-based (19). These recommendations required updating in view of new data available including the HAPO study (41), (20) and other studies. This led to the publication of the report: ‘Diagnostic Criteria and Classification of Hyperglycaemia First Detected in Pregnancy by WHO in 2013 (23).

## **1.4 Testing in UK**

In the UK, the 75-g 2-hour oral glucose tolerance test (OGTT) is used to test for gestational diabetes in women. Women with no prior history of GDM who are identified to have risk factors for developing GDM at their antenatal booking are offered an OGTT at 24 to 28 weeks (42).

For those women who have had gestational diabetes in a previous pregnancy the following are recommended (42):

- Early self-monitoring of blood glucose levels or
- A 75-g 2-hour OGTT as soon as possible after booking (whether in the first or second trimester), and
- A further 75-g 2-hour OGTT at 24 to 28 weeks if the results of the first OGTT are normal.

## **1.5 Screening and diagnosis of GDM in UK**

The National Institute for Health and Clinical Excellence (NICE) published the first national guidelines for GDM in 2008: NICE CG63: “Diabetes in pregnancy: Management of diabetes and its complications from pre-conception to the postnatal

period” (34). In 2015 this guideline was updated to the NICE NG3 guideline (42) due to new published evidence from more recent studies including the HAPO study (41). The objectives of the NICE NG3: “Diabetes in pregnancy: management from preconception to the postnatal period ‘’ is to improve the diagnosis of gestational diabetes and help improve glycaemic control in women with diabetes before and during pregnancy (42). The guideline makes recommendations for the management of diabetes and its complications in women of childbearing age who are either planning pregnancy or those who are already pregnant. It focuses on preconception and planning care but includes information pertaining to care that should be offered to women with diabetes and their new-born babies. It also makes recommendations for women with GDM and women with pre-existing diabetes depending on available supporting evidence (42).

NICE NG3 recommends screening for GDM using clinical risk factors and a 2-hour OGTT to diagnose GDM. GDM is defined as (42):

- FPG  $\geq$  5.6 mmol/L or a
- 2-h glucose  $\geq$  7.8 mmol/L following a 75-g OGTT.

Depending on the clinical need the OGTT is recommended in the first or second trimester based on up-to-date research evidence and cost effectiveness of treatment (42).

## **1.6 Risk Factors**

The NICE 2008 and updated NICE NG3 2015 guidelines recommend testing pregnant women for gestational diabetes if they have any one of the following risk factors (42):

- BMI above 30 kg/m<sup>2</sup>
- Previous macrosomic baby weighing 4.5 kg or above
- Previous gestational diabetes
- Family history of diabetes (first-degree relative with diabetes)
- Family origin with high prevalence of diabetes [South Asian (specifically women whose country of family origin is India, Pakistan, or Bangladesh); Black Caribbean; Middle Eastern (specifically women whose country of



family origin is Saudi Arabia, United Arab Emirates, Iraq, Jordan, Syria, Oman, Qatar, Kuwait, Lebanon, or Egypt)]

In 2010 the Scottish Intercollegiate Guidelines Network (SIGN) guidelines on the management of diabetes adopted the IADPSG diagnostic criteria for diabetes (43). It recommends screening all pregnant women with certain clinical risk factors such as obesity, prior macrosomia, family history of diabetes and high-risk ethnicity at first antenatal visit. Women who have an HbA1c of 42 to 46 mmol/mol, fasting glucose 5.1 to 6.9 mmol/l or two hour glucose 8.6 to 11.0 mmol/l are reviewed for the need for immediate home self- monitoring of glucose monitoring and in case of an unclear diagnosis a 75-g OGTT is recommended at 24-28 weeks (43). SIGN recommends testing all high-risk pregnant women at 24 to 28 weeks with a 75 g OGTT (43).

In January 2011, The Royal College of Obstetricians and Gynaecologists (RCOG) produced a document on diagnosis and treatment of GDM (39). It discusses the clinical impact of the HAPO (21), ACHOIS (7) and Multicentre, Randomised Trial of Treatment for Mild Gestational Diabetes (MFMU) trials (44) and the challenges of translating the results in clinical practice (39). The Royal College of Obstetrician (RCOG) appear to favour the IADPSG approach to screening and diagnosis of GDM taking into account cost implications but do not make any recommendations (39).

## **1.7 Pathophysiology of Gestational Diabetes Mellitus**

Physiological changes occur to meet the demands of the growing foetus in healthy pregnant women. The cardiovascular, respiratory, renal, hematologic, and metabolic systems adapt and change as the pregnancy progresses. An essential metabolic adaptation that occurs is insulin sensitivity. As the healthy pregnancy progresses, insulin sensitivity changes over time. Insulin sensitivity usually increases slightly in early gestation to provide adequate glucose uptake to be meet up the energy demands in later pregnancy (5). With progression of pregnancy there is production of several placental and local hormones (oestrogen, progesterone, leptin, cortisol, placental lactogen, and placental growth hormone) which contribute to insulin resistance (45). This results in mildly raised maternal blood glucose levels which are easily transported across the placenta to meet the energy demands of the growing foetus (46). A breakdown in these metabolic adaptive processes during pregnancy can result in GDM.

The pathophysiology of GDM is complex and can be affected by multiple organs including the placenta, liver, brain, adipose tissue, and muscle. However, the two main components underlying the pathophysiology of GDM are beta cell dysfunction and chronic insulin resistance. Pregnant women who developed GDM were found to have a greater degree of insulin resistance prior to pregnancy compared to women who did not develop GDM (47). Hence it appears that most women who end up developing GDM have pre-existing beta cell impairment on a background of insulin resistance (48, 49). These pre-existing impairments in pregnant women can progress in the post-pregnancy period and result in an increased risk of type 2 diabetes (50).

$\beta$ -cell dysfunction occurs when pancreatic  $\beta$ -cells are unable to adequately sense blood glucose concentration or to release an adequate amount of insulin for the corresponding hyperglycaemia. Prolonged secretion of insulin is thought to result in  $\beta$ -cell dysfunction (51).  $\beta$ -cell dysfunction can occur because of defects at any stage in the complex process of insulin production and secretion including pro-insulin synthesis, post-translational modifications, granule storage, sensing of blood glucose concentrations, or the complex machinery underlying exocytosis of granules (52, 53).

In an insulin resistant state cells in the body do not respond to insulin adequately. Failure of insulin signalling at the molecular level results in reduced plasma membrane translocation of glucose transporter 4 (GLUT4), the main transporter of glucose into cells. The rate of glucose uptake stimulated by insulin has been reported to be 54% less in GDM as compared to normal pregnancy (47). Although the number of insulin receptors remain unaffected, insulin signalling is affected by a reduction in tyrosine or increased serine/threonine phosphorylation of the insulin receptors (54). Other mechanisms that have been described in GDM includes altered expression and/or phosphorylation of downstream regulators of insulin signalling, such as the insulin receptor substrate (IRS)-1, phosphatidylinositol 3-kinase (PI3K), and GLUT4 (47).

Insulin resistance exacerbates  $\beta$ -cell dysfunction. Insulin resistance in hyperglycaemia which further stimulates the pancreatic  $\beta$ -cells to produce further insulin. Persistent hyperglycaemia results in a state of glucotoxicity which results in direct  $\beta$ -cell failure (55). A vicious cycle of hyperglycaemia, insulin resistance, and further  $\beta$ -cell dysfunction ensues once  $\beta$ -cell dysfunction occurs.

## 1.8 Prevalence of GDM

Each year there are approximately 700,000 women who give birth in England and Wales. Amongst these women, around 5% have a diagnosis of pre-existing diabetes (T1DM or T2DM) or have GDM. Amongst the women who have pre-existing diabetes, 5% have T2DM and 7.5 % have T1DM. The proportion with GDM is 87.5%. The prevalence of T2DM has increased dramatically in the last few decades. With increased rates of obesity in women and more older women becoming pregnant, the incidence of GDM has also been on the rise (42). In several countries, including developing countries the prevalence of GDM has increased by more than 30% in the last 2 decades (56, 57). GDM has reached epidemic proportions worldwide (58).

The prevalence of GDM varies across the world due to many factors including the use of different criteria for diagnosis, methods of screening, types of studies conducted and the underlying population characteristics. In the US, 7% of all pregnancies are complicated with GDM (59). A study looking into the prevalence of GDM worldwide found the highest prevalence to be in the Middle Eastern and North African regions with an estimated median of 12.9% [range 8.4 to 24.5%] (60). The second highest GDM prevalence was reported to be in South-East Asia with a median of 11.7% [range 8.1 to 18.3] followed by Western Pacific with a median of 11.7 % [range 4.5- 25.1] and South and central America with median prevalence of 11.2% [range 7.1- 16.6] (60) . The lowest GDM prevalence was in Europe with a median of 5.8% [range 1.8 to 22.3%] (60). In addition to these inter-continental differences in the prevalence of GDM, variances are present within the same country and between countries. This is principally due to the different diagnostic criteria used for GDM in various countries.

## 1.9 Screening of GDM

The prevalence of GDM is also dependent on the screening process used in a particular region or country and on the year, it was undertaken. Three screening approaches are taken worldwide:

- routine or universal for all pregnant women,
- selective screening of high-risk women or
- a combination of routine and selective.

Ideally all women should be screened for GDM but in most countries screening is based on the presence of risk factors. The screening rates can also vary in different countries. A survey in USA between 2014 and 2015 reported 90% of obstetricians using the 2 step approach to screen pregnant women routinely which is indicative of high rates of screening (61). Screening rates in Sweden was low due to poor compliance with local guidelines (62). Hence, although the prevalence of GDM is estimated to be relatively low in Sweden where 2% of pregnancies are affected by GDM (63), this might not be a true reflection of the prevalence of GDM.

Another important influencing factor is the criteria used for diagnosing GDM. For instance, the prevalence using the WHO 1999 (19) and modified IADPSG (20) diagnostic criteria in Norway was estimated at a median of 22.3% (range 13 to 31.5%) whereas in Ireland it was 1.8% using the NICE criteria (42).

In the US, 7% of all pregnancies are complicated with GDM (59). Since 2014 the ADA have recommended to either use the IADPSG criteria which involves a one-step approach using a 75g 2 hours OGTT (64) or a two-step approach which recommends a 100-g 3-h OGTT test, following a 50-g glucose challenge test with cut-off values ranged from 130 to 140 mg/dl (NDDG or C&C criteria) (27, 28, 65).

The timing of screening for GDM during pregnancy, which varies across the world also impacts on the prevalence rates. In UK screening is usually done at 16 weeks and at 28 weeks whereas in Nigeria, the screening can occur at from 4 weeks of gestation onwards, between 24 to 28 weeks or anytime during the third trimester (66-69).

Race and ethnicity are major risk factors for GDM and therefore multi-ethnic countries such as Canada, USA and Australia have variable prevalence's of GDM. A study in Northern California investigated ethnic disparities in the prevalence of gestational diabetes mellitus and reported the prevalence of 10.2 % in Asians, 10.9% in Filipinos, 6.8% in Hispanics, 4.5% in Non-Hispanic Whites and 4.4% in African American (70).

## **1.10 Complications**

GDM is associated with multiple maternal and foetal complications (71-73) which can be identified early or treated to improve pregnancy outcomes:

- Premature infant
- Stillbirth

- Large for gestational age baby or macrosomia
- Birth trauma
- Shoulder dystocia
- Respiratory distress syndrome
- Neonatal hypoglycaemia
- Admission for greater than 2 days or more in neonatal intensive care unit

## **1.11 Cardiometabolic Complications of gestational diabetes**

T2DM and GDM share similar risk factors, genetic predisposition and metabolic defects (74, 75). Having a family history of diabetes, being overweight or obese, advanced maternal age and being from certain ethnic groups increase the risk of developing T2DM and GDM (76). The metabolic defects in both GDM and T2DM are insulin resistance and impaired insulin secretion (54). Mutations in insulin receptors, insulin-like growth factor-2 and glucokinase are rare underlying genetic causes for T2DM and also for GDM (74, 75).

Historically people with diabetes have a higher prevalence of cardiovascular disease (CVD), which is also a major cause of death in these people (77) compared with individuals without diabetes (78). A systematic review of studies from 2007 to 2017 evaluating the prevalence of CVD in people with T2DM reported that overall 32.2% were affected with CVD whilst 29.1% had atherosclerosis, 21.2% had coronary heart disease and 10% had a myocardial infarction(79). Approximately 50% of all the deaths were due to CVD (79). Hence screening for T2DM is an important strategy to reduce mortality and CVD events. A study in Denmark where middle-aged adults from a general practice were screened for cardiovascular risk factors and diabetes reported a significant reduction in the risk of all-cause mortality and cardiovascular events in people who had T2DM in this cohort (80).

### **1.11.1 GDM and risk of CVD events**

Women with a previous diagnosis of GDM are at increased risk of developing hypertension, obesity, dyslipidemia and metabolic syndrome (81-83) which increase

their risk of CVD. A retrospective Canadian study 15 years ago analysed the cardiovascular events in women with a history of GDM who had been followed up for a median of 11.5 years (84). This study showed significant associations between GDM and CVD events [unadjusted Hazard Ratio – 1.71 (1.08- 2.69)] compared with women without GDM, which were attenuated when adjusted for subsequent diabetes [adjusted HR- 1.13 (0.67- 1.89)] (84). Similar results were reported by another cross-sectional study with odd ratio for CVD as 1.85 amongst women with previous GDM who had a family history of T2DM (82). Women with previous GDM having an increased risk of CVD makes this population high risk and highlights the need for surveillance and screening for other CV risk factors (84). A more recent retrospective study from Quebec Canada investigated the occurrence of cardiovascular events 25 years post-delivery in women with previous GDM who gave birth from 1989 to 2013 compared to women without GDM (85). A higher cumulative incidence of hospital admissions due to CVD was reported in women with previous GDM (190.8 per 1000 women) compared to those without GDM (117.8 per 1000 women) (85). GDM was associated with an increased risk of IHD [Hazard Ratio -1.23 (95% CI-1.12-1.36)] and myocardial infarction (Hazard Ratio 2.14 (95% CI- 1.15- 2.27)] (85). Mortality from CVD was not reported in this study.

Cardiovascular and metabolic changes that increase the risk of T2DM and CVD form part of the metabolic syndrome which comprises dyslipidemia, central adiposity, hypertension, and elevated fasting glucose levels (86). Evidence of metabolic syndrome has been demonstrated in previous studies showing women with previous GDM having raised fasting cholesterol, triglyceride, free fatty acid levels, insulin, C-peptide and higher pre-pregnancy weight/BMI (87, 88).

According to the National Cholesterol Education Program (NCEP) Adult Treatment Panel III (ATP III), metabolic syndrome is diagnosed if three or more of the following five criteria are met (86):

- waist circumference over 40 inches (men) or 35 inches (women),
- blood pressure over 130/85 mmHg,
- fasting triglyceride (TG) level over 150 mg/dl,
- fasting high-density lipoprotein (HDL) cholesterol level less than 40 mg/dl (men) or 50 mg/dl (women) and
- fasting blood sugar over 100 mg/dl.

The presence of the various components of metabolic syndrome, T2DM and self-reported CVD events in women with a history of GDM and a first degree relative with T2DM were compared to women without GDM in a retrospective study investigating the risk of CVD (82). This study showed an increased prevalence of CVD in women with prior GDM [adjusted OR 1.85 (95%CI 1.21 - 2.82; p=0.005], who were reported to have increased central adiposity, higher fasting insulin levels, higher LDL and low HDL levels and a higher proportion of them had hypertension compared to women without GDM (82). Other studies have reported women with previous GDM to have obesity (49), insulin resistance (88), dyslipidemia and higher waist circumferences (81) (49, 89) which all form part of the metabolic syndrome.

The study by Carr et al (2006) demonstrated the women with prior GDM had a more atherogenic profile, with more women reporting a history of dyslipidemia requiring use of statins (82). A subgroup in this study which had data available for the metabolic syndrome as per the NCEP (ATP III) criteria was analysed and showed women with previous GDM had a higher chance of having metabolic syndrome [Odds Ratio 3.28(95% CI 2.10-5.12)],  $p < 0.001$ , after adjusting for age, menopausal status and ethnicity (82).

### **1.11.2 GDM and hypertension**

Hypertension affects 5 to 10 % of pregnancies and results in maternal and fetal complications such as seizures, cerebrovascular vascular accidents, intrauterine growth retardation, fetal distress and death (90). The underlying pathophysiology of pregnancy-induced hypertension is poorly understood but believed to be multifactorial including hyperglycaemia and insulin resistance (91). The association between pregnancy-induced hypertension and gestational diabetes is not sufficiently understood. Few studies have established an association between GDM and pregnancy-induced hypertension (92, 93). A previous study reported statistically significant high proportions of maternal hypertension and other complications such as C section, macrosomia and neonatal hypoglycaemia in women treated for GDM compared to women without GDM (92). A similar study investigating 9000 women with a history GDM reported increased risk of pre-eclampsia in these women as well as C-section and shoulder dystocia after adjusting for maternal age, gestational age, birth weight, BMI, and parity (93). A Swedish study of 10666 women who had previously given birth, reported an increased risk of pre-eclampsia that had a

statistically significant association with women who had gestational diabetes [odds ratio = 3.11, 95% confidence interval 1.61-6.00), type 1 diabetes and twin birth (94). The association between gestational hypertension and GDM, T1DM and twin births were mildly positive but not statistically significant (94). This study also reported women a BMI > 29 had higher risks of both gestational hypertension (odds ratio = 4.85, 95% confidence interval 1.97-11.92) and preeclampsia (odds ratio = 5.19, 95% confidence interval 2.35-11.48) (94).

A retrospective large cohort study 10 years ago reported women with a previous history of pre-eclampsia and gestational hypertension (GH) had a 2-fold increased risk of developing diabetes when followed up to 16.5 years after pregnancy, even in the absence of GDM (95). Interestingly this study also demonstrated women with known GDM who also had pre-eclampsia or GH had a much higher risk [HR=18.49; 95% CI: 17.12–19.96] of developing post -partum diabetes as compared to having GDM alone [HR=12.77; 95% CI: 12.44–13.10] (95). A more recent retrospective study involving 28 198 women with GDM from a Canadian register showed that women who had either GDM or GH had a 40% increased risk of CVD/mortality post pregnancy and a doubled risk if they had both GDM and GH (96) . This study also demonstrated a 15- fold [95% CI:13.7, 17.3] higher risk of developing post-partum diabetes if the women had a history of GDM or GH. The women who had both GDM and GH previously had a 37 [95% CI: 26.0, 52.3] fold higher risk of post-partum diabetes and a 6-fold higher risk of post-partum hypertension (96). One limitation in this study was that they were unable to specify which type of diabetes was present at follow up.

## **1.12 Glucose Intolerance post GDM**

It has been previously established that women with a history of GDM have a higher risk of developing T2DM and metabolic syndrome (76, 97). Several small and large retrospective and prospective studies have been conducted in the last few decades in various geographical parts of the world to establish this link. A systematic literature review evaluating factors resulting in variation in risk of T2DM in women with previous GDM from a period of 6 weeks post-partum to 28 years post-partum, reported the cumulative incidence of diabetes ranging from 2.6% to 70% in the women studied (76). This study reported a steep increase in the development of diabetes in the first 5



years post-partum followed by a plateau phase after 10 years (76). A study by Bellamy et al (2009) reported a seven-fold higher risk (RR 7.43, 95% CI 4.79–11.51) of T2DM in women with previous GDM when compared with those with normal glucose tolerance (12).

A systematic review and meta-analysis investigating the risk of glucose intolerance in women who had previously been diagnosed with GDM based on the IADPSG criteria reported the pooled relative risk of developing T2DM post-partum at 7.42 (95% CI: 5.99 - 9.19) (98). 43 included studies evaluated 4,923,571 pregnant women amongst which 5.8% (284,312) had a previous diagnosis of GDM and within which 5 studies used the IADPSG criteria (n = 6174 women, 1314 with GDM) (98). The relative risk of developing T2DM post GDM (IADPSG criteria) was reported as 6.45 (95% CI: 4.74 - 8.77) compared to a relative risk of 9.08 (95% CI: 6.96 - 11.85, p=0.17) based on other diagnostic criteria (98). Irrespective of the diagnostic criteria for GDM, the relative risk of developing post- partum IGT was reported at 2.45 (95% CI: 1.92–3.13) (98). Interestingly, the studies using IADPSG criteria did not evaluate the risk of cardiovascular events in these women post- partum. The strength of this systematic review is the large number of studies included and therefore large population considered for statistical analysis.

A follow up study of Singaporean women with GDM or hypertensive disorder during pregnancy (HDP) were found to have a threefold increased risk of developing abnormal glucose metabolism or hypertension respectively. Having both GDM and HDP during past pregnancies was not associated with additional risk of postpartum cardio-metabolic diseases beyond that associated with either complication alone (99).

### **1.12.1 GDM and the risk of developing T2DM**

The rising prevalence of T2DM in the last few decades has been attributed to people adopting a more sedentary lifestyle associated with urbanization and more younger people being diagnosed with diabetes (100). According to WHO, the global prevalence of T2DM rose from 108 million in 1980 to 422 million in 2014 (101). Glucose intolerance during pregnancy can also reveal undiagnosed type 2 diabetes in many women who are screened due to certain risk factors. The increase in GDM prevalence invariably reflects the underlying high prevalence of T2DM in the population (60).

Women who have been diagnosed with GDM have a higher risk of developing T2DM. Several studies carried out across the world to estimate the risk of GDM developing into T2DM have reported variable estimates. A systematic review reported the cumulative incidence of T2DM ranging from 2.1 to 66.7 % following a diagnosis of GDM. The studies included in this review had median follow up ranges from 7 months to 10 years and the majority were from high income countries with few in low to middle class countries (such as Brazil, China & India) (60).

These large variations in relative risk of development of T2DM post GDM across various countries is due to the different diagnostic criteria of GDM and T2DM, the length of follow up, rate of retention of the studies and the characteristics of the population studies. For instance, the relative risk estimates in the European countries ranged from 2.7 in Germany (8, 9) to 47 in Finland (10) whilst the approximate relative risk in South Indian women was 23 (11).

Irrespective of the variations in the risks across different countries, the practical application of this knowledge is that women with GDM should be made aware of the risk of developing T2DM in the future as well the appropriate advice on how to prevent it. Management of GDM provides a window of opportunity to highlight the rise in T2DM, its complications and how to prevent it. Surveillance of women who have had GDM is an important preventative measure. The NICE guidelines in UK recommend checking HbA<sub>1c</sub> 12 weeks post-partum in women who have had GDM as well as once yearly HbA<sub>1c</sub> thereafter (42, 102).

### **1.13 Cardiometabolic effects on the fetus**

The offspring born from women with a history of GDM are more likely to be obese, overweight (103, 104) and develop glucose intolerance, which has been attributed to exposure to gestational hyperglycaemia and fetal hyperinsulinemia (105). The correlation between excessive insulin exposure during gestation in women with diabetes and weight gain was investigated in a longitudinal study by Metzger et al (106). Amniotic fluid concentration measured at 32 to 38 weeks in 56 children were correlated to their height and weight measurements (relative obesity) at the age of 6 and the results showed the children who had more exposure to insulin in the uterus had gained more weight and were obese (106). Based on these findings it was

suggested that exposure to excess amniotic fluid insulin may predispose to childhood obesity (106).

Children born to women with pre-gestational diabetes (T1DM, T2DM and gestational diabetes) who were exposed to excess insulin in utero were found to have Impaired Glucose Tolerance in childhood and early adolescence as reported in a prospective follow-up study (107). This study also reported there was no association with IGT and the underlying etiology of the mother's diabetes (gestational versus pre-gestational) or presence of macrosomia at birth (107).

The association between fetal exposure to GDM and future cardiometabolic risk in the children was demonstrated in a long term follow up study in Chinese children who had been born to women with GDM and were followed up at the median age of 8 years (7 to 10 years) (108). Cardiometabolic parameters measured showed that after adjusting for age and gender, these children who were exposed to maternal hyperglycaemia had significantly higher blood pressures (systolic and diastolic) and lower High-Density Lipoprotein cholesterol levels (108). A small proportion of the children who developed impaired glucose regulation had high umbilical cord insulin levels at birth (108). This study demonstrated the increased cardiometabolic risk in children born to women with GDM and high insulin levels in utero which could independently predict the occurrence of abnormal glucose tolerance in childhood(108)

The cardiometabolic risks of the cohort of children who were assessed at the age of 8 years by Tan et al (108) were reassessed at the age of 15 years (109). Several parameters were measured and compared between the adolescent offspring who were born from mothers with Normal Glucose Tolerance (NGT) to the offspring born from mothers with GDM. The age, tanner stage, anthropometric measurements, lipid profile and rate of abnormal glucose tolerance (AGT) were similar in both these cohorts. AGT (diabetes, impaired glucose tolerance, and impaired fasting glucose) was found in 14 adolescents who were more obese and had higher levels of adiposity (109). The study also showed hyperinsulinemia in utero, measured as either umbilical cord insulin level  $\geq$  90th percentile or C-peptide level  $\geq$  90th percentile was associated with a 10-fold increase in the risk of being overweight following adjustment for birth weight, Tanner stage, maternal BMI and GDM weight. The results also showed that only insulin levels  $\geq$  90th percentile was associated with a 17-fold increase in metabolic syndrome (diagnosed according to the International Diabetes Foundation criteria with modification in waist circumference ( $\geq$ age- and sex-specific 90th percentile of

Chinese individuals). These findings were consistent with those found in adolescents born from mothers with pre-gestational diabetes (106, 110). This study was however limited by small study population.

Unlike a previous study, the study by Tan et al (109) showed the effect of in utero hyperinsulinemia on being overweight and the development of metabolic syndrome was independent of the birth weight of the offspring and the mothers' BMI. This study had a few limitations including small sample size and that it was restricted to a single ethnicity. This study was not powered enough to evaluate the effect of GDM on the offspring's abnormal glucose tolerance and other cardiometabolic risks and epigenetic programming. This would require a larger sample sized prospective follow up study of the children through to their adulthood.

A previous study has reported a significant association between pre-pregnancy obesity and offspring being in the highest BMI quartile and developing metabolic symptoms between ages of 6 to 11 years (111). Women who are obese are at increased risk of developing GDM compared to women with normal BMI (18). A review looking into a link between pre-pregnancy obesity, GDM and childhood obesity showed a positive association between maternal GDM and childhood obesity/overweight which was attenuated following adjustment for pre-pregnancy BMI(105).

Exposure to prenatal maternal hyperglycaemia or diabetes has been associated with development of obesity, diabetes, metabolic syndrome and congenital heart disease (112-114). Danish children born to mothers with a history of diabetes who had been followed up for 40 years as part of a population-based study reported increased rates of early CVD in early childhood and in early adulthood (115). These increased CVD rates in the offspring were from women who had pre-gestational diabetes [1.34 (1.25 to 1.43)] and gestational diabetes [1.19 (1.07 to 1.32)] (115).

In view of gestational diabetes being a major risk factor for metabolic syndrome, future development of diabetes and increased risk of CVD in the women as well as offspring born to women with previous diabetes, the prevention, screening and timely treatment of diabetes in this cohort of women is of utmost importance to improve health and reduce the future risks of CVD events. The American Heart Association has recommended long-term surveillance and management of CVD risk factors in women who have had GDM and/or GH (116) (117).

## **1.14 Financial burden**

The rise in the prevalence of GDM has substantial economic burden for healthcare services across the world. £10 billion is spent per year on diabetes by the NHS which represents 10% of its entire budget. Approximately 80% of the money spent on diabetes is for treating complications of diabetes (118), GDM being one of them. A recent report has projected the NHS budget for diabetes will rise by approximately 17% and the NHS annual diabetes budget will increase from £9.8 billion to £16.9 billion over the next 25 years (118) as above. The current cost of £ 7.7 billion for treating diabetes complications is expected to rise to £13.5 billion by the years 2035/6 (118).

In the US, the economic burden associated with existing diabetes, undiagnosed diabetes and prediabetes (adults), and GDM (mothers and new-borns) reached nearly \$404 billion in 2017 of which nearly \$1.6 billion was due to GDM (119). A retrospective study in Italy investigated the medical cost for women with GDM who delivered in the hospital including the type of delivery & neonatal complications such as macrosomia and shoulder dystocia, hypoglycaemia, respiratory distress, hyperbilirubinemia, and brachial plexus injury which required additional length of stay and care. The study reported the cost difference between a woman with GDM and one without GDM was approximately €817 with a national economic burden estimated at €44.8 million for that particular year (120).

## **1.15 Summary**

In chapter 1, I have introduced a background to GDM including several aspects which will help understand this condition in general and in the context of this study. The historical perspective and challenges about reaching an international consensus on the diagnostic criteria for GDM has been presented. However, much progress has been made since the 1960s to date with the emergence of guidelines for the diagnostic criteria for GDM worldwide with the use of the 2 hours or 3 hours OGTT (20, 23, 34).

GDM is independently associated with maternal and foetal outcomes such as stillbirth, large for gestational age, pre-eclampsia, macrosomia and shoulder dystocia (121) (21). Effective treatment of GDM can result in reducing these complications (21) (122) (7). The prevalence of GDM has increased worldwide (59, 60). I have discussed the

cardiometabolic complications of GDM including the risk of CVD evens post GDM, GDM and hypertension and metabolic syndrome. I have also discussed glucose intolerance post GDM including the fact that women with GDM have an increased risk of developing T2DM (8, 12). GDM and its close association with obesity will result in further rise in the prevalence of T2DM which has already reached pandemic levels. The cardiometabolic effects of GDM on the fetus has been explained and future adverse effects in early childhood and adolescence years.

GDM and T2DM have a significant burden on the healthcare services. Management of GDM provides a window of opportunity to instigate the adequate knowledge in these women that could prevent the recurrence of GDM and T2DM. In chapter two, I will discuss the psycho-social aspects related to pregnancy and GDM as well as the important role of education in the management of GDM.

## Chapter 2 Literature Reviews

Chapter 2 is divided into two parts. Firstly, I will present a literature review I conducted looking into the psycho-social effects of a new diagnosis of GDM. Psychological issues such as anxiety, stress and depression that can occur prenatally and during pregnancy will be discussed as well as their maternal and foetal effects. The previous experiences of women living with GDM will also be presented. Secondly, a literature review of GDM and education and the role of theories and models used in health education and health promotion will be presented. I will also be discussing GDM and behaviour change models including the COM-B [Capability, Opportunity and Motivation] model, TDF [Theoretical Domains Framework] and the PRIME theory of motivation. The importance of education in the management of GDM will be discussed. The intricate links between health education, health promotion and the role of behaviour models will also be discussed in relation to the current study. The rationale of the study including the basis of the study will be presented and discussed. Lastly, I will discuss the aims of the study as well the primary and secondary outcomes of the study.

A scoping review of the relevant literature was conducted. The primary aim of the review was to look into the ‘psychological effects of GDM’ and the role of ‘education in GDM’. The data bases used for the literature review included Medline, Pubmed, PsychInfo, Embase, Web of Science and the Cochrane library. I also looked into the grey literature. The Trust’s librarian also helped in the literature search. Journals published between 1980 to 2014 and in English only were included prior to the start of the study. The following Medical Subject Headings (MeSH) words with Boolean logic were used for the search:

- Gestational diabetes and education
- Gestational diabetes and anxiety
- Gestational diabetes and depression
- Diabetes and education

The following literature reviews were initially conducted at the start of the study in 2014/2015 and have been updated in 2021 and 2022. There have been few publications

related to the current study subject since 2016 which have been included in this updated version of the literature review.

## **2.1 Psychological Impact of GDM**

Pregnancy is usually an exciting time in the life of a woman but can also be a vulnerable period. The pregnant woman undergoes several physical and physiological changes. Women respond differently to these changes in their body. Some may adapt quickly whilst others may experience low self-esteem and even depression (123). A diagnosis of GDM can shift the notion of a normal pregnancy to a problematic one. The women with a new diagnosis of GDM can experience a spectrum of emotions which would be unique to them but also dependent on their pre-existing mental state.

### **2.1.1 Maternal problems during pregnancy**

There has been an ongoing increase in the prevalence of medical disorders during pregnancy in women in the last three decades as a result of developments in modern medicine and changes in women's lifestyle. Women have been progressively delaying childbearing until later ages. The Office of National Statistics reported a doubling in the conception rates in women aged 40 years and above since 1991 (124). Older women are more likely to develop medical problems including hypertension, obesity and have a higher risk of developing gestational diabetes and venous thromboembolism (125).

Growing advances in surgery and medicine have enabled women to have successful pregnancies despite having underlying chronic medical conditions or risk factors such as obesity which would have otherwise precluded them from becoming pregnant (125). However, this also increases the risk of morbidity and mortality in these women (126). The risk factors in gestation can result from physiological, psychological, and social aspects.

Any medical condition diagnosed during pregnancy will have psychological effects on the woman. Screening for depression and anxiety prenatally or during pregnancy is not routine in UK. Unless the woman is known to have a clinically diagnosed depression or any other psychiatric disorder and are on anti-depressants or antipsychotic medications, the HCPs do not actively review mood disturbances until the woman actively complains about such issues. Due to several reasons, there is a



tendency to focus on the medical aspects of the care for pregnant women. Although women with GDM have regular reviews by a multidisciplinary team, there is an inadequacy in exploring the psychological aspects of the pregnancy.

Gestational diabetes is defined as impaired glucose tolerance first recognised during pregnancy (127, 128). The prevalence of GDM varies across the world due to the use of different criteria for diagnosis, methods of screening, types of studies and underlying populations as previously discussed. The risk of GDM is influenced by race and is different in various ethnic groups. Important risk factors for GDM include obesity, advanced maternal age, race/ethnicity, parity, family history of type 2 diabetes and previous macrosomia (6, 129). It is important to treat GDM in order to manage and minimise maternal, perinatal, and fetal complications associated with GDM. Fetal adverse outcomes include fetal loss, congenital or other malformations, fetal intrauterine growth retardation, premature delivery, and macrosomia (64, 130-132). Women with GDM can develop serious complications such as pregnancy induced hypertension, pre-eclampsia and worsening of any pre-existing renal problems or retinopathy (64, 132-134). Perinatal complications include difficult labour, need for caesarean section, neonatal hypoglycaemia, and shoulder dystocia (64, 131, 132).

Women with GDM have been reported to have a seven-fold increased risk of developing T2DM compared to pregnant women without diabetes (12, 135) but this is variable worldwide. Babies born to women with GDM have a higher risk of developing childhood obesity and T2DM later in life and cardiovascular problems (13, 15, 16, 136). A previous study has also reported long term neuropsychiatric complications in infants who had been exposed to GDM (31).

Although it is essential to understand the pathophysiology, prevalence, risk factors and the maternal and foetal complications of GDM, it is also important to recognise the psychological effects this diagnosis can have and its potential implications. Pregnancy is an important life changing event for women. In addition to a change in social role, they experience physiological and emotional changes during the course of pregnancy. Most women are excited and look forward to a positive pregnancy experience. However, pregnancy itself can be a stressful state due to multiple factors. Physiological problems such as nausea, vomiting, constipation, lower back pain, dyspnoea and limb swelling can cause physical and mental distress to women during

pregnancy. This can result in the women feeling more anxious rather than enjoy their pregnancy.

Women undergo physiological and physical changes which can impact on their psychological state. Pregnant women can be affected at the emotional, behavioural and cognitive levels which can lead to mental health problems which can in turn result in adverse maternal and foetal effects (137, 138). The psychological issues experienced during pregnancy can often persist and impact negatively on the mother's mental health but also lead to long term developmental issues in the infants (137, 139). These issues are likely to continue postpartum leading to more serious psychological health issues in both mother and the children (140).

Stress, anxiety, or depression can occur at any stage during pregnancy or can pre-exist. Pre-natal anxiety in general or specifically related to pregnancy has been reported by previous studies but difficult to estimate the prevalence worldwide (138, 141, 142). Factors such as age, marital status, violence, physical or sexual abuse, social support, obstetric history, and body mass index have been associated with pre-natal depression (140, 142, 143).

Traditionally research in psychiatry has focused on post-partum depression, clinical depression, and anxiety states during pregnancy (141, 144-146). However, research in psychiatry in the last two decades has established 'pregnancy anxiety' as one of the potent risk factors that can adversely affect fetal and maternal outcomes (138, 146). Outside the remit of psychiatry, there has been research contributions by other allied health fields including health psychology, behavioural medicine and social epidemiology which have contributed towards research on the short and long term effects of anxiety in the mother and the infant (146).

There are various screening tools that have been and are currently used to evaluate the spectrum of symptoms of anxiety or depression in women who are pregnant including the Centre for Epidemiological Studies Depression Scale (147, 148), Edinburgh Postpartum Depression Scale (EPDS) (149) or Beck Depression Inventory (150). Evaluation of these symptoms is instrumental in guiding health care professionals in identifying, preventing, and treating pregnant women who exhibit mood disorders (144, 146).

## **2.1.2 Antenatal Psychosocial stress**

Another phenomenon that has been recognised is the association between high levels of ‘antenatal psychosocial stress’ and maternal factors which can contribute to poor pregnancy outcomes (151). Estimates on the prevalence of antenatal psychosocial stress varies. A previous study has estimated 25% of women experiencing some form of psychosocial stress during their pregnancy (152). Another study in an urban group reported low-to-moderate antenatal psychosocial stress in 78% of women and high levels in 6% (151). Women are exposed to several types of stressors during pregnancy. These vary worldwide and can range from lack of financial stability, unemployment, strained relationships and medical complications in pregnancy (146).

Psychosocial stress is induced by situations of social threat including social evaluation, social exclusion, and the need for achieving a specific goal (153, 154). In the context of pregnancy, it has also been described as ‘an imbalance felt by a pregnant woman who is unable to cope with multiple demands which can have physiological and behavioural effects’ (155). Studies have reported associations between psychosocial stress and symptoms of depression (156, 157), co-existing medical conditions (158), domestic violence (159-163), underlying psychiatric conditions (164), poor weight gain (158) and substance misuse (158, 165). Some of these factors have been associated with poor birth outcomes including preterm delivery (166-168) and low birth weight (166, 167, 169).

Identifying, treating, or preventing these factors can help reduce adverse effects in the mother and the baby. In 2006, the American College of Obstetricians and Gynaecologists (ACOG) advocated assessment of psychosocial risk stressors in women as part of their pre-natal and post-natal assessment. It recommended that this assessment should be carried out irrespective of their literacy level, race, ethnicity or social status (170).

## **2.1.3 Antenatal depression**

Antenatal depression also defined as Major Depressive Episode is amongst one of the most common mood disorders which has been associated with environmental and genetic factors (171). Females of childbearing age are at highest risk of developing depression as well as antenatal depression which remain under-diagnosed and under-

treated conditions (172, 173). The underlying pathophysiology of antenatal depression has been attributed to fluctuations in high levels of peptide and steroid hormone during childbearing age and pregnancy (174).

The prevalence of antenatal depression has been estimated in the range of 15 to 65% worldwide (175, 176). It has been reported that antenatal depressive symptoms can persist or recur in future pregnancies (177, 178). Antenatal depression in developing and developed countries contributes to disease burden by affecting the quality of life of mothers (179). Antenatal depression also has major economic implications with an estimated 8.1 billion pounds spent each year by the health service in UK in the care of antenatal depression or related issues (180, 181).

Multiple studies have investigated several factors that are associated with antenatal depression. These reviews have identified the most common risk factors which have been associated with antenatal depression including previous experience of abuse or violence, personal or family history of any mental health problem, low economic status, financial problems and lack of social support (176, 182-185). These studies which were carried out in various parts of the world and in different socio-cultural backgrounds and socio-economic status have been instrumental in identifying important risk factors that could potentially be addressed or alert the HCPs. However, it is important to acknowledge that not all of these associated for risk factors can be tackled due to certain cultural or socio-economic factors which makes the role of the HCP important in such circumstances.

Other variables which are equally important and can be addressed have been identified. Certain lifestyle choices such as history of smoking, alcohol and substance misuse as well as level of education have been linked to antenatal depression (184, 186). These harmful habits are potentially modifiable. Behaviour change models and other health promotion models could be used to address these issues. The input of specialised services in these problem areas have to be coordinated and sought prior to pregnancy preferably.

Previous complicated obstetric history such as previous hyperemesis gravidarum, hypertension, diabetes mellitus and adverse birth outcomes including stillbirth, preterm birth, low birth weight and loss at birth are associated with a higher risk of antenatal depression (182, 184, 187). Women who have unplanned or unwanted

pregnancy are vulnerable and have higher occurrence of have antenatal depression (188). Knowledge about these experiences in the past medical history in these women provides an opportunity to ‘highlight’ them and provide appropriate pre-pregnancy counselling or other appropriate help in the pre-pregnancy phase.

Studies have also shown that prenatal mental health can affect obstetric interventions. A previous Canadian study has shown an association between depressive symptoms in third trimester with increased of emergency C section in normo-glycaemic pregnant women (189). The two main adverse outcomes in women with antenatal depression that have been identified by multiple studies are preterm birth (137, 190-192) and low birth weight (191-194). A previous systematic review of reviews has reported the risk of preterm birth to be 1.40 times higher in infants who have been born to mothers who were depressed and the risk of low birth weight was 1.49 times higher (175). These results are consistent with a recent meta-analysis of 23 studies which reported significant risk of pre-term birth [RR+ 1.35, 95% CI: 1.19 – 1.52], low birth weight [RR- 1.86, CI: 1.32-2.62] and intrauterine growth retardation [RR=4.39, 95% CI: 2.45- 7.86] in women with antenatal depression (195). This highlights the importance of timely screening to promote and improve pre- and antenatal mental health care in women.

### **2.1.4 Anxiety and Depression during pregnancy**

Depending on the criteria used, the prevalence of depression during pregnancy has been estimated at 16% with 5% experiencing severe depression (144). The prevalence varies worldwide depending on the type of studies carried out (196, 197). Studies have reported stress, anxiety or depression to be independent risk factors which can result in adverse maternal and foetal outcomes during pregnancy (138). Preterm birth (< 37 weeks’ gestation) and low birth weight (< 2.5kg) are the most common adverse outcomes as a result of stress and anxiety during pregnancy (198, 199).

### **2.1.5 Stress in Pregnancy**

Studies have reported an association between stress in pregnancy and adverse maternal and foetal outcomes, more specifically low birth weight (LBW) and preterm birth (PTB) (200). In these studies, stress during pregnancy refers to major life events experienced by the women during their lives which have increased the risk of PTB or

LBW. These can include death of a close member of family, witnessing natural disasters, poverty or being homeless (138). Other chronic stressors that have impacted on foetal growth and LBW are specific to certain countries including unemployment and overcrowding in low income women (201) and women experiencing racism or some form of discrimination during pregnancy or throughout their lives (202). The proposed underlying mechanism for the foetal effects due to chronic stress has been attributed to physiological and behavioural changes (138).

### **2.1.6 Pregnancy anxiety**

Pregnancy anxiety also known as ‘pregnancy specific anxiety’ is when the pregnant women experience feelings of fear related to the health of the fetus, fear of attending health services and interacting with HCPs, fear for their own survival during pregnancy and also worries related to labour and taking on the role and responsibilities of being a mother (138, 203). Pregnant women who are experiencing pregnancy specific anxiety often describe feelings of being ‘anxious’, ‘concerned’ ‘scared’ or panic related to pregnancy (204). Other anxieties experienced by pregnant women include fears about the growth of the baby, losing the baby and difficult labour (205).

### **2.1.7 Anxiety, Depression and GDM**

A bidirectional relationship has been reported between depression and glucose impairment in non-pregnant women (206, 207). Metabolic changes such as oxidative stress, chronic inflammation and insulin resistance can result in hyperglycaemia but have also been associated with depression (208). Conversely, symptoms of depression can occur as a direct result of metabolic changes resulting in hyperglycaemia or due to the physical and emotional stress of managing diabetes (209). At the physiological level, depression and anxiety which are stressful states can induce the production of excess cortisol in the body which in turn increases the risk of gestational diabetes (210).

Trying to establish any temporal relations between depression and GDM using longitudinal measures have been inconsistent and limited. A previous study by Morrison et al (2015) reported a positive association between depression in first trimester and GDM but this was attenuated following adjustment for pre-pregnancy BMI (211). This study postulated that recognition of depression in the first

trimester as a risk for GDM could potentially lead to earlier detection and subsequent management of these 2 conditions to improve clinical outcomes (211). This study was limited by the fact that women in the study were from a single centre from the Appalachian area. Larger multi-centred prospective RCTs would have to be conducted to investigate whether women with depression in first trimester would benefit from OGTT in the second trimester to diagnosed GDM. A meta-analysis of 5 cohort studies reported women with a history of depression may have an increased risk of GDM [pooled Odds Ratio =1.2, 95% CI: 1.09-1.33](212). Although the number of women included in the analysis was large (total:122,197), the studies included a mixture of prospective and retrospective studies and subgroup analysis carried out showed a more positive association with prospective studies [pooled OR: 1.61 (1.17, 2.21)] as opposed to retrospective studies [pooled OR: 1.16 (1.05, 1.29)](212).

A previous prospective study reported women with persistently high depression scores in the first and second trimesters measured by Edinburgh Postnatal Depression Scale to have an increased risk of GDM [adjusted RR 3.21; 95% CI: 1.00, 10.28] (213). This study also reported a 4.62-fold increased risk of subsequent post-partum depression in these women with GDM (213). Although this study was conducted in 12 clinical US centres and included a good sample size with 162 multi-racial women with no prior history of psychiatric disorders or chronic conditions that were followed up, the two fold increased risk of GDM in the first trimester was attenuated to 1.72 following adjustment for relevant covariates (age, race, ethnicity, parity, previous GDM, pre-pregnancy BMI and markers of socioeconomic status) (213). Also, the higher risks demonstrated in both trimesters were demonstrated in non- obese women only but not in obese women (213). Further studies would be required to evaluate the risk of depression in obese women as the prevalence of obesity is high in women with GDM and obesity itself can be associated with depression.

A previous meta-analysis showed a reciprocal link between depression and obesity (214). Baseline obesity in normo-glycaemic population was shown to increase the risk of onset of depression when followed up and found to be more pronounced in Americans than Europeans (214). This study also showed baseline depression increased the risk for developing obesity but not overweight (214). It is also important to consider the types and subtypes of depression that could exist in obese and non-obese women. A previous study has reported that individuals who are obese are more

likely to have depression with atypical features (215). Further studies are required to evaluate metabolic changes in early pregnancy and its link to depression in obese and non-obese women (213).

The ACOG recommends that pregnant women should be screened at least once during pregnancy or in the post-partum period (216), but with studies showing high depression scores in first trimester (213), highlights the importance and need to screen pregnant women for depression earlier on, particularly those who have no documented history of mental health problems.

There are few studies which have shown positive correlations with anxiety levels or depression in women with GDM. Daniells et al compared the anxiety levels at the start of the third trimester, antepartum, and 6 weeks postpartum in women with GDM to women without GDM (217). The results showed higher levels of anxiety at the first assessment but subsequently there were no major differences in the anxiety scores pre- and post-delivery in both groups. The study also showed the women's anxiety levels improved, and they felt happy they were tested for GDM and would do so in the future if required (217). Another retrospective study of 12, 239 women who were born in Bradford, UK showed no evidence of increased risk of GDM in women with common mental health problems before pregnancy or of GDM in women with mental health issues during pregnancy (218).

A previous meta-analysis of 18 studies has reported a significantly increased the risk of post-partum and antenatal depression in women with GDM (219) which highlights the necessity to evaluate for post-partum depression in women with a history of GDM. Studies which have shown that anxiety does not increase the risk of GDM (189, 195, 220).

### **2.1.8 Women's Experiences of GDM**

Over the last decade HCPs have recognised that the psychological needs of pregnant women and especially those with an underlying medical problem cannot be overlooked as directly or indirectly they have adverse effects on the mother or the infant. Several studies in diverse populations have been carried out to investigate the various psychological and psychosocial aspects of the experiences of pregnant women with GDM.



Multiple qualitative studies using several methodologies such as interpretive phenomenology, grounded theory and ethnography amongst others have been conducted throughout the world to investigate the perceptions or experiences of women with GDM. These studies have looked into the experiences of the women around various aspects of GDM including initial reactions, social and cultural influences, individual understanding of the seriousness of GDM, adequacy of social support, barriers to self-care and concern for self and baby and perceived fear of developing T2DM (217, 221-223).

Qualitative studies have investigated the initial reaction of the women upon receiving the diagnosis of GDM either through surveys or face to face interviews. Women from various backgrounds have experienced emotions ranging from feeling 'surprised', 'disappointed', 'sad' to feeling 'panicky', 'scared', 'upset', 'depressed', 'disappointed', 'worried', 'anxious' and even 'guilty'(217, 222-226). These initial reactions can have a short term or long-term implications such as how the women accept the diagnosis, associated complications and even accept or comply with treatment. These reactions also provide insight into how to HCPs can approach women diagnosed with GDM to potentially minimise the short- or long-term effects or complications.

An Australian study investigated the lived experience of GDM amongst immigrant South Asian women through interviews taken following their diagnosis and 6 weeks post-partum (227). The results showed the women had little knowledge about diabetes in general despite the fact that the incidence of T2DM and GDM is higher in the South Asian population. The women and their partners were upset following the diagnosis. Due to cultural variances, the women found it challenging to make changes to a diet conducive for GDM as well as the need for exercise (227). Interestingly, despite having been informed about the risk of future T2DM, the women stated they would try to but not certain they would be able to maintain their modified lifestyle (227). This study demonstrates the challenges of managing women with GDM from a different ethnic and social background. Education in these circumstances has to be tailored to specific needs and culturally relevant for better implementation.

A retrospective study consisting of a large cohort of women provided their views on their previous experience of having been diagnosed with GDM in the previous 3 years. The findings in terms of their initial reaction were consistent with other studies (224-

226) including that of ‘shock, fear, anxiety, scepticism and uncertainty’ (228). Thematic analysis of this study highlighted other aspects which were important to the women such as their experience and challenges in adapting to their new life with GDM, feeling ‘abandoned’, ‘the need for support’, ‘need to improve health’ and ‘need to prevent diabetes’ (228). An interesting finding of this study was that younger women who had had GDM at least twice previously were less inclined to view GDM as an opportunity to improve their health (228). These studies highlight the need for emotional support for certain women diagnosed with GDM. HCPs have to actively ask about emotional concerns that women may have as some women may not be forthcoming.

A large part of GDM has to be managed by the women themselves. Self-management involves monitoring blood glucose levels, adjusting diet to maintain good blood sugar values which requires knowledge and motivation. A study investigating the self-management of GDM in multi-ethnic women provided an interesting perspective into the experiences of women with GDM. The themes emerging from this study provided good insight into their journey of self-management of GDM including barriers encountered. Following the initial shock, the women seemed to quickly adapt to the new situation until they completely accept the diagnosis of GDM. The women developed individual strategies to deal with the practical management of GDM with the support of their family. Towards the later stages of pregnancy when the women had overcome many challenges and made major lifestyle changes, they felt the healthy benefits, felt more positive, and keen to stay healthy in the future (229). In addition to a supportive environment the women stated their motivating factor in sticking to their diabetes management plan was the baby’s well-being (229).

A meta-synthesis of multiple studies looking into the perception of women with GDM revealed five themes related to the experiences of the women: ‘emotional response’, ‘loss of normal pregnancy’, ‘privileging the baby’, ‘information and health care support’, and ‘personal control’ (230). The emotional responses consisted of a mixture of negative as well as positive thoughts. Whilst some women were in denial or depressed (231) others felt more positive and energetic due to changes in their diet (227). Some women viewed GDM as an ‘alarm bell’ which provided them the opportunity to make the appropriate and timely improvements in their lifestyle for themselves (232).

A poignant response by certain women was that following a diagnosis of GDM they felt their 'pregnancy' was no longer 'normal' and consequently the expectant mothers could not fully focus on the 'nesting' phase of their pregnancy (231). These emotions were linked to the 'medicalization' of their pregnancy with the focus being on more clinic visits, monitoring of blood glucose, changing diets and adopting stricter routines (231).

'Loss of control' is another strong feeling which women have expressed when describing their experience of having GDM (230). Women with GDM felt a loss of control as they felt they were under constant 'surveillance' by the medical team or their friends and family members. Women felt frustrated and irritated by constant remarks made to them about what they were eating in various social settings (222).

They also felt 'out of control' in the context of finding it challenging to manage their blood sugar levels despite their best efforts (222). Conversely some women felt a greater sense of personal control when they witnessed the positive impact of the lifestyle changes, they had made following their diagnosis. This also resulted in them focusing more as their pregnancy progressed (233). Other women changed their attitudes from feeling like 'victims' to regaining control of their diagnosis and its outcomes (222).

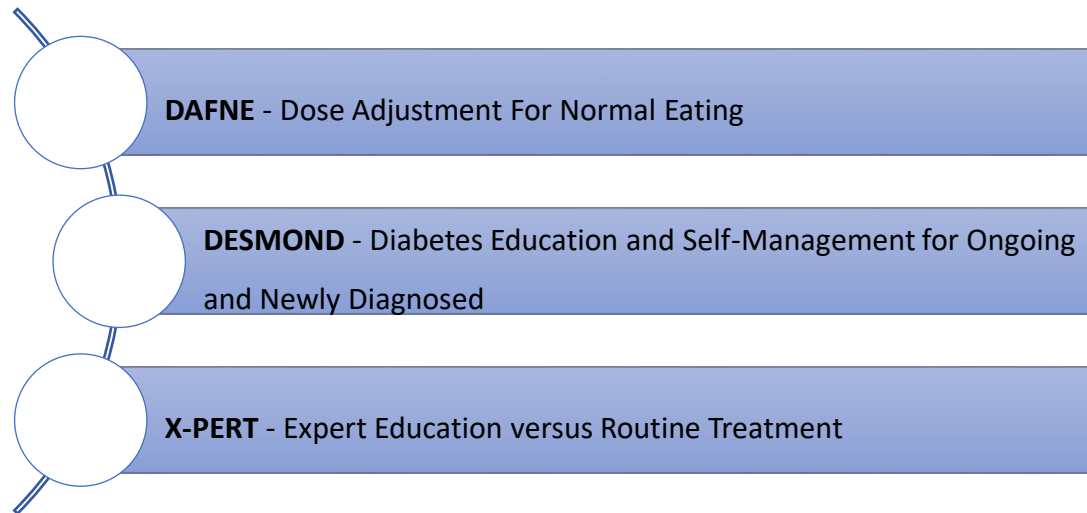
## **2.2 GDM and Education**

This is a review of the literature looking into the role of education as an intervention in GDM. Education in type 1 diabetes and type 2 diabetes has been included for comparative purposes. I will also discuss the role of theories and models of health promotion with education programs.

There are three pressing issues related to GDM which are being faced worldwide. Firstly, the prevalence of GDM is rising worldwide and secondly that of obesity and thirdly women with GDM have a 5 to 12% risk of developing T2DM in the next 5 to 10 years (42). Other than T2DM, GDM also increases the risk of other long term complications in the mother and the child including impaired glucose tolerance, obesity and cardiovascular disease (234).

In addition to optimising treatment of GDM, there is an urgent need to develop strategies for preventing GDM and T2DM. Education is an effective and valuable tool

to this end. Education plays a vital role in the management of diabetes. Over the years multiple education programmes have been established for several types of diabetes (**Figure 3**) (235) (236) (237):



*Figure 3: Education programmes designed for people with diabetes*

DAFNE course is a structured education programme for people with type 1 diabetes who are taught how to accurately titrate their insulin doses considering their carbohydrate intake and their pre- meal blood glucose levels. A previous randomised control trial in patients receiving the DAFNE course showed an improvement in the quality of life and their glycaemic control (235). DESMOND is intended for people with type 2 diabetes or those at risk of diabetes who are taught to self-manage their diabetes through evidence based information and other training toolkits (236). Another education programme called X-PERT aims to provide effective education to help prevent or manage people with type 2 diabetes including complications. A previous study showed X-PERT improved glycaemic control, blood pressure, weight and reduced the use of diabetes medications (237).

Whilst there is existing evidence based and structured education programmes for type 1 and type 2 diabetes, there is no such education programme dedicated to gestational diabetes at the national level in UK. Most Trusts across UK usually provide gestational diabetes education locally. However, in the last 2 to 3 years, there has been an increase in the development of online education programmes for women with GDM. These online education sessions or programmes have been organised by individual Trusts across the UK or region wise. For instance, there was an online education programme

for gestational diabetes launched for women who live in the Leicester, Leicestershire or Rutland areas which would be available to them upon registration. Similarly, in the Greater Manchester area, an online education programme for GDM was launched in 2018.

The NICE (National Institute for Health and Care Excellence) guidelines in UK provides thorough guidance on the management of diabetes in pregnancy from preconception to postnatal care (42, 129). This guideline advises HCPs to offer structured education to women with pre-existing diabetes who are planning a pregnancy (42, 129). This guideline also advises women without diabetes who are planning to get pregnant to undergo an OGTT following a risk assessment. These specific risk factors include a BMI above 30 kg/m<sup>2</sup>, previous macrosomia (baby weighing 4.5 kg or more), previous GDM, family history of diabetes (first-degree relative with diabetes) and an ethnicity with a high prevalence of diabetes.

This guideline provides information on the detailed management of GDM and recommends referral to a dietician and implementation of dietary changes, exercise and use of metformin and insulin if required (42, 129). It appears that any education to be provided to a woman newly diagnosed with GDM would be split between the dietician and the medical team who form part of a multidisciplinary team managing the women. The lack of a specific education programme for women with GDM is quite prominent in this leading UK guideline.

An education programme aiming at women with gestational diabetes would ideally cover topics from how a diagnosis is made including risk factors, the underlying pathophysiology, the control of glucose and insulin in the body, the different interventions to manage GDM such as dietary changes, physical exercise, medications, information on short term and long-term complications of GDM in the mother and baby and the risk of T2DM development. The women would also be taught how to check their blood glucose levels and advised on the target values. The ultimate objective of the education programme would be to empower women to manage their blood sugars levels and prevent maternal and neonatal complications such as pre-eclampsia or macrosomia (7, 44, 238).

The first line of management in GDM involves lifestyle changes. This includes education about the right type of diet, the role of physical exercise and regular

monitoring and control of blood glucose levels. This is referred to as the self-management of GDM which requires discipline from the patient and correct information, guidance and support from the HCPs (239). Medications are required if glycaemic control is not achieved through lifestyle measures (59). A diabetes dietician is the ideal person to provide the required education around gestational diabetes. Traditionally women with GDM have received individual dietary assessment and recommendations. The main aim of the dietician is to educate the women about healthy behaviour, how to manage their blood sugar levels to minimise complications but also monitor the women's nutritional requirements to balance weight gain and adequate foetal growth.

The current national [42, 88], and international guidelines recommend medical nutrition therapy, weight management, appropriate physical activity and blood glucose monitoring (240) to manage GDM. Dietary intervention or Medical Nutrition Therapy is the mainstay treatment of GDM to manage blood glucose levels (241) (242, 243). The aims of MNT are to cater to the nutritional needs of the mother and the fetus whilst achieving appropriate maternal weight gain during pregnancy and fetal growth (240, 242). MNT is quite impactful as a lot of women with GDM can control their blood sugars with dietary changes only throughout pregnancy. A previous American study reported 70% of women with GDM achieved glycaemic control with a healthy lifestyle and adequate nutrition (242).

MNT consists of a meal plan which has a controlled proportion of carbohydrate which will result in an appropriate weight gain, achieve normal blood sugar levels without development of ketosis (240). A diabetes dietician would be the most appropriate HCP to provide advice about nutrition, particularly guiding them regarding healthy food choices, portion sizes and home cooking. The dietician traditionally provides individualised nutrition plan to women taking into consideration their cultural and personal preferences, levels of physical activity and socioeconomic status (240) (242).

Different countries have provided guidelines around MNT following the diagnosis of GDM. The main recommendations [Table 2] are similar and include individual nutritional advice by dieticians, approximate amount of carbohydrate and protein per day, calorie restriction per day or to encourage the use of Low GI food.

**Table 2: Main nutritional recommendations from international guidelines**

<b>Guideline</b>	<b>Year Published</b>	<b>Main Recommendations</b>
IDF	2009	<ul style="list-style-type: none"> <li>• Culturally sensitive and individualized nutrition as advised by specialist in GDM nutrition therapy</li> <li>• Lower GI diet by regulating carbohydrate intake and proportion</li> <li>• Reduction of a maximum of 30% of calorie intake in overweight women</li> </ul>
Endocrine Society Clinical practical guideline	2013	<ul style="list-style-type: none"> <li>• Calorie restriction of 35 to 45% of total calories</li> <li>• 3 small/moderate sized meals and 2 to 4 snacks</li> <li>• Choose higher quality and low GI food</li> </ul>
NICE	2015	<ul style="list-style-type: none"> <li>• Refer to registered dietician</li> <li>• Healthy diet in pregnancy</li> <li>• Lower GI food</li> </ul>
Diabetes Canada	2018	<ul style="list-style-type: none"> <li>• Refer for assessment and counselling by dietician</li> <li>• Healthy diet with carbohydrate restricted to minimum 175 g/day</li> <li>• Low GI foods</li> <li>• 3 moderate sized meals and 2 or more snacks</li> </ul>
ADA	2018	<ul style="list-style-type: none"> <li>• Individualized plan agreed by dietician and women</li> <li>• Dietary reference for pregnant women per day: 175 mg carbohydrate, 71 g of protein and 28g of fibre</li> </ul>

IDF [International Diabetes Federation] (244); Endocrine Society Clinical practical guideline (240); NICE [National Institute of Clinical Excellence] (42); Diabetes Canada (245) ADA [American Diabetes Association] (242)

There is a variability in the recommendations provided by guidelines from various countries with some advocating calorie restriction whilst others only advocating lower GI foods. Hence currently there is no consensus for an optimum or ideal diet that can be recommended for GDM worldwide. Traditionally, reducing simple carbohydrate intake to control hyperglycaemia has been recommended (246)

An important aspect of GDM education centres around knowledge about carbohydrates and calorie intake. Women with GDM are advised to have foods which are of low glycaemic index (GI) as previously discussed. This recommendation was made following few studies in pregnant women who did not have GDM. A study by Clapp et al showed that pregnant women who were on a low GI diet had lower capillary blood glucose levels, less insulin resistance and lower birth weight compared to women consuming high GI foods (247). A similar study comparing women on low GI versus high GI in pregnant women showed babies of lighter weight and less macrosomic babies in the low GI cohort (248). Women were advised to have 3 regular meals in a day and 3 snacks.

Further studies in the last few decades have provided evidence that have contributed towards nutritional recommendations for GDM. A randomized controlled trial was conducted 25 years ago to validate a nutrition practice guideline for GDM developed by a specialist working group that were being used in clinics across the United States at the time (249). Certain parameters in women with GDM attending the clinics that used the nutrition practice guidelines were compared with those who followed the standard care (249). Analysis from 215 women showed women receiving MNT from the practice nutrition guidelines had improved their HbA1c. Although not statistically significant, fewer women who received MNT from the practice nutrition guidelines required insulin compared to those with standard care [(24.6% v/s 31.7%) (P=0.05)]. (249). This study also demonstrated a lower post-partum HbA1c in the women who had followed the nutrition practice guidelines as compared to those who had standard nutrition care [7.1% in nutrition practice guidelines cohort v/s 13.8% in usual care group) (P =0.25). Unfortunately, this difference glycaemic control was not statistically significant due to a small sample size (156 women) resulting from women having early deliveries, non-attendances at appointments or declining post-partum test (249). Pregnancy outcomes in this study showed no statistically significant difference in the rate of macrosomia (birth weight > 4 kg), mode of delivery and proportion of pre-term



(<37 weeks) in the 2 groups due to sample size limitation (249). Other pregnancy outcomes measured in this RCT were informative. There was no difference in delivery method (approximately one third by caesarean section) and the rate of macrosomia (birth weight >4,000 g) was 13% in both groups. The proportion of preterm (<37 weeks) deliveries was more than two times higher in the usual care group vs the nutrition practice guidelines group (10.6% and 4.6%, respectively) (P=0.25), but not statistically significant given the sample size limitations (249).

An earlier RCT evaluating perinatal outcomes in women with GDM who had intervention in the forms of dietary advice from registered dietician, blood glucose monitoring and the need for insulin compared to routine care (7). The rate of perinatal complications was higher in the routine care group compared to the intervention group [1% v/s 4%, P=0.01] (7).

Numerous studies across the world have investigated the effects of distinct types of education interventions in women with GDM. The traditional way of imparting any form of education to women with GDM has been individual sessions which is labour intensive and requires considerable resources (239). A group education session for women with GDM would be an excellent alternative and cost effective. There were very few places that had used group education for GDM that could be found in literature prior to 2015, which was the start of my study.

The Swedish Medical centre in Seattle Washington is one of the places which provides group education sessions as well as individual education sessions to women diagnosed with GDM. This centre provides education to more than 300 women with GDM on an annual basis. The aim of their education session is to provide optimal nutrition therapy, encourage women to manage their GDM and simultaneously providing valuable information on ways to reduce the risk of developing diabetes in future (250).

The group education classes split into a 2-hour session (introductory class) and a 1-hour follow-up class. Women with special needs such as those requiring a language interpreter are reviewed on an individual basis. A dietician and a diabetes nurse teach in both settings and the curriculum is similar. The contents of the curriculum are quite detailed discussing diagnosis, aetiology, knowledge to carbohydrates and protein and self-blood glucose monitoring. This session is provided within a week of the diagnosis which is ideal.

A second 1 hour follow up class is provided a week later when the blood sugars of the women are viewed but most importantly important topics are discussed including the risk of developing T2DM in the future, prevention of T2DM, role of breastfeeding, nutritional requirements during lactation and effect of contraception on blood glucose levels. They are also provided with appropriate documentation on practical post-partum lifestyle strategies. The women subsequently have a mixture of telephone and face to face visits to have further treatment based on their blood glucose levels (250). This education provided during pregnancy and advice after delivery is quite elaborate in this institution. Unfortunately, no data is available regarding any pregnancy outcomes or feedback from women attending this centre. This information would be very useful in advocating such a model of care.

An Iranian study investigating the effects of a health education program and behavioural interventions in women with GDM were being treated with either diet only or insulin. The women were randomised in 4 groups: diet with and without health education and insulin with and without education. The educational session consisted of advice regarding diet, exercise, maintaining glycaemic control, postpartum diabetes control and mode of delivery. There was no difference in the Quality-of-Life Scores between the groups before the education program, however the scores were high post education session and the highest in the insulin and health education group. This study demonstrated improvement in the quality of life of women with GDM following a health education session (251). Such a session would help the women tackle underlying concerns or anxieties during pregnancy. The limitation of this study is that it is limited to a single ethnic group.

Few studies have compared group education with individual teaching sessions. A previous Canadian study compared the efficacy of nutrition counselling in women with GDM who had attended in a small group (2 to 4 women) set up compared to individual sessions. The knowledge of the women were assessed through completion of a test consisting of multi-choice questions completed prior to the sessions, immediately after the session and a week later. The results showed significant and equal improvement in knowledge ( $p < 0.0001$ ) after the counselling session in both groups. More importantly knowledge was sustained a week after the session in both groups [95% CI: -6.2 to 2.4]. Small group teaching saved 27 dietician hours. This study demonstrated teaching/counselling women in small groups was as cost-

effective compared to individual teaching (252). The main limitations in this study were that randomisation was not used and the sample size was small (41 women in individual and 35 in group counselling). Despite the limitations, this study demonstrated the merits of group teaching.

A Mexican study evaluated maternal health behaviours, glycaemic control and neonatal outcomes in a group of women with GDM who underwent an education intervention in the form of an additional 1-hour session by a Parish Nurse. These outcomes were compared with women who had usual standard care. Although the results showed no significant reduction in HbA1C, macrosomia or neonatal hypoglycaemia, there was an improvement in self-reported health promoting behaviours in the women receiving additional teaching (253). The strength of this study is that the women were randomised with 49 women receiving extra education and 51 women having usual care. However, the limitation was the small ample size.

Online education is now becoming an effective tool of education in multiple disciplines and are being used in diabetes education. An Australian study investigated the application of a web based educational intervention in women newly diagnosed with GDM. 110 women were randomised into the intervention group which included standard care plus online education and the control group received standard education only in clinics. Data was collected at baseline and 12 weeks post-partum. The primary outcomes measured included effects on maternal body mass index (BMI), blood pressure and glycaemic control and infant birthweight (14).. The intervention group showed significant maternal weight loss and improvement in glycaemic control ( $p < 0.05$ ). More women lost weight in the intervention group ( $p < 0.001$ ) and were in a healthier weight range at 12 weeks post-partum (44 % versus 32%). Infants born from women in both groups had normal birthweight. More women in the intervention group attended for their 12 weeks postpartum OGTT [96.2% vs 70.7%,  $p < 0.001$ ] (14). This randomised study with a good sample size showed promising results for the use of online education session which can also be cost effective. Although women receive the online education at an individual level, online education sessions are usually delivered in a group platform through the use of communication technologies like zoom, Microsoft teams, skype etc.

### **2.2.1 Health Education**

The WHO defines health education as “consciously constructed opportunities for learning involving some form of communication designed to improve health literacy, including improving knowledge, and developing life skills which are conducive to individual and community health” (254). Health education aims to improve health by instigating motivation and increasing confidence or self-efficacy to promote appropriate and healthy actions. Health education also considers the underlying social, economic and environmental conditions that influences health as well as individual and behavioural risk factors within a particular health care system (254). Health education is however not an isolated endeavour and has a symbiotic relationship with health promotion and together these contribute to health policies (255).

### **2.2.2 Health Promotion**

WHO defines Health promotion as “the process of enabling people to increase control over the determinants of health and thereby improve their health” where participation is essential to sustain health promotion action (254). Being a key element of public health practice, health promotion involves a combination of health education, service improvement and advocacy (256). Health care professionals, community workers, professional groups and volunteers have a role to play in health promotion. The principles of health promotion are based on the original recommendations made by the Ottawa Charter (254, 257).

Health promotion is an evolving field and uses many approaches. Recent years have seen a change from a medical model of health which focuses on disease rather than health to the social model or holistic approach whereby the physical, mental, emotional, spiritual and vocational aspects of health are taken into consideration (256).

Another approach used in health promotion is the individualistic approach where the person is held responsible for their illness and health behaviour and medical intervention and educational activity is used to solve the health issue (258). The structuralist approach in health promotion uses a more positive concept of health and primarily targets the social, political and cultural aspects (258). There are certain core values associated with health promotion and in the processes of working within health promotion including equality, equity, autonomy, fairness and partnership working, participation, choice, respect, sustainability and inclusiveness respectively (259).

Health promotion involves several approaches to achieve its objectives including coercion, persuasion, or empowerment. Health empowerment can be considered to be a combination of two components: self-efficacy and health literacy. Self-efficacy is associated with feelings such as high self-esteem, power and control, confidence to take action and beliefs about the ability to change a situation. Health literacy relates to abilities such as decision-making skills, ability to communicate health issues, having the cognitive capability and an understanding of health and disease (256). Health empowerment aims to develop the capacity of individuals and communities to enable them to actively learn and participate in the process of making informed decisions about their health. This process is underpinned by counselling, community development and social learning theory (256, 260).

Planning health promotion is an iterative cyclical process that involves firstly a needs or situation analysis, secondly considering a strategy such as health education with a particular method and setting, thirdly implementation with monitoring and fourthly evaluating, reflecting and learning from the whole process (256).

In UK, a Public Health Guideline [PH35] was published which outlined the health promotion strategies and interventions for the prevention of T2DM at the community and population level (261). The Programme Development Group (PDG) for this public health guideline took into consideration the urgent need to address the rising incidence of diagnosed and undiagnosed T2DM and its significant cost to the NHS. The PDG considered 3 types of approach (261):

- (i) Individual which focused on people identified as being at high risk for T2DM.
- (ii) Identifying and targeting communities of people at high risk of T2DM and
- (iii) Total population with no assessment of risk or targeting of interventions.

This guideline made recommendations based on available evidence from large studies and considering cost effectiveness of each approach used. A previous study has reported reduction in likelihood of development of T2DM in people with pre-diabetes who have had behavioural interventions (262). A Finnish study also showed reduction in the risk of developing T2DM in people with impaired glucose tolerance if they made variable reductions in their weight, total and saturated fat intake and increased their physical activity and fibre intake (263). Therefore, the PDG felt that interventions

promoting these goals could significantly lower the risk of developing type 2 diabetes among people from lower socioeconomic communities and from black and minority ethnic groups.

### **2.2.3 Health Education models**

Human behaviour is central to health promotion. It is necessary to understand the various influences on health and illness prior to planning any effective health promotion intervention. Behaviour can be influenced at various levels including individual, friends and family, community, and society. Several models of behaviour that operate at each of these levels have been described (256). In the context of a person with diabetes supported by his family and friends, the health belief model, social learning theory and social network theories might be directly relevant. Diabetes is a chronic condition which the person has to live with. Self-management, more specifically establishing self-management behaviour is key to improving and maintaining glycaemic control. Educational interventions are often based on certain education theories or health promotion theories or models. A sound theory is important in the design of an effective, efficient, and practical educational programme

### **2.2.4 Health Belief model**

The Health Belief Model is an established theoretical model which helps explain the behaviour of people (264, 265). This model has been applied to other health related behaviours including influencing the uptake of vaccines (266). The health belief model operates on 3 sets of beliefs that individuals have about a health problem: perceived susceptibility, perceived seriousness and perceived benefits and disadvantages (264). Occasionally a trigger might be required to prompt the person to act (264). This model is helpful in explaining why people could choose not to take any action following health education.

In practice this could translate to an instance where a woman with GDM may accept she is at risk of developing T2DM in the future, but she might not believe that T2DM is serious enough. She might also believe that the efforts required to make changes is not worth the future benefits. This demonstrates the importance of influencing health beliefs of women around GDM in a positive way.

### **2.2.5 Social Learning Theory (SLT)**

This behaviour model is mostly aimed at individual level and does not include social factors that influence behaviour (256). The individual does not live in isolation and hence there are other groups of theories which consider the individual in a social context. Social Learning Theory (SLT) is one of them.

Influenced by the behaviourist learning theories Albert Bandura proposed the social learning theory which explains how human leaning and behaviour can be influenced by cognitive as well as environmental factors. SLT is also called social cognitive theory (260). Bandura highlighted that people learn through their own experiences and also from the environment through an observational learning process and through a modelling process (260). Bandura pointed that people's beliefs are a source of motivation which affect their perception, interpretation, and behaviour. Individuals learn by modelling their behaviour on others. People can be positively or negatively influenced by 'role models' such as TV stars or a 'rock star' in the context of smoking or drugs.

SLT highlighted that people with low self-esteem are more likely to be influenced to adopt harmful behaviours such as smoking or taking drugs, conversely people with high self-esteem have belief in their own capability (self-efficacy) to take the appropriate actions to manage a situation on their own way. Self-efficacy is itself a key part of health education and empowerment and needs to be promoted. Self-efficacy plays a central role in health promotion and is probably a goal in its own right, especially in the context of socially disadvantaged or socially excluded groups (256).

### **2.2.6 Social Network Theory**

Social Network Theory also considers the social context of individuals who are usually surrounded and supported by their family, friends, and community. Social networks allow the flows of information in various communities, can exert a degree of pressure in the way people act but can also provide support to people with various medical and mental conditions.

Social network influences health in many ways. It acts as a source of information: people seek and tend to believe information obtained through their various networks which consists of people they trust. Social network can have considerable influence and pressure over individuals. People are susceptible to diverse types of information at variable degrees. These influences can occur at the level of peers, family, or

community. A very useful influence of social network is the practical or emotional support obtained from family and friends, especially for those who are unwell or in need (256).

### **2.2.7 One-to-One communication used in health education and promotion**

Choosing an appropriate method of communication and tailoring it to the appropriate age group are 2 important aspects for health promotion or education to be effective. Each method offers advantages, disadvantages and can have barriers for it to be successful. One to one communication is a commonly used method in workplaces or health settings and highly effective in providing tailored advice.

One to one communication is used in settings such as in face-to-face clinical consultations, education sessions, telephone discussions, virtual consultations, teaching a patient to use a device or face to face counselling sessions. Main barriers to one-to-one communication include dealing with non-verbal aspects, use of medical terminology, language used and the context.

### **2.2.8 Group communication used in health education and promotion**

Group work is another widely used method used in the work organisations or health settings to promote health promotional activities, for facilitating self- help, teaching of skills and health empowerment. An understanding of group dynamics and participatory learning methods are key aspects in the success of group communication. The aims of small group teachings can be different, and the learning methods should be chosen to meet the needs of the group.

In a group setting is an ideal setting for learning as they are interactive, and the participants are able to share their experiences and ask questions. Compared to one-to-one communication group sessions are meant to be more effective in influencing lifestyle changes since the attenders feel the pressure to commit as they feel formally or publicly committed to the group. Small group teaching can be useful in exploring values and beliefs and developing problem solving skills.

### **2.2.9 Adult Learning theory**



The principle of adult learning is used in small group interactive teaching sessions. Establishing the participants prior knowledge on the topic being discussed makes people engage and learn better. The content has to be presented in a clear, relevant, and interesting way such as use of visual aids. Complicated information should be clarified and made meaningful. Participants should be encouraged to participate actively through sharing of information or asking questions. Understanding of the topic should be checked at intervals and feedback provided (267).

## **2.2.10 Self-Management**

Self-management is an important strategy used in the management of chronic diseases. It has been defined as ‘the person’s ability to manage the symptoms, treatment as well as dealing with the physical and psychosocial consequences whilst living with a chronic condition’ (268). The objectives of self-management for an individual are to be able to monitor the condition and to effectively implement cognitive, emotional and behavioural changes to ensure an adequate or satisfactory quality of life (268).

Self- management requires a successful working partnership between the individual and the HCPs within a dynamic and continuous process (256). Self-management helps individuals to be compliant with their treatment and enables them to use their knowledge, skills, and support from the HCPs to effectively control their chronic condition. Self- management programmes have been successfully implemented in multiple chronic conditions (268, 269).

## **2.2.11 Behaviour Change in GDM**

As previously discussed, GDM impacts not only in the immediate but also the future health of the child and the mother. Three main types of interventions that are used in GDM are (1) dietary changes and exercise; (2) self-monitoring of blood glucose levels; and (3) behavioural/ counselling interventions (270). Behavioural changes in lifestyle during pregnancy is an important aspect in the acute management of GDM for positive maternal and fetal outcomes. These behavioural changes also must be maintained long term if future glucose intolerance including GDM or T2DM development are to be prevented. It has been reported that post-partum glucose intolerance in women with previous GDM is influenced by pre-pregnancy metabolism, intrapartum gain of adipose tissue, stresses on pancreatic beta cells induced by pregnancy, fat stores

accumulation during pregnancy and retained post-delivery and post-partum behaviour (271).

I have previously discussed how behaviour is important in the maintenance of optimal health and in health promotion. Several models such as the health belief model, social learning theory and social network theories have been used in various interventions in people with type 1 and type 2 diabetes (272-276) (276, 277)[ 218, 219, 220-224].

### **2.2.12 GDM and Health Belief Model (HBM)**

The Health Belief Model has been used as a framework to evaluate the impact of various interventions or other aspects of care used in GDM worldwide. In an Iranian randomised controlled study, the HBM was applied to improve self-management as part of a weekly education programme in women with GDM and compared to standard care (278). This study reported significant differences in perceived susceptibility, severity, benefits, barriers, self-efficacy and HbA1C in the intervention group as compared to the control group ( $p < 0.001$ ) (278). This study had a good sample size of 110 and was a randomized study but was limited to a single ethnic group and geographical area. An interesting application of HBM was demonstrated in another Iranian study which investigated the effectiveness of training sessions enhanced by the HBM model to improve the behaviours of pregnant women with the aim of preventing GDM (279). This study with a relatively small sample of 91 pregnant women showed a positive correlation between age and preventative behaviours [ $r=0.22$ ,  $P<0.05$ ] and between BMI and perceived susceptibility [ $r=0.26$ ,  $P<0.05$ ] (279). The results also showed significantly higher mean scores in all the constructs of the HBM post intervention in the enhanced training session as compared to the control group (279). The strength of this study was the multi-stage randomisation process. Although the women were from different health centres, and they belonged to the same ethnicity and urban city context.

Compliance with dietary changes is as important as the dietary changes themselves for the latter to be effective. However, this can be challenging which may require additional help or motivational input. A semi-experimental study investigated the influence of an education based on health belief model in women with GDM and the effect on adherence to diet was evaluated using completion of pre and post intervention questionnaires (280). This study reported significant increase in the mean scores of awareness and other components of the HBM ( $p < 0.01$ ) following the

education (280). Although this study had an element of randomisation, the study was limited by a relatively small sample and use of an unvalidated questionnaire. However, this model helped the women understand the importance of nutritional behavioural changes during pregnancy which will in turn help to deal with challenges in that process (280).

### **2.2.13 GDM and Social Cognitive theory**

Social learning theory has also been used in multiple interventions in GDM to improve outcomes with variable degrees of success. A previous study compared pregnancy outcomes following the use of a counselling program based on social learning theory in Mediterranean Turkish and Austrian women with GDM (281). The counselling sessions included translators when required and the sessions were repeated multiple times to re-enforce information about GDM and diet. There was no significant difference in the glycaemic control and proportions of babies with macrosomia in the two cohorts (281). This study however demonstrated comparable pregnancy outcomes with similar mean birth weights in these 2 ethnically diverse groups following intensive education sessions with social learning theory as a framework (281). This demonstrated the use of socially and culturally appropriate education can have comparable outcomes in diverse populations. This is important as GDM is more prevalent in certain ethnic populations

Dietary and physical activity intervention based on social cognitive theory in pregnant women from an area with high prevalence of GDM and T2DM, showed minor impact on diet post intervention but highlighted the challenges in maintaining appropriate body weight and physical activity during and after pregnancy (282).

Health Care Professionals often find it challenging to deal with the issue of poor adherence to medical regimen in women with GDM (283). Self-efficacy which is one of the important constructs of the Social/Cognitive learning theory emphasises the integrative use of cognitive, social, and behavioural skills in the application of day-to-day actions (272). Within this context, 3 main processes of personal change that are important in behaviour patterns include: the adoption of a new behaviour, the generalization of behaviour and the long term maintenance (272). Self-efficacy in women with GDM has shown to be a reliable predictor of medical adherence which is a crucial aspect of management and directly affects pregnancy outcomes in GDM (284)

## **2.2.14 The Theoretical domains Framework (TDF)**

A key factor in improving healthcare and health outcomes is behaviour change. Within the healthcare set up, behaviour changes can be necessary for Health Care Professionals (HCPs), managers and other allied HCPs (285). Application of evidence-based medicine by doctors or compliance with medications by patients are important areas requiring behaviour change (285). However, implementation of evidence-based practice amongst HCPs has remained variable despite high level recommendations (286, 287), mostly due to the influence of organisational and personal factors (285).

Changing the different types of behaviour in HCPs at all levels is challenging but can be more effective when principles of behaviour change are more evidence based (288). There are many theories that underlie these principles of behaviour change, which are often not included in the design and assessment of the process of implementing interventions (289). Behaviour change interventions which are theory driven have been reported to be more effective (290). However, the choice of which type or number of theories, inclusion or exclusion of relevant theoretical constructs or avoiding overlapping theories can make it challenging to choose the appropriate processes that would define a successful behaviour change (291) (292). To overcome these challenges, a group of psychological theorists, health service researchers and health psychologists collaborated to develop an integrative framework of theories called the Theoretical Domains Framework (TDF) (293).

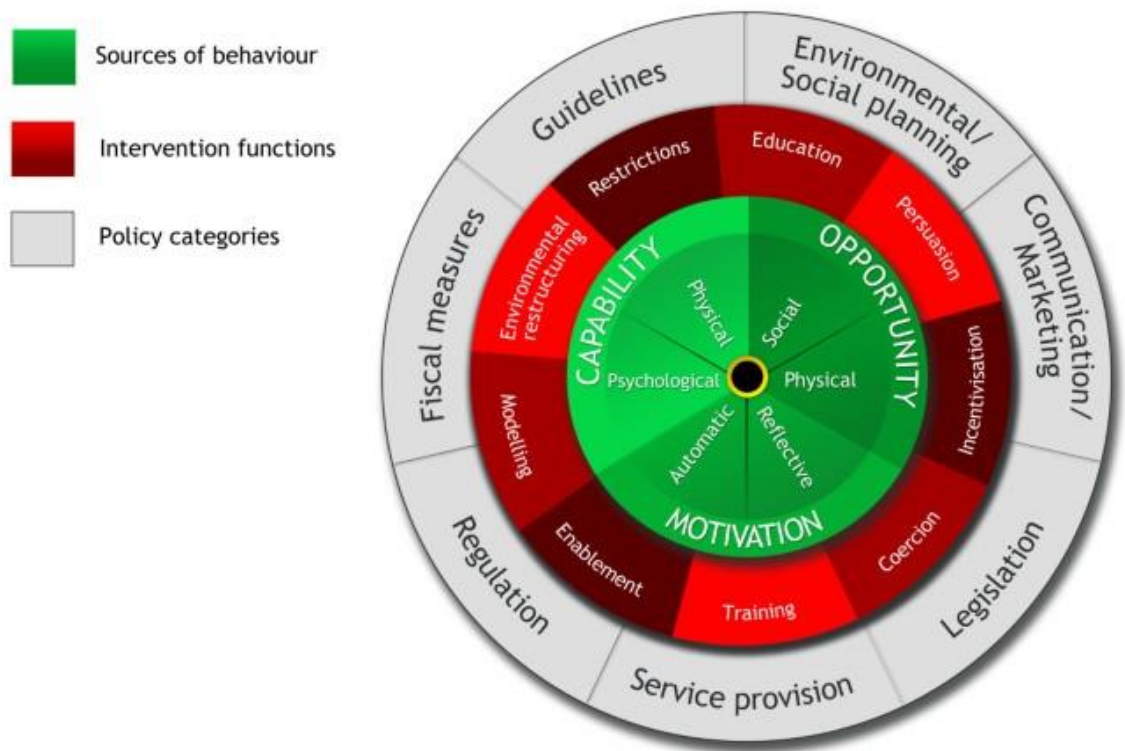
The objective of the TDF was to integrate several behaviour change theories thereby simplifying and making theory more accessible and user-friendly to other fields (293). Thirty-three theories and 128 key theoretical constructs related to behaviour change were initially identified which were then synthesised into a single framework. A six stage consensus process was used resulting in a framework with 12 theoretical domains and model questions to assess implementation of behaviour changes and inform intervention design (293). The TDF was at a later stage refined and validated giving rise to 14 domains of theoretical constructs including 'Knowledge', 'Skills', 'Social/Professional Role and Identity', 'Beliefs about Capabilities', 'Optimism, Beliefs about Consequences', Reinforcement, 'Intentions, Goals, Memory', 'Attention and Decision Processes', 'Environmental Context and Resources', 'Social

Influences’, ‘Emotions’, and ‘Behavioural Regulation’. This newer and refined version is more evidence based (293).

### **2.2.15 The Behaviour Change Wheel (BCW)**

The BCW is related to the TDF. The BCW was a refined framework for characterising and designing behaviour change interventions based on the systematic review of "frameworks of behaviour interventions & theories" carried out in 2011 (294). This review identified 19 frameworks which covered 9 intervention functions and 7 policy categories. These identified frameworks did not meet the criteria for a "model of behaviour" and therefore a new "behaviour system" was developed that consisted of 3 components including capability, opportunity, and motivation (COM-B system/model) (294). The synthesis of the 19 frameworks of behaviour change resulted in the development of a new guiding framework called " Behaviour Change Wheel (BCW)" (294). The BCW (**Figure 4**) consists of 3 inter-related layers (294, 295):

- the first layer used the COM-B model
- the second layer helped identify options from the 9 intervention functions by considering the various barriers and enablers associated with that intervention behaviour
- the third or outer layer identified 7 policy options that could be used to deliver a particular intervention function



*Figure 4: The Behaviour Change Wheel (294)*

## 2.2.16 The Capability, Opportunity, Motivation (COM-B) model of behaviour change.

The COM-B model of behaviour highlights three important factors that are required for a particular behaviour to be changed (296, 297):

- Capability
- Opportunity and
- Motivation.

The COM-B model proposes that an individual's behaviour at any point in time is governed by that person's capability and opportunity to embrace that behaviour and the person is more motivated to perpetuate that behaviour compared to any other competing behaviours (294).

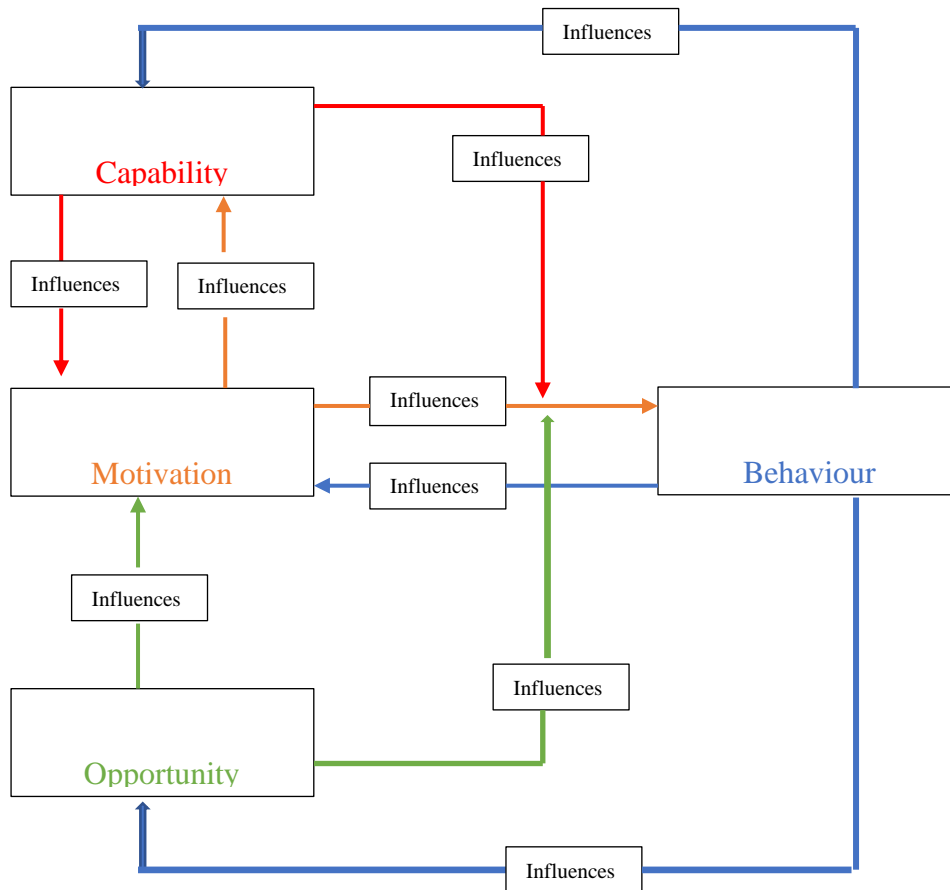
There is an intricate and inter-dependent relationship amongst the 3 factors that impacts on behaviour, which in turn influences these factors through a feedback loop system (**Figure 5**). This interplay results in 'behaviour' being viewed as a dynamic function over time (297).

As illustrated in the COM-B model (Figure 5), capability and opportunity do not directly influence behaviour but rather influence the relationship between motivation and behaviour. In practice this translates to the fact that at any point in time, both capability and opportunity, have to be present for 'motivation' to generate a particular behaviour. Looking at this effect from a quantitative perspective, the likelihood of a behaviour increases with greater opportunity and capability (297).

Opportunity is described as an attribute of an environmental system, which along with capability facilitates or makes a certain behaviour possible. Capability can be physical or psychological. Physical capability involves a person's physical abilities such as dexterity, muscular strength, or balance whereas psychological capability constitutes mental faculties such as cognition, memory or reasoning. Behaviour feeds back to capability, opportunity, and motivation through a positive or negative feedback loop (297).

Motivation is invariably associated with a competitive aspect where the individual is exposed to several competing behaviours. This can result in an individual becoming more motivated towards a specific behaviour they wish to pursue at the expense of being less inclined towards another behaviour at the same time (297)

Motivation is a core part of the model and the PRIME Theory of motivation provides a framework for understanding how reflective thought processes (Planning and Evaluation processes) and emotional and habitual processes (Motive and Impulse/inhibition processes) interact at every moment leading to behaviour (Responses) at that moment (297) .



*Figure 5: Interconnected components of the COM-B model (297)*

### **2.2.17 The PRIME Theory of motivation**

There are several models and theories of motivations that are based on emotions and drives, reflective choice processes or those that focus on instinct and habit. The aim of the PRIME Theory of motivation was to bring the large number of models and theories of motivation into a single framework (296). PRIME theory acknowledges the fundamental principle of human behaviour which is that human's actions are driven by 'needs and 'wants' or also known as 'motives'. The PRIME Theory of motivation provides a framework for understanding the structure of the human motivational system which consists of

- reflective thought processes which include planning and evaluation processes and
- emotional and habitual processes (Impulse and inhibition processes generated by motive, learned or instinct associations) which interact resulting in
- behaviour (Responses) at that moment in time (296).



It is recommended the COM-B and PRIME should be used in conjunction with more specific models relevant to the specific behaviours in question. The COM-B model has been used with various frameworks to investigate and implement behavioural changes in several aspects of care in pregnant women with GDM and in post-partum women including those with previous GDM.

Pregnancy offers an excellent opportunity for health promotion as part of the antenatal care and is often described as a 'teachable moment' for behaviour change (298). There is no specific model of health behaviour change during pregnancy. A previous study comparing the use of the COM-B and the 'Teachable Moments' models to explain eating behaviour during pregnancy was inconclusive but suggested certain stages of pregnancy may be more conducive for behaviour change (298).

The COM-B model was used in a study exploring barriers to a healthy lifestyle in post-partum women using data from interviews from two focus groups (pregnant women and HCPs) (299). The results highlighted that the women wanted more help regarding how to maintain a healthy lifestyle from HCPs and accessible, user friendly and motivational tools that would provide health related information and help them plan a healthy life by managing their health related risks(299). This study proposed an intervention based on Information Technology (IT) that would provide instant access to high quality information to the women and their partner (299).

Theoretical Domains Framework (TDF) and the COM-B model have been used to look into barriers to testing for type 2 diabetes in women with previous GDM. Lake at al (300) used TDF to synthesise and categorise determinants (personal factors) that affect screening for T2DM in women with a history of GDM. These determinants were mapped onto the COM-B model resulting in recommendations that could be sent to women with previous GDM in the form of messages. This messaging system aimed at individual women would promote screening and intervention resulting in increased uptake of post-partum type 2 diabetes screening (300). This study identified eight key TDF domains which included: the perception of risk of developing T2DM, addressing knowledge, fear of being diagnosed with diabetes, less on personal health and fatalism (300).

Another systematic review and qualitative synthesis applying the TDF and the COM-B model identified barriers to and enablers of health behaviours amongst post-partum women with previous GDM from multiple ethnic and cultural backgrounds to identify appropriate interventions (301). This study also identified interventions related to the

barriers and enablers which could be used as evidence-based recommendations to support and implement behaviour change (301).

The COM-B model and the TDF have also been used for more modern applications. In a recent study, they were used to help develop a smartphone application ('stay-active') with the aim to increase physical activity in women who have been diagnosed with GDM (302). Mapping 'barriers and enablers' of physical activity to the COM-B and TDF enabled the identification of specific aspects for a targeted behaviour change and interventions (302). Changes required were reflective and automatic motivation, social and physical opportunity and psychological capability whilst intervention functions included education, enablement, persuasion and training (302). This behaviourally adapted application for women with GDM is currently awaiting a clinical trial to assess its feasibility and acceptability (302).

Another qualitative study evaluating barriers and facilitators to maintaining a healthy lifestyle in post-partum women with previous GDM used the COM-B model and the socioecological model (303). Key themes reflecting capability, opportunity or motivation components of the COM-B model highlighted aspects that were important to the women that required behaviour change (303). The socioecological domains (individual life, family life, community, and healthcare provision) provided context to certain factors which would appropriately inform the development of interventions (303)

These studies highlight the importance of incorporating theory driven models of behaviour change along with mapping with the COM-B model to increase the efficiency of the process and outcomes in an education programme, including group education. Application of behaviour change models in women with GDM in areas such as diet could result in short and longer-term benefits and minimize their risk of developing future GDM and/or T2DM.

## **2.2.18 Theory used in diabetes education and interventions**

Diabetes care interventions based on theory have been shown to be effective in the school settings. Enabling adolescents to acknowledge and self-manage type 1 diabetes can be challenging. Studies using Social Cognitive Theory (SCT) (272) has been shown to be effective in areas resulting in increase in the frequency of blood glucose

monitoring, increase in the compliance of insulin administration, and school staff being less fearful of managing high and low blood sugars (273). Another study which evaluated school staffs' knowledge on diabetes showed a significant increase in their diabetes knowledge evaluated by questionnaire following a SCT based teaching programme (274).

Systematic reviews looking into the effectiveness of a group based self-management education program compared to routine treatment in people with type diabetes has reported major improvement in lifestyle changes, clinical outcomes such as glycaemic control and psychosocial outcomes (275). Several studies included in this systematic review used a single theory such as social cognitive theory in their interventions (276, 304) whilst others used the empowerment model (277, 305). Other studies used a combination of theories such as SCT and social ecological theory (306) or combination of empowerment, and planned behaviour (307). A knowledge of these theories or models of health and education is valuable and can be applied to make interventions more effective in the health care settings.

### **2.2.19 Rationale for study and methodology**

Considerable research has been carried out related to various aspects of GDM. Quantitative epidemiologic studies have identified important risk factors related to GDM which have informed multiple national (42, 129) and international guidelines related to GDM (308, 309). Other quantitative studies have provided valuable information on perinatal and postnatal outcomes of GDM (310), including those following different types of intervention (7, 311, 312). Although the knowledge about the risk factors, prevalence and outcomes are informative at the population level they do not determine what happens at the individual level which is equally if not more impactful.

Qualitative researchers have investigated the factors affecting and perceptions of women with a diagnosis of GDM using various methodological perspectives. Qualitative studies using ethnography have provided insights or perceptions about GDM in a particular homogeneous groups or in different cultures but did not really describe the actual thought processes or inner experiences of GDM (313). Similarly studies related to GDM using grounded theory have been useful in providing theories rather than detailed descriptions of living with GDM (226). Existing

phenomenological studies have looked into associated aspects of GDM including effects of intervention (diet and physical exercise), the need for social support, perceived risk of T2DM, concern for baby, self-concern in addition to emotional responses of having a diagnosis of GDM (217, 221-223, 229, 249). A lot of these studies have revealed information on how women with GDM react emotionally and described other associated factors that influence them, but they have not managed to entirely focus on the actual lived experiences of acquiring a diagnosis of GDM.

Although pregnancy is meant to be a positive experience, an additional medical problem such as GDM and associated adverse maternal and fetal effects can rapidly change it into a distressful pregnancy. As previously discussed, pregnancy in itself can be a stressful state at the physiological, physical, and psychological level. Several studies have identified GDM as a potential risk factor for developing anxiety and depression during pregnancy (217).

In the last decade many studies have emphasized the psychological influences of having a diagnosis of GDM in pregnant women across many countries and how these aspects need to be addressed to improve the care of these women (229). However, there isn't much information in literature on any robust actions that have been taken to improve these aspects of care for women with GDM.

Following a diagnosis of GDM which universally brings a sense of worry of varying degrees to most women in the world, their first instinct is to gain information on the condition and to manage it in order to have a safe and successful pregnancy. Education is key in the management of GDM. Education sessions provided by most Trusts in UK are the mainstay of information for the women diagnosed with GDM. This education session usually delivered by a dietician or sometimes by the diabetes specialist nurse can be in the form of individual sessions. There has been no previous qualitative study using Max van Manen's phenomenology of practice to investigate women with GDM who have undergone a group structured education session following a new diagnosis of GDM.

The theoretical framework that has been chosen to investigate this study is Max van Manen's phenomenology of practice. Phenomenology of practice is a context sensitive form of interpretive inquiry. It is a human science research methodology that enables the reflective study of pre-reflective experiences. A human science methodology,

phenomenology consists of a combination of philosophical methods; human science and philological methods (314) (315).

Max van Manen's phenomenological method advocates the 4 life existentials which are used to guide the phenomenological process (316, 317). These 4 life existentials or lifeworld themes include: lived space (spatiality), lived time (temporality), lived body (corporeality) and lived human relation (relationality or communality) (316). Max Van Manen proposes that almost all human experiences in the world go through these four existentials (316). Hence studying the essence of a phenomenon through these 'life existentials' is an effective way of drawing nearer to understanding the phenomenon in question. In my study the phenomena being investigated are

- 'the lived experience of being diagnosed with GDM' and
- 'the lived experience of attending a 'Group' education session or 'One-to-One' education session following a new diagnosis of GDM'.

In this context, the important question to ask is: What is the lived meaning of 'being diagnosed with GDM as the pregnancy unfolds?' A true understanding of the 'lived experience of GDM' cannot completely be understood from an objective or subjective perspective but by understanding the way in which the women 'confront' the diagnosis of GDM (317). The early involvement of multidisciplinary HCPs takes the notion of a 'normal pregnancy' away from the women.

Understanding the psychology of the women with GDM to gain insight into their mind and behaviour is becoming increasingly important. This cannot be achieved by just obtaining information about their perception or opinions of GDM but by understanding their actual lived sensibilities of acquiring a diagnosis of GDM. Van Manen's phenomenology of practice enables a deeper enquiry and understanding into their emotions, behaviours, decision making processes, and actions through study of their various lived relationality, spatiality, corporeality and materiality (316).

Gaining a deeper understanding of the women's lived experiences and what dictates their behaviour has important practical and clinical implications. These are potentially amenable to interventional or behavioural changes. Anxiety and depression brought on by GDM or exacerbated by GDM is an area that can be targeted through a robust education programme throughout pregnancy and postnatally. GDM also provides a window of opportunity to try to delay or prevent development of T2DM which has

become a pandemic. Behavioural changes during pregnancy could positively influence health behaviour of the women, their children, and the family as a whole. Knowledge of risk of T2DM and obesity and how to tackle these issues could be taught. Valuable information gained from women's intrinsic experiences can help improve the quality of care and services provided to the women from a medical and nursing point of view. This can lead to implementation of new models of care. Most importantly, a phenomenological approach helps to highlight key issues which are important to the women especially those related to information and education. The latter can be addressed through improvement in existing education curriculums used for education programs or changing the way these are delivered.

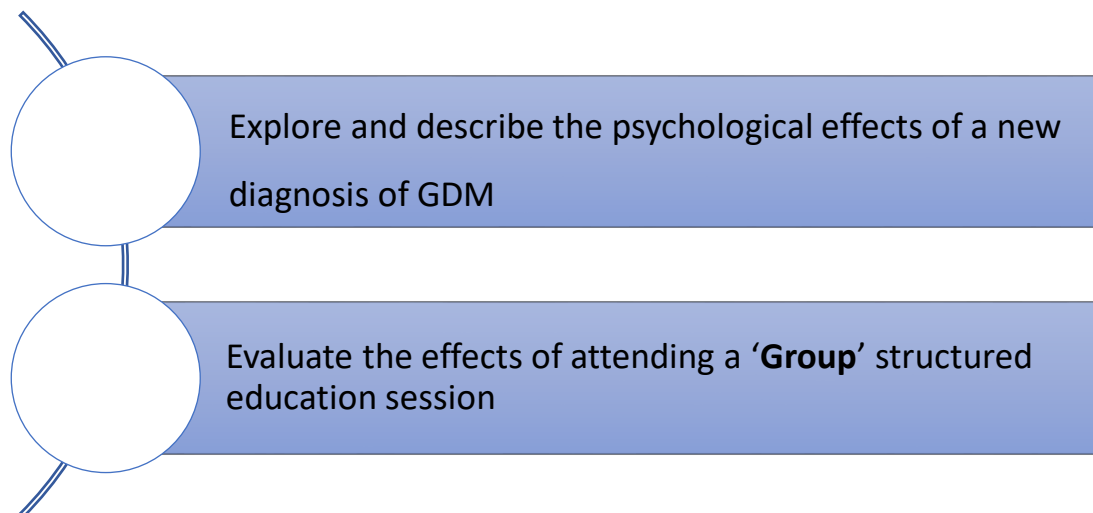
The standard care in UK for women newly diagnosed with GDM is to receive individual education by a dietician. A group structured education programme for GDM based on national criteria is delivered by trained dieticians at the Countess of Chester NHS Foundation Trust (COCH). This group structured education session at COCH is unique to Mersey region A. Since aspects such as patient's experience and behaviour components had not been considered in this education programme, the basis of my study was to evaluate the effects of women with GDM attending a structured group education session. This was compared to the standard care of one-to-one education session. Two questionnaires ('knowledge about GDM' and 'the psychological impact of GDM') were used to help in the evaluation of the these 2 phenomena under investigation. These questionnaires were used pre and post attendance to the education sessions, 4 to 6 weeks after the education session and 6 to 8 weeks postnatally.

## **2.2.20 Study Aims**

The two aims of the study are shown in **Figure 6**:

The first aim of the study was to explore the phenomenon of 'being newly diagnosed with GDM'. This was further elucidated by focusing on the following questions:

- What are the lived experiences of being newly diagnosed with GDM?
- What are the lived experiences of attending a structured 'Group' or 'One-to-One' education session following a new diagnosis of GDM?



*Figure 6: The two aims of the Study*

A qualitative methodology, more specifically the Van Manen's phenomenology of practice including the four life existentials (Spatiality, Corporeality, Temporality and relationality) was used to investigate this study [235, 283]. This approach enabled a deeper understanding of the phenomenon through in-depth analysis of the participants' interviews [235] followed by reflective thinking through the process of interpretive phenomenology which resulted in meaningful and descriptive written interpretation of the phenomenon. Detailed analysis of the emerging essential themes which represented the 'lived experience descriptions' of the women lead to new knowledge and provided deeper insight into the 'lived experience of being diagnosed with GDM' [234, 235].

The second aim of the study was to evaluate the experiences and knowledge of the women attending a Group structured education as compared to the traditional One-to-One education session.

The study population consisted of women who were diagnosed with GDM for the first time based on a positive 2- hours Oral Glucose Tolerance Test. These women were randomised to attend either a 'Group' education session or a "One to One" session.

The primary outcome of the study was to evaluate the:

- The lived experiences of women who were newly diagnosed with GDM

The secondary outcomes included the:

- Effect on GDM knowledge (cause of GDM, risk factors of GDM, maternal and fetal risks, risk of T2DM, management of GDM and effects of different food types on blood sugar levels)
- Perceived worry levels
- Knowledge recall post-partum
- Dietary behaviour at various stages of pregnancy.

The data obtained from the quantitative questionnaires would be useful in assessing the secondary outcomes i.e the knowledge of the women in various categories and at different stages of pregnancy and worry levels. The qualitative data which is in the form of emerging themes as explained above would add more insight into the phenomenon of ‘lived experience of GDM’ from a lived body, time, space and relationality perspective and how the themes can help inform existing issues in the management of women with GDM

## **2.3 Summary**

In chapter 2, I have described how women change their perception of a ‘normal’ pregnancy to a problematic one after being diagnosed with a medical problem such as GDM. I have also described several psychological states such as anxiety, stress and depression that can pre-exist in women which can worsen during pregnancy. These psychological issues can also arise during any pregnancy or could be as a result of GDM. I have presented studies from existing literature that have tried to explain the inter-relationships between GDM and anxiety and depression. Anxiety, stress and depression during pregnancy are risk factors that can result in negative maternal and foetal outcomes (146). The emotional and behavioural responses of women with GDM varies across the world and have been studied using several methodologies.

I have also discussed the important role of education in the management of GDM. The education provided to women is central in the management of GDM but can have a much larger impact in the lives of these women, who have an increased risk of developing GDM and T2DM in the future. I have also highlighted the positive and empowering influence of Health Belief Models, Social Learning Theory, and self-efficacy strategies in the self-management of certain medical conditions including diabetes. I have discussed the Health Belief Model used as a framework to evaluate



interventions in GDM. I have also described the Theoretical Domains Framework and Behaviour Change Wheel used in behaviour change interventions. The COM-B model and PRIME theory of motivation have also been thoroughly discussed including their application in several GDM interventions. I have emphasised the importance of enhancing and maximising the use of structured education for GDM which has a key role in positively influencing the future health behaviour of women with GDM and in reducing the risk of T2DM in the future. I have discussed the rationale of my study including the methodology to explain why it is important to understand the psychological impact of GDM from a woman's 'lived experiences' perspective. Lastly, I have outlined the aims of the study including the primary and secondary outcomes. In chapter 3, I will be discussing the theoretical frameworks that will be used to investigate this study.

## **Chapter 3 Methodological Perspectives**

Chapter 3 will present the research methodology and the underlying theoretical frameworks that will be used to investigate this study. A qualitative phenomenological methodology has been chosen to investigate the aims of this study. I will explain how descriptive phenomenology and the 4 life-existentials described by van Manen (317) will be used to explore the phenomena of ‘a lived experienced of a new diagnosis of GDM followed by an education intervention’.

I will explore other qualitative methodologies that have been used to investigate the impact of GDM and education and will justify the methodology I have chosen. I will describe the different types of phenomenology and highlight how descriptive phenomenology helps the participants explore the meaning of their experiences. I will describe how Van Manen’s four life existentials (lived time, lived space, lived body, and lived relations) will guide the interviews and subsequent analysis in this study. I will also describe self-reflective processes I used to remain unbiased whilst conducting this study.

### **3.1 Quantitative methodology**

Quantitative research used in natural sciences aims to test for hypotheses, and search for objective explanations for “cause and effects” pertaining to the subject matter under study. The quantitative approach tends to have a narrow focus and is usually context free with a majority part of the research work confined to laboratory settings but also extended to fieldwork (318). The gold standard of quantitative research is a double blinded Randomized Controlled Trial (RCT). It is considered the most powerful design in experimental clinical trials. In randomized clinical trials participants are randomly assigned to receive one of two or more interventions in comparative and controlled experiments. In these RCTs both the researchers and the subjects are unaware of the interventions allocated to the participants. The outcomes in this type of research are less biased compared to observational studies (319).

Quantitative data is collected by rigid and objective observations using measurements and/or completion of standardised questionnaires or surveys. Data analysis uses statistics to test for significance levels, reliability and validity of measurable outcomes which can be generalised. The quantitative researcher remains detached from the participants and data collected. Quantitative research has to be valid and reproducible.

Quantitative and experimental methods are typically used in clinical, biological and epidemiological research (318).

### **3.1.1 Quantitative GDM studies**

Quantitative studies related to GDM have focused mostly at the population level including factors associated with GDM, prevalence of GDM, management and clinical outcomes. Studies have demonstrated the prevalence of GDM to be variable worldwide being dependent on different populations being studied and is estimated to be 15.1% worldwide (320). The prevalence is higher in certain ethnic groups such as from Asia or Middle East (321, 322) and in people who are obese/overweight (6, 18). Quantitative studies have also shown the impact of various criteria used for diagnosing GDM on the prevalence of GDM (323, 324). Quantitative studies have confirmed the linear increase in risk of developing GDM with increasing maternal age (325, 326). Randomised controlled trials have investigated the optimal diet in gestational diabetes. One RCT suggested diets higher in complex carbohydrate and fibre and low in saturated fat might be effective in preventing hyperglycaemia after meals, reducing insulin resistance and preventing excess foetal growth (327). Other studies have found no difference in birth weight or adverse pregnancy outcomes when comparing patients on low-glycaemic index (GI) with high-GI or conventional high-fibre diet. (328, 329). Several RCTs have provided insight into the impact of interventions on perinatal and maternal outcomes of patients with GDM. An Australian RCT showed that patients with GDM who had intervention had less serious perinatal morbidity and showed improved quality of life (7). The Hyperglycaemia and Adverse Pregnancy Outcomes (HAPO) international multicentre study demonstrated strong correlation between hyperglycaemia during pregnancy and increased birth weight (21). Although quantitative studies have provided valuable information on several aspects of GDM they have not been able to capture the emotional aspects or 'lived experiences' of women with GDM.

### **3.1.2 Mixed method GDM studies**

Quantitative studies in the form of RCTs have investigated the perinatal and postnatal outcomes of gestational diabetes based on various forms of intervention including diet and or insulin as compared to routine antenatal care. These studies have shown

significant reductions in adverse pregnancy outcomes including large for gestational age births, macrosomia and shoulder dystocia (310).

Mixed quantitative and qualitative studies have been used to investigate the impact of education in women with GDM. These studies have been prospective or retrospective and used validated and/or non-validated questionnaires to assess the knowledge about GDM, quality of life and overall satisfaction following different types of education sessions (239, 330). A prospective study investigating the effect of GDM education provided by a multidisciplinary team as opposed to individual sessions reported improved GDM knowledge as well as satisfaction with the education sessions in both cohorts (239). Similar findings were reported in a study looking into online GDM education sessions using this method (331).

### **3.2 Qualitative Methodology**

Qualitative research explores the various perspectives and ‘life world’ of individuals and the meanings they attribute to their experiences. This is achieved by exploration, description and acquiring in depth knowledge of participants’ experiences and hence their life worlds (318). A qualitative approach provides an insider or ‘emic perspective’ (332) where the researcher attempts to investigate the participants’ unbiased feelings, experiences and perceptions without imposition of any external framework. The subjective accounts of the participants, their interpretation of their behaviours and actions, their intentions and motives help ‘uncover’ the meaning they give to their experiences, thereby providing an ‘insider’s view’ (318).

The qualitative process aims to derive explanations and theories from data obtained from participants through detailed non-standardised interview processes, observation, fieldwork, media and/or various documents. Context and natural settings, as well as the element of time, are important aspects of qualitative research. Sampling of participants in qualitative research can be purposive, theoretical or even flexible as the research progresses (318, 333).

An ‘empathic’ and non-judgemental approach is required in order to obtain insights from the participants’ perspectives. The researcher has to adopt a non-judgemental stance in order to gain access to the true thoughts and feelings of the participants. This leads to a relationship between the researcher and the participant which is built on mutual trust. In an interview, the researcher, as the listener, becomes the learner and

the participant becomes the teacher which leads to negotiation and sharing of ideas in a unique 'social science relation' (334).

'Social science relationships' have often been described as 'more enduring, negotiated and equal' (334). Once rapport and trust has been established the participants are empowered and discuss important and relevant issues more openly and also ask questions (318). The researcher's or outsider's point of view is referred to as the 'etic perspective' (332). This includes the researcher's preconceived ideas, personal experience, critical observation, description, analysis and interpretation of the phenomenon (332). The qualitative researcher and the participants being directly involved can influence each other, and the findings of the study (318, 333).

### **3.3 Theoretical Framework/Philosophies**

In addition to research strategy and design another important factor that dictates the choice of a research method is the theoretical perspective. This constitutes a set of underlying concepts that helps understand the social world and provides a framework to carry out the research work (335). Ethnography, constructionism, and phenomenology are examples of theoretical perspectives that inform qualitative methods (336, 337).

Grasping the underlying philosophic assumptions related to the research study is vital and forms the basis of the chosen method for the research (333). For instance, a phenomenological approach is used to study a specific phenomenon in relation to effects on individuals' life worlds. Data is usually collected through interviewing participants. On the other hand, if one were to study the social processes that exist within human interactions, a grounded theory approach is more appropriate. The grounded theory method collects data through observation of participants, interactions with others and interviews to generate a theory regarding the phenomenon in question. Researchers who are interested in studying the culture of a particular group of people choose ethnography. Ethnographers use observational techniques and analyse data obtained from interviews and various documents (333, 335). Hence, philosophical assumptions guide the research in the appropriate direction and provides the correct framework to produce credible, reproducible research (318).

### **3.3.1 Ethnography**

Ethnography which has its historical roots in anthropology (338-340) is concerned with describing a group, culture or community (318, 341). Four different types of ethnography that have been described including:

Classical ethnography (342)

Systematic ethnography (343)

Interpretive or hermeneutic ethnography (343)

Critical ethnography (344).

Irrespective of the type of ethnography fieldwork, immersion in the culture, and observation is central to uncover meanings of these behaviours (333).

Ethnographic studies have provided useful information on specific aspects pertaining to GDM. An ethnographic study in the PIMA population explored the attitude and perceptions of pregnant Pima women regarding their understanding of the diagnostic process of diabetes in pregnancy, concepts of health beliefs and future risks of developing diabetes (313). Based on the experiential information provided by pregnant women with diabetes, this ethnographic study made suggestions regarding barriers to attendance at group or individual educations and recommended programs for diabetes prevention (313). Ethnography is an appropriate methodology used to provide insights or perceptions about a phenomenon in a particular homogeneous group or culture but does not really describe the actual thought processes or inner experiences of the phenomenon.

### **3.3.2 Grounded Theory**

Grounded theory (GT) is another qualitative approach which focuses on the exploration of social processes that prevail within human interactions. GT approach has its roots in sociology, more specifically from symbolic interactionism which explores the processes of human interactions and social roles. Unlike other qualitative approaches, grounded theory does not require a theoretical framework prior to data collection. Researchers using grounded theory aim to generate a systematic theory from data collected through observation, interviews, documents, events, or visual and oral presentations. Although there is no hypothesis at the start of the study the researcher might occasionally use a prior interest or problems encountered previously as a starting basis. Data is collected from multiple sources including fieldwork

observations, participants' interviews, diaries, newspapers, literature searches and even the researcher's experience since 'everything is data' (345).

Data analysis is intricately linked to data collection and begins in the early stages, occurring continuously alongside data collection. There is progressive focusing of data collection as new information obtained leads to novel emerging ideas which can also change the direction of the research if the need arises. There are certain key aspects that are distinctive to GT compared to other qualitative methods including theoretical sensitivity, theoretical sampling, data analysis with different levels of coding, comparison of codes, core category and integration theory (346-350).

A previous study using grounded theory to investigate the experiences of pregnant women acquiring and living with a diagnosis of GDM came up with the emerging theory describing the women's experiences as that 'from stunned to balance' (226). The study also reported other experiences which described their pregnancy journey including: 'having a personal responsibility', 'being under surveillance', 'feeling socially apart', 'being sufficiently supported', 'changing the self-image', 'adapting to a new situation' and 'waiting for the ultimate truth' (226). An important point to highlight in the methodology used in this study is the women were interviewed twice: the first interview was at the end of the pregnancies or at the later stages of pregnancy and the second a few years later as a follow up interview. Moreover, the participants were mostly women who had had GDM in previous pregnancies. The interviews were conducted retrospectively and therefore the events, experiences and other anecdotes obtained from the women could be less accurate and also not reflective of actual 'lived experiences.'

### **3.3.3 Content Analysis**

Content analysis was initially described as an approach used to study sources from multimedia including films, verbal dialogues, cartoons and political speeches (351). Content analysis has undergone significant changes over time and now reflects more awareness of theoretical perspectives in the use of images, words, and other media. Content analysis now requires accurate use of handling, sampling and coding of unstructured data for the purpose of validity and reliability (352).

Several qualitative exploratory studies have been conducted in the last decade to explore the experiences of women with GDM. These studies have used structured or semi-structured interviews and qualitative content analysis to describe the perceptions

and health beliefs of pregnant women from various cultures about GDM and related issues (353-356).

### **3.3.4 Introduction to Phenomenology**

A modern-day definition of phenomenology is the study of the nature and meaning of phenomena. This process is achieved by focusing on the phenomena as they appear through our subjective experiences in order to provide a rich description of the lived experience (357). The fundamental aims of a phenomenological approach appear to be focusing on people's perceptions of the world they live in and their lived experiences (358), an understanding of the hidden meanings and essences of their experiences (359), and the orientation and ways of lived experiences (315). This is achieved by the phenomenological approach which uses certain assumptions about the way the world is viewed and can be known, as well as using processes to capture and describe experiential essences in order to reconstruct realities (360).

Phenomenology originated as a philosophical movement in the 19<sup>th</sup> century and later developed into an effective qualitative research method used in the fields of social sciences and psychology. However, phenomenology as a school of philosophy, was developed by the German philosopher Edmund Husserl [1859-1938] who was mostly influenced by the work of Brentano (361).

Two types of phenomenology emerged: transcendental or pure phenomenology by Husserl and existential phenomenology which was associated with later thinkers such as Martin Heidegger (1899-1976), Maurice Merleau-Ponty (1908-1961) and Jean Paul Sartre (1905-1980) (318).

#### **3.3.4.1 Transcendental Phenomenology (Descriptive)**

Husserl aimed to establish philosophy as a rigorous science as opposed to the existing Cartesian philosophy that was based on objectivity, empiricism and positivism through the method of phenomenology (362). He proposed that phenomenology is the method through which the 'essence' or the very core of a phenomenon can be understood (363, 364). Husserl developed several key concepts and words whilst he described the process of phenomenology. Husserl's phenomenology aimed to describe the constitution and experiences of the world through conscious acts. He proposed that the fundamental structure of consciousness is intentional (365). Husserl aimed to describe and study the world of experience which he termed the "lifeworld", which he



described as the “world of immediate experience,” the “world as already there,” and the “world experienced in the natural and primordial attitude” (314). In order to gain a pure understanding of the lifeworld, Husserl proposed that one has to forego one’s subjective and preconceived ideas and any other theories regarding the phenomena under study through a process called phenomenological reduction or “bracketing” (314, 366, 367). Husserl wanted to study phenomena as they present themselves to consciousness (368). He viewed consciousness as a direct grasping of a phenomenon (369) through an intentional process which was guided by human intention and without any inductive or mechanistic causation (370). The essential feature of this consciousness was ‘intentionality’ which was directed to an object (371). In phenomenology, consciousness refers to an individual’s consciousness of the world (358). Husserl’s transcendental or descriptive phenomenology aims to describe and provide a global view of the phenomena and meanings under study in an objective way and without the need of a ‘fine-grained’ view (372). Husserlian phenomenology essentially advocated a more descriptive approach with emphasis on consciousness and essences of the phenomena (357).

### **3.3.5 Intentionality**

The purpose of intentionality is to understand the worldly structure of consciousness. Intentionality describes the different ways human beings are ‘connected’ or ‘attached’ to the world in inseparable ways and how consciousness is always conscious of something. All our activities (feeling, thinking and acting) are ‘orientated to’ or ‘with’ the things in the world. We usually discover a person’s world or landscape in this way. However, since we are ‘in’ and ‘of’ the world we cannot step out of the world and view it in a detached view. We are not reflexively conscious of our intentionality with respect to the world. Intentionality is only available to the consciousness retrospectively. “The world is revealed to us as ready-made and already there” according to Merleau-Ponty (373). For instance, our experience of looking at a book from a phenomenological perspective is closely linked to intentionality. The book as it shows itself in consciousness is the phenomenon. The intentional ways in which the book ‘gives itself’, ‘shows itself’ or appears in consciousness characterises its phenomenality. There are various modalities in which the phenomenality of a phenomenon may appear or give itself (316, 317).

#### **3.3.5.1 Noema and Noesis**

Noema and noesis form part of the constituents of phenomenological intentionality or a way of seeing consciousness manifests itself. The world we experience is usually divided into subject and objects. In the phenomenological world, noema represents the object and noesis is the subject. Noema represents that to which we orientate ourselves to and noesis is the interpretive act or the way the phenomenon is experienced (358, 374)

### **3.3.6 Bracketing or Epoche**

Intentionality and essences were central to Husserl's phenomenology and has been adapted as part of Max van Manen's phenomenology of Practice. With use of consciousness as a starting point and intentionality the 'essence' or deeper understanding of a phenomena could be understood (375). Husserl also believed that in order to clearly describe an essence, phenomenological reduction (also called epoche) or bracketing is essential. Bracketing is the suspension of one's beliefs, individual bias, and prior assumptions about a phenomenon (376-379).

It is advisable for a qualitative researcher to clarify his/her ideas, any biases, suppositions, or presuppositions about the study topic prior to the start of the study.

This activity would facilitate enlightenment towards consciousness or the essence of the topic by approaching it in an open and unprejudiced manner (333). One of the ways to carry out bracketing is for the researcher to write down their pre-conceived ideas or pre-suppositions which can provide a point of reference and would enable more objective data collection and analysis (333). Another way which can help the researcher keep an open mind during the research process is to keep a journal. Journaling would enable them to perform a 'reality-test' between the observed research findings and what get documented (333). During qualitative studies, bracketing should be done before and repeated throughout data collection and analysis. Bracketing is also an iterative process that forms part of a reflexive journey (380). This process of self- disclosure makes the researcher more vigilant in case their data collection or analysis are becoming subjective or biased (333). To study and report the true meaning of the phenomena, bracketing is essential.

#### **3.3.6.1 Phenomenological Reduction**

Daily experiences of the lifeworld are usually taken for granted. Phenomenology is the way to gain access to the meaning structures of these lived experiences. This is

achieved through the method of reduction which works in 2 opposing but complementary ways: firstly by suspending or removing any obstructions to access the phenomenon through the process of bracketing or epoche; secondly by returning or leading back to the phenomenon through a step called reduction (381). The term reduction is derived from 're-ducere' which means to lead back. There are several modes and forms of reduction that have been described over time. The aim of the epoche and reduction is to return to the world as we live it in the natural attitude. There are various aspects and methodological gestures of the epoche-reduction process including: a sense of wonder, to be open to the lived experience, concreteness and different approaches. There are also different kinds of reduction including ontological, eidetic, radical, ethical and originary (317)

### **3.3.7 GDM studies using thematic analysis**

Interviews using interpretative phenomenological analysis approach have been used in many studies to investigate the experiences of women with GDM and have provided valuable information and recommendations (226, 227, 382). Some studies have provided insight into the various feelings women experience such as fear and distress and learning to whilst trying to adjust to the diagnosis of GDM (383). Other such studies have highlighted the state of shock that women experience on receiving the diagnosis, methods they use to come to terms with the diagnosis and the need for a supportive environment (229). Some studies have focused on cultural differences in the understanding of GDM and its complications amongst women (223). Despite being informative and insightful these studies have not really explored the lived experiences of being diagnosed with GDM and informed the particular decisions made or actions taken by patients following the diagnosis.

In order to explore the objectives of my study I have chosen Max Van Manen's hermeneutic phenomenology, more specifically Max van Manen's lived experience human enquiry using the life existentials (316). I have not chosen ethnography as my study is not focusing on women's experiences from different cultures or ethnicity. Whilst grounded theory has been used to study certain aspects of GDM as described previously had provided good insight into experiences about GDM, there is a lack of an underlying theoretical philosophy and more focus on social interactions whereas the focus of my study is the lived experiences of the women from the perspective of time, space, and relations.

### **3.4 Max van Manen's Phenomenology of Practice**

Following the establishment of Husserl's transcendental and Heidegger's hermeneutic phenomenology, other philosophers further developed their own views of phenomenology by adding or refining the original concept including Jean Paul Sartre, Ademo Giorgi, Hans-George Gadamer and Max van Manen (358, 372). Van Manen was influenced by Gadamer's hermeneutic phenomenology who proposed that all understanding in phenomenology depended on language. He advocated that understanding, language and interpretation was intricately linked (316, 358).

Max van Manen's phenomenology of practice as a human science represents a combination of the:

- philosophical method of phenomenological inquiry,
- human science methods and
- philological methods (315, 317).

According to Max van Manen the objectives of human science are to explain the meaning of human phenomena and understanding the lived structures of meanings. Van Manen describes a human science research approach, showing a semiotic use of the methods of phenomenology and hermeneutics. He defines phenomenology as a process that describes how one orientates to lived experience, hermeneutics as how one interprets the "texts" of life, and semiotics as the practical writing or linguistic approach to the method of phenomenology and hermeneutics (316).

Human science is rationalistic and based on the assumption that human life or experience can be made intelligible. To be rationalistic involves believing and using the power of thinking, insight and dialogue to understand and maintain a thoughtful and conversational relation with the world (316). However, human science acknowledges the complexity and the "ineffable" element to life and in order to understand the full range of human experience it cannot restrict itself to formal intellectualist interpretation of human reason.

Human science operates with its own criteria for precision, exactness, and rigour by providing rich, complete, and detailed interpretive descriptions of the entity or notion being studied in the text. Human science research is both 'strong' and 'soft' in that a strong and rigorous human science text distinguishes itself by its uniqueness, strength and resolve to stand up for notion in question. However, a human science can also be

soft, subtle or sensitive in order to enable reflective awareness of the meanings of life's phenomenon (316).

Hermeneutic phenomenological human science focuses on the human world "as we find it" in its multifaceted aspects and aims to engage and study people (men, women, children) in their natural day to day environment. Hence the situation becomes pivotal and the starting point for the purpose of analysis in phenomenological research (316). Max van Manen defines methodology as the theory behind method including the process used to choose what method and the reason why. Methodology refers to the philosophic framework, the important assumptions, and characteristics of a human science perspective. It encompasses the general orientation to life, the view of knowledge and an understanding of what it means to be human (316).

Van Manen's hermeneutic phenomenological research is a dynamic interplay of a combination of six research activities (316):

- i. Turning to the nature of lived experience.
- ii. Investigate the experience as we live it rather than pre-conceptualize it.
- iii. Reflecting on the essential themes which characterize the phenomenon.
- iv. Describing the phenomenon through the art of writing and rewriting.
- v. Maintaining a strong and orientated pedagogical relation to the phenomenon.
- vi. Balancing the research context by considering parts and the whole.

### **3.4.1 Turning to the nature of lived experience**

The starting point and end point of a phenomenological research is lived experience. This phenomenological inquiry is discovery orientated and aims to find more about the phenomenon and the world as immediately experienced (364). Phenomenology then transforms the knowledge of this phenomenon or "lived experience" into a textual expression of its essence. This text describes a reflexive re-living and a reflective account of a meaningful experience (316). Lived experience has been described as our immediate, pre-reflective consciousness of life or self-given awareness which is 'unaware of itself' (384). In other words, a lived experience has a temporal aspect where it is perceived immediately through consciousness and subsequently viewed in an objective way on retrospection through reflexive awareness (384). Lived experience has been described as the product of the soul's fulfilment and expansion of its existence. Thus, lived experience is believed to have a certain essence or a 'quality' that is recognized retrospectively (384). Other authors have explained the

meaning of an ‘experience’ as the ‘unity of a significant whole’ (385). An experience has a particular ‘structural nexus’ or a motif that provides a particular quality to it (384). Lived experiences are related to each other like patterns or units of meaning which form part of a bigger context which is deciphered through reflection (384). In addition to having a temporal structure, an individual experience is associated with qualities such as space, mood and shared world which is experienced by the individuals.

Meaning is assigned to these lived experiences through conversations, artwork, dreams and other interpretive acts and by creating memories (316). For instance, the act or experience of skydiving is much more than the mechanical process involved in this activity. It involves a combination of physical, mental, emotional, and learning aspects which upon conscious reflection makes it into a unique experience which is described as ‘skydiving.’ Hence through a reflective process a person with a “non-thematic consciousness” experiences different dimensions of life and ‘thematizes’ his experiences for e.g. skydiving, bike riding etc.

Phenomenology gives reflective expression to life experiences by ‘re-achieving a direct and primitive contact with the world’ (364). The reflective thinking is translated into reflective writing through the process of interpretive phenomenology which involves meaningful and descriptive interpretation of the lived experience. Humanness is expressed through language and it has been proposed that language, thinking and being are one (386). Thus, lived experience also has a linguistic structure (364, 387).

Hence it has been proposed that all human experiences and interactions could be translated and interpreted textually (317). Hermeneutic phenomenology in this situation could result in multiple and conflicting interpretations of texts (387). Thus, interpretation and analysis of lived experiences and actions have to be contextual and follow a sound methodological framework in order to prevent one from questioning various interpretations that may arise.

### **3.4.2 Investigate the experience as we live it rather than pre-conceptualize it**

An aim of phenomenological research is to study the essence of the phenomenon or lived experience. To be able to capture the essence of this phenomenon involves

defining the meaning of this essence, asking the relevant questions, and orientating oneself in relation to it. A phenomenological approach focuses on the ontic or concreteness and the ontological or nature of the essence. An accurate description of a phenomenon can be done through a linguistic construction. This involves determining the structure of a lived experience which will result in a novel and deeper understanding of nature and significance of this experience (316).

This phenomenological quest for the essence has often been compared to an artistic or creative attempt at providing a holistic, analytical, unique, sensitive, and powerful linguistic description of certain phenomenon of life. Grasping the meaning of the essence of a lived experience requires an orientation ‘to the things themselves’ (363). Turning to the phenomenon of lived experience requires re-establishing contact with the original experience and re-learning to look at the world by renewing the basic experience of the world (364). It also means submerging oneself and becoming full of the world and the lived experience.

Living the numerous experiences in life confers a certain wisdom to one which makes the person being referred to as “being experienced” (316)<sup>8</sup> The phenomenological researcher with his personal wisdom and experience of life has to explore the nature and various aspects of the lived experience.

The phenomenological researcher has to grasp the meaning of the lived experience that is being studied. In order to achieve this, the questions that are asked include: what is a skydiving experience itself for a person or what is it like for a person to skydive (387)?

In my study the question would be: what is it like for a pregnant woman to be told that she has been diagnosed with gestational diabetes? What is it like for a woman to live with a diagnosis of gestational diabetes? The focus of the phenomenological research is on the experience of being diagnosed with gestational diabetes and living with it.

### **3.4.3 Reflecting on the essential themes which characterize the phenomenon: formulating the phenomenological question**

Questioning is at the heart of a phenomenological inquiry. The main objective of phenomenological research, which is the study of lived experience, is achieved by answering the question: ‘what is the nature of the lived experience?’ or what is it like

to have a certain experience, for example the experience of having a particular diagnosis or an educational experience? (316). However, prior to attempting to answer a phenomenological question, the researcher has to identify and deepen his/her interest in the phenomenon in question. This profound interest in the lived experience serves as an initial guide to formulate the appropriate questions that will lead to the answer. True questioning and interrogation stems from the heart or the centre of our being (388).

The researcher has to be constantly aware and not deviate from the original phenomenological question and remain steadfast in the orientation to the lived experience (387). The researcher also has to question and establish his/her relationship in terms of knowledge and experience with the lived experience under study. The researcher asks: “What does it mean to be a teacher or a doctor?” or what is teaching? What is being a doctor? Although there is a lot of literature or theory regarding the answer to these questions, no one has been able to get to the essence of “teaching’ or ‘being a doctor.’ The question that needs answering is: What is it about a lived experience such as teaching that makes it possible for it to be what it is in its essence? (387)

To understand the essence of the question requires being open and keeping open the possibilities that may emerge (388). One way to keep oneself open to possibilities involves maintaining the deep interest in the phenomenon under study. In order to answer the phenomenological question, the researcher has to remain committed to the question but most importantly aim to ‘live’ the question and eventually ‘become’ the question. Only by going back to the question over and over again will a phenomenological researcher grasp the meaning or essence of the phenomenon (387). In experimental research, questions are usually stated as null hypotheses and have clearly written protocols that can be conducted by anyone other than the initial researcher. Unlike an experimental researcher the phenomenological researcher is personally involved in that the question is ‘lived’ by the researcher in addition to being clear and understood. Stating a question at the start of phenomenological research is not the end as the process evolves over time and other questions may emerge. Instead of posing the question at the beginning of the research sometimes the researcher captivates and draws the reader’s attention to the subject through phenomenological description and attempts to elucidate a first-person experience of the phenomenon (316).



The question of ‘what is a lived experience’ or what is it like to experience....?’ can be phenomenologically approached at a superficial and a deeper level. The deeper dimension to the question involves the ‘intelligibility’ of the phenomenological question. This could be fulfilled through existing knowledge and theories. However, a phenomenological researcher, by definition, cannot formulate or pre-empt theories or abstract knowledge about the subject in question. Phenomenological research gains knowledge through the study of the lived experiences of others in its various forms, through our own experiences and through who we are. Detailed phenomenological description and interpretation of this knowledge through writing leads to new knowledge or new theories (316).

In order to provide a true reflection of the lived experience, a thoughtful and reflective approach is important. Unlike other types of research, a phenomenological researcher distinguishes the superficial appearance and the essence of the phenomena. Through the process of reflection phenomenology brings more clarity to a phenomenon which was previously considered ‘obscure’ and evaded the intelligibility of one’s natural attitude to daily life. The reflection is always focused on the question of the constitution of the nature of the lived experience (316).

### **3.4.4 Describing the phenomenon through the art of writing and rewriting**

Phenomenological research is constantly involved in ‘bringing to speech’ of some phenomenon or lived experience through the process of writing. The process of thinking and expression with language is intricate and difficult to separate. It has been reported that thought, speech, rationality, and language derived their contemporary meanings from the same root: ‘logos.’ With time ‘logos’ has remained to mean ‘language’ which involves having a conversation, inquiring, or questioning. Therefore, through the application of language and thoughtfulness phenomenology enables a lived experience to be viewed exactly as it is. Heidegger reported the aim of phenomenology is ‘to let that which shows itself be seen from itself in the way it shows itself from itself’ (389).

Phenomenological research is labour intensive and requires a lot of effort from the researcher. The phenomenological researcher has to constantly strive to remain focused and orientated towards the original question and not get distracted or tempted

by preconceived ideas, speculations, narcissistic reflections, or abstract theories. A constant and strong interest has to be maintained with the aim to gain a deep and true understanding of the essence of the phenomenon under study. To orient oneself to a phenomenon involves showing a keen interest and to understand one's station and vantage point with respect to the phenomenon in question. For instance, someone who is interested in the field of pedagogy can orient to life as a parent or teacher. In my study I will be oriented as a medical doctor and partially as an educator in that I will always be a source of information for the women with gestational diabetes.

The aim of orientating to phenomenon is to acquire a concrete and as accurate as possible linguistic description of the lived experience. A possible interpretation about the nature of this lived experience can then be derived through the phenomenological processes of research and descriptive and interpretive writing (316). To remain oriented towards the phenomenon the researcher becomes fully animated and refrains from giving importance to superficial and false information (316).

An important limiting factor for remaining focused or oriented towards a phenomenon are the pre-conceptual beliefs of the researcher. It is important for the researcher to explain his assumptions, presuppositions, theories, understanding and beliefs about the phenomenon at the very onset. This awareness enables the researcher to come to terms with these pre-conceived assumptions and keep them at bay. This is an important aspect of reflexivity (316).

Phenomenological research is constantly involved in 'bringing to speech' of some phenomenon or lived experience through the process of writing. The process of thinking and expression with language is intricate and difficult to separate. It has been reported that thought, speech, rationality, and language derived their contemporary meanings from the same root: 'logos.' With time 'logos' has remained to mean 'language' which involves having a conversation, inquiring, or questioning. Therefore, through the application of language and thoughtfulness phenomenology enables a lived experience to be viewed exactly as it is. Heidegger reported the aim of phenomenology is 'to let that which shows itself be seen from itself in the way it shows itself from itself' (389).

### **3.4.5 Balancing the research context by considering parts and the whole.**

The phenomenological research process consists mostly in questioning the essence of the phenomenon. However, it is equally important to focus on the final outcome of phenomenological research, which is the production of a rich, structured, and interpretive text. The researcher occasionally can become absorbed in the interrogation phase of the research and give less attention to key details that will contribute towards a powerful text. It is imperative that the researcher keeps an eye on the overall design of the research study but at the same time give equal attention to parts that are important contributions towards the whole text or structure. There is a danger for the researcher to get too absorbed in writing that this can create a chaotic frame of mind and processes and aims might become blurred (317).

It is extremely important to intermittently take a step back to obtain a perspective on the overall picture/text as well realizing the parts that play a significant role in the final outcome (316). It is essential to inquire if the research question regarding the phenomenon is valid at the time the research is being conducted. Questioning whether the findings of the research question will be potentially adding new information to an existing body of knowledge regarding the phenomenon is also valid and should be revisited by the researcher (316).

## **3.5 Van Manen's life existentials**

The phenomenologist's fieldwork is the experiential lifeworld of human beings (317). The fundamental aim of the phenomenological inquiry is to explore the structure of the lifeworld. The human lifeworld which is experienced as lived experiences in everyday situations and through relations is often complex. These lived experiences can be described and interpreted as 'structures of meanings' or 'themes.' Humans at various stages in their lives can have multiple and different lifeworlds. The lifeworld experienced by a child is different to that of an adult. Hence, one individual can have a lifeworld of a teacher, a parent, a friend, a researcher and so forth. Lifeworlds can also vary with locations or at separate times of the day. An individual can experience different lifeworlds such as the lived world of work during the day and the lived world of home in the evening (390).

Max Van Manen proposes four fundamental lifeworld themes which are inherently present in the lifeworlds of all human beings irrespective of their social, cultural, or historical background. These lifeworld themes also known as “existentials” can guide the phenomenological research process:

- lived space (spatiality),
- lived body (corporeality),
- lived time (temporality) and
- lived human relation (relationality or communality) (316, 317).

All human experiences in the world go through these four existentials. The concept of existentials forming part of the fundamental structure of the lifeworld dates back to the work of Merleau Ponty (364). The four existentials play a fundamental role in the phenomenological processes of question formulation, writing and reflecting (315).

### **3.5.1 Lived space (Spatiality)**

Space in the physical world is often thought of in mathematical measurements of length, width, and depth or in geographical terms. However, in phenomenology, spatiality (lived space) describes felt space. Lived space has larger implications in the human lifeworld as it can contribute to its richness. People experience lived space differently. Exploring the nature of the lived space can reveal the quality of meaning it confers to the experience in question. The lived space can significantly impact on an individual’s feelings or experience. Being in a big city’s skyscraper can be intimidating and make the individual feel small. One can feel scared, trapped, or suffocated in a crowded elevator but can also have a feeling of being free in wide open space of nature. The felt space of a home or dwelling place provides a profound sense of security and well-being to an individual (317). A home provides a secure sanctity where individuals can be themselves and feel protected (386, 391).

A person who is depressed or lonely will have a different space experience even if situated in his/her secure home. A person visiting relatives in a hospital may not find the hospital space too scary. However, if the person was a patient, then his lived hospital experience could be terrifying and have other long-term implications (392). The felt space of being in an Intensive Care Unit (ICU) can be strange and frightening. An intubated patient waking up in ICU can feel estranged amongst new faces and lonely (393).

Inquiring into the nature of lived space can be very insightful. The type of space a person chooses to read or write, or any other activity can determine more about themselves and their world (316, 317).

### **3.5.2 Lived body (Corporeality)**

From a phenomenological perspective lived body or corporeality refers to the fact that we are always bodily in the world. The lived body is central to a person's existence (315, 394, 395). The first contact with an individual in his/her lifeworld or landscape is through his/her body. Having a body means that we exist in and with the body simultaneously. The physical body or bodily presence can reveal information about ourselves but can also conceal certain things in spite of ourselves (316). The body can lose its naturalness (315, 396) or may feel enhanced when subject to someone else's gaze. For instance, the body may turn awkward or bodily actions may become clumsy when subjected to critical gaze. On the other hand, the body may appear more graceful under a gaze full of admiration or a person may blush or appear radiant under the gaze of a loved one (316). Hence depending on how one feels about someone or something, the appearance of the latter may be distorted accordingly (316). For example, a study reported that patients waking up in an ICU bed and unable to talk or move thought they were in prison (392).

In good health people tend to take their body for granted. However, during critical illness the body feels under threat and emotions such as pain and discomfort draws attention to the body. This can also give rise to feelings of alienation from the body and distort the way one experiences the world (397). During periods of critical response many hormones are produced which further exacerbate the stress experienced by the body which result in further disruption and disturbance of the relationship with the body and world (398). Such patients often fail to fully understand or make sense of their experience (394, 395). This experience becomes embodied and can become alive when a person is confronted by similar stressful situations again (397).

When a lived body is deprived of sleep as a result of noise and other procedures the patient who is under a lot of stress (399) can be forced to perceive the ICU space differently or even misinterpret it (392, 400, 401).

### **3.5.3 Lived time (Temporality)**

Lived time (temporality) is subjective time as opposed to clock time or objective time. The perception of lived time changes according to our mood. For instance, lived time seems to speed up when we are happy and having a good time such as when we are on a holiday. Conversely, time seems to slow down when we feel bored such as in an uninteresting lecture or when we are under stressful situations such as in a dentist's waiting room (315, 316). Lived time also describes our temporal way of being in the world such as in the case of an elderly person recollecting past memories or a young adult orienting himself/herself to an open and bright future (316).

To gain a better understanding about a person, knowledge about their past, their present and their future aspirations is necessary. The past, present, and future are the temporal dimensions which form part of the person's temporal landscape. What occurs in the past of a person can have profound effects on his/her present. Memories and experiences leave their imprint on a person's being and can influence the ways in which the person behaves such as being confident or timid. People inherit mannerisms and gestures from parents, friends, teachers etc but can also modify and adapt them into their own. The language and words spoken by a person is often connected to their past such as the type of school attended or ethnicity born into or exposed to (316, 317).

Interestingly, the perception of the past can be altered by the stresses and pressures experienced in the present time. Individuals may re-invent themselves, change their perception about their present as well as their past. It is also believed the past can change itself due to the anticipation of the thought of living in a known or unknown future (402). Lived time also encompasses an individual's wishes, plans, and goals that one aspires for. In other words lived time shapes our present and future hopes and expectations (316, 317). A person's sense of identity can be influenced by 'lived time' in terms of experiences gained during childhood, work life or love life (317, 374). Heidegger (1962) describes the intricate relationship between time and 'being' stating there would be no being without time (389).

### **3.5.4 Lived other (Relationality)**

A person's life revolves around being and dealing with multiple relationships (403). The existential theme of relationality can guide the phenomenological reflection by inquiring how the self and others are experienced in the context of the phenomenon in question (374).

Relationality is the lived relation we maintain with others in the interpersonal space that we share with them. All the four existentials are inter-connected (374). An example of how relationality and corporeality are inter-related is when first encounter another person for the first time. We usually approach other people through bodily contacts such as handshakes or by embracing someone. Our first impression is usually that of their physical appearance and presence. This first physical impression can be later confirmed as we gain more information about the person through conversations or other physical sources such as letters, books (316) or nowadays the internet or social media. Conversational relations enable us to transcend our 'selves' whereby we gain a deeper understanding of other people.

In a larger social context, by developing relationships and exchanging experiences human beings develop a sense of purpose in life (316). Relationality helps inquire how the self-experiences relations in different lifeworlds. Love and friendship are phenomena that can be explored through the quality and importance of the relations in question. In the new era of social media and technology one wonders how the online interactions or contact compare or differ from face-to-face contacts (374).

Lived corporeality and lived space can influence relationality. In a phenomenological study, patients in ICU who felt separated from their loved ones felt vulnerable and lonely and treated the ICU staff as strangers as they did not trust the staff. Spatial dislocation and corporeal separation from family in critically ill patients in ICU affects their relationality and can also lead to more agitation (392).

Relation has been regarded by some phenomenologists as being central in understanding human phenomena particularly through by examining subjects such as love and eros (404) and the importance of sense of community (405).

### **3.5.5 Lived Technology (Lived cyborg Relations)**

The existential theme of technology is a recent concept that is becoming more relevant as humans have developed an intricate relationship with and dependency on

technology. Within the existential of ‘things and technology’, there are several types of ‘lived cyborg’ relations that have been described in the human experience (317). People experience technology in different ways. Most people take technology for granted in their day-to-day life. There are people who make the best use of technology to make their life more comfortable and these people adapt easily to the newer forms of technology. Conversely other people find technology challenging and hard to adapt to newer gadgets.

Many philosophers in the 1950s and 1960s had started discussing human experiential experiences with the computer from a phenomenological perspective described as the ‘empirical or ontic’ dimension of technology (406).

Heidegger describes technology as another way of experiencing contemporary life by being ‘a means to an end’ and allowing ‘things to be revealed’ (407, 408). However, he also warns of the danger of technology and its developments from which it might be difficult to escape (409). Other philosophers have developed a phenomenology to understand the various relations human have with technology as well as the role of ethics and politics in this context (410).

The phenomenology of technology in an important field of study which is being used to throw light on areas ranging from love, language, sex, community, language (404, 411). In the field of pedagogy, it has been used to influence teacher-student relations in the context of teachers adapting to new technology such as PowerPoint, smart boards etc (412).

Van Manen has described the important role of technology in medicine and its impact on the ethics of health science practices and the experiences of family and friends in intensive care units (413).

### **3.6 Approach to thematic analysis**

According to van Manen, theme analysis is not just a mechanical application of frequency count or coding of significant terms from transcripts, breakdown of a documentary or the use of coding software (317). Instead he posits ‘analysing’ thematic meanings of a phenomenon i.e. a lived experience is a creative, complex and insightful discovery (317). Thematic analysis is described as a process of ‘seeing meaning’ which is driven by ‘reduction’ or ‘epoche’ (316, 317). van Manen



recommends that while exploring themes texts should be treated as sources of information and meaning should be sought at the following levels:

- Wholistic reading approach where the phenomenological or significance of the whole text could be ‘captured’ (317).
- Selective reading to highlight certain ‘words’, ‘phrases’ or ‘statements’ (317).
- Detailed reading approach where attention is paid to every sentence or sentence cluster to look for meanings (317).
- Hence van Manen recommends the thematic analysis of a ‘phenomenon or lived experience’ should be analysed and presented as (i) a lived experience description [LED], (ii) converted into an anecdote, (iii) submitted to the wholistic, selective and line by line thematizations and (iv) themes used for some phenomenological reflective writing (317).

### **3.7 Reflexivity - My personal experience**

Prior to engaging in a qualitative inquiry, the researcher has to acknowledge and be aware of his personal influence on the study. Several definitions of reflexivity have been made including several connotations (414). Reflexivity can be defined as the responsibility of the researcher to examine his influence in all aspects of the qualitative inquiry through self-reflection (333). Reflexivity locates the researcher in the research project. It is the process where the researchers engage in explicit, self-aware analysis of their own role (415).

It is the responsibility of the qualitative researcher to be conscious of the subjective aspects of the study and to continuously reflect and critically analyse the effects of personal influence on the study (416). By taking a reflective stance and developing a self-monitoring process, the researcher is constantly aware of his own involvement in the study. This includes his interaction with the participants and different aspects of the study (318). Through the process of reflexivity, the researcher is able to enhance the quality of the study by minimising personal influence (333) (416).

Reflexivity can also be referred to as ‘critical subjectivity’ (417). This is where the researcher’s personal response and thoughts about the research and the research participants and his/her own social location in relation to the study are considered.

This is particularly important in health research where researchers have frequently been socialised into professional ways of thinking (318). Reflexivity is not only the

researcher's critical reflection of his/her role in the study but also on the process of data collection and the factors influencing it. Five types of reflexivity have been described (418) (415) (**Figure 7**). A challenging aspect of the hermeneutic phenomenology is the fact that the researcher most probably already has either some or an in-depth knowledge on the phenomena that is under investigation. This knowledge exists in the forms of assumption, perceptions, "scientific knowledge," "common sense" or "pre-understanding" (408) (317).

- 
- i. Introspection is the process of exploring one's personal experience and understanding to provide further insights and interpretations to the research.

---

  - ii. Intersubjective reflection focuses on awareness of the relationship between the researcher and the participants and how it may influence the research.

---

  - iii. Mutual collaboration results in an account involving the researcher and the participants' own reflections which can influence the study and the researcher has to be aware of this.

---

  - iv. Social critique: reflexivity here is related to the power relationship and the social position of the researcher and participant that the researcher must acknowledge.

---

  - v. Discursive deconstruction: the researcher has to recognise that language can lead to different meanings and must therefore acknowledge that the findings can have multiple interpretations or meanings in his/her writing or construction of the text

**Figure 7: Types of reflexivity used in research**

Due to the researcher's existing knowledge on the phenomena in question the researcher would be inclined to make interpretations about the study subject. In this case it would be ideal to keep one's knowledge completely aside which Husserl (314) referred to as "bracketing" which is difficult to achieve. Certainly, in my case, being in the medical field and already having an in-depth knowledge of GDM and its various aspects would make it challenging. Hence, the best way forward is to explicitly declare my pre-existing assumptions, theories, and presuppositions.

As a doctor training to be a specialist in the field of diabetes I have reviewed and dealt with pregnant women with diabetes throughout my career. However, as a researcher in the same field I realised that I will not be directly involved in the care of the participants and will be more of an outsider trying to gain first-hand information about their "lived experiences" from them. I found maintaining this separation between a physician and a researcher quite challenging initially. I was aware that my prior

knowledge in this area of study could influence or bias the interview process. For instance, I knew I had to be conscious not to be too 'medical' in my approach. I had to prepare myself mentally to take on the role of a researcher and refrain from getting involved in the management of their gestational diabetes because I assumed they would end up asking specific medical questions about their condition. For instance, during the interview, especially when some prompting was required, I had to ensure that I continued to use open questions and prompts that were not suggestive in any way. It was empirical that the answers provided by the participants were a vivid description of their own feelings and experiences described in their own words.

Occasionally it could be frustrating when the answers to the questions were mono syllables. I had to improvise and find ways to continue the conversation and extract more information from them without influencing them. Getting to know the participants had its own merits and disadvantages. Having built a rapport with them allowed them to be more open with me. Some of them found a friend in me and would share their happy and sad moments. Occasionally they would become emotional, and the conversations could be overwhelming. Some participants found the interview an outlet to vent their various frustrations with system such as mix up in their bookings, multiple appointments etc. The latter was another source of information to be fed back to the relevant departments for further improvement.

We are always taught to provide patient centred care. Learning about phenomenology has enabled me to make further changes in my communication skills and the level of openness and responsiveness from patients has been very noticeable. In fact, my interactions with my surroundings and the way I view the world around me is very different after learning concepts such as life world, lived spatiality, corporeality, temporality, and relationality.

### **3.8 Summary**

In chapter 3, I have explained the underlying reasons for using descriptive (transcendental) phenomenology and van Manen's 4 existentials as the underlying theoretical frameworks to investigate this study rather than other methodologies such as grounded theory or ethnography. Phenomenology would enable the in-depth study of the 'lived experiences' of the women and understand the meanings they attach to these experiences. This descriptive phenomenological process will 'capture' the

‘essence’ of the phenomenon under study, which is ‘the lived experience of being newly diagnosed with GDM and attending an education session’.

The importance of remaining objective whilst conducting a phenomenological inquiry was emphasized. I have described how I applied the processes of ‘bracketing’ and reflexive processes such as self-reflection and declaring my biases prior to the start of the study to maintain my objectivity as a researcher. Van Manen’s 4 life existentials as part of his phenomenology of practice has also been described in detail. Understanding the participants’ unique experiences from these 4 life existentials of ‘lived body’, ‘lived time’, ‘lived relations’ and ‘lived materiality’ will provide deeper insight into their daily ‘lived experiences’ which will result in a rich descriptive text. In chapter 4, I will describe the practical methods that have been used in designing and conducting this study.

## Chapter 4 Methods

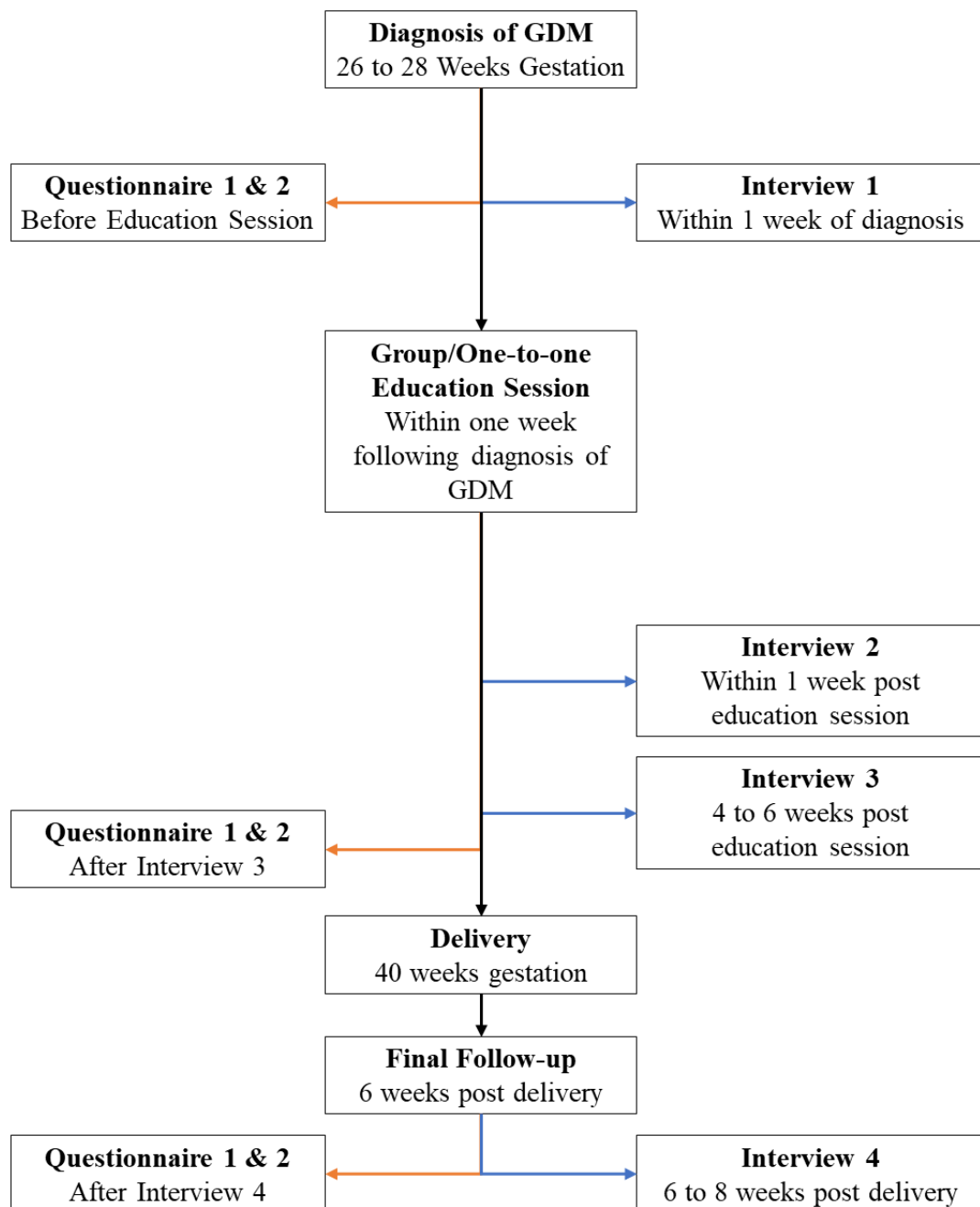
Chapter 4 will describe the methodological procedures that were used to set up and conduct this study. Based on the research question, a qualitative design, more specifically a phenomenological approach was chosen. There was a quantitative aspect to the design involving the completion of 2 questionnaires. This chapter will also describe the inclusion and exclusion criteria for participants as well as the processes involved in recruitment and randomisation. Ethical approval was gained prior to recruiting eligible women in the study. This ensured the study was conducted within ethical boundaries. Appropriate steps were taken to safeguard the confidentiality of data and ensure the comfort of the women involved. This chapter will also discuss the informed consent process including provision of information in detail. These methods used were to ensure that the study adhered to adequate research standards and the study design could be reproduced.

### 4.1 Study Design

The structure and type of delivery of education imparted to women diagnosed with GDM varies in UK. Education has traditionally been provided on a one to one basis but can also be imparted in group sessions. A ‘Group’ structured education programme for GDM based on national criteria is delivered by trained dieticians at the Countess of Chester NHS Foundation Trust (COCH). This group structured education session at COCH is unique to Mersey region and provides a unique opportunity to positively influence future health behaviour in this high-risk population. This education session is delivered in the form of a Power-point presentation and consists of relevant educational information for the women diagnosed with GDM. However, patient’s experience and specific behaviour components to this presentation have not yet been considered. The research design of this study was primarily qualitative but also had a quantitative aspect. The qualitative aspect consisted of semi-structured face to face interviews which were audio recorded. The quantitative approach involved the use of two unvalidated questionnaires which aimed to explore the women’s knowledge about gestational diabetes, their fears, expectations, and their general attitude towards being tested for GDM [Appendix A and B]. **Figure 8** shows an overview of the study design.

## 4.2 Ethics

This study was an NIHR (National Institute of Health and Research) approved study. The IRAS (Integrated Research Application System) Project ID is 167063. This study was carried out in accordance with the ethical principles in the Research Governance Framework for Health and Community Care (Second Edition, 2006) (419) which was updated in 2017 [HRA, 2017]. This study (REC reference: 15/LO/1754) was approved by the London Research Ethics group [Appendix C].



*Figure 8: Flow Chart of interview and questionnaire schedule*

### 4.3 Study site

This study was conducted in the Diabetes and Endocrinology and the Obstetrics and Gynaecology departments at the Countess of Chester Hospital. Pregnant women with GDM who were registered in this hospital were approached to participate in this study. Interviews were conducted between February 2016 to December 2016.

### 4.4 Study Population

This study focused on women with a diagnosis of GDM. Detailed history was obtained from patients before they had the Oral Glucose Tolerance Test (OGTT). The information obtained included their gestation, pre-existing medical conditions, medication they were taking and other demographic details. Once a potential candidate was identified their medical records were checked to ensure they complied with the following inclusion and exclusion criteria (**Figure 9**).

<b>Inclusion criteria</b>	Pregnant women who have been diagnosed with gestational diabetes for the first time following a positive oral glucose tolerance test.
	A participant may enter the study from 26 to 28 weeks of pregnancy.
	The participants would be registered patients within the Countess of Chester Hospital.
<b>Exclusion criteria</b>	Women with previous gestational diabetes or other types of diabetes
	Women with Polycystic Ovaries Syndrome.
	Women who are unable to communicate in English and unable to give informed written consent. This group will be provided an educational session on an individual basis through an appropriate interpreter if required.

*Figure 9: Study Inclusion and Exclusion Criteria*

### 4.5 Sample size

The sample size in a phenomenological study depends on the type and nature of the study (317). The aim in a phenomenological study is to obtain just the right amount of experiential material to produce a reflective phenomenological text that describes the

'phenomenon as it is'(317). Sample sizes ranging from one to ten people are considered sufficient in phenomenological studies (420). Phenomenological studies usually consist of small sample sizes as the processes of data collection and analysis are lengthy and time consuming (333). Previous studies using phenomenology to study aspects of GDM have used 6 to 12 participants (421, 422). The intended sample size at the start of my study was 30 but we ended up recruiting 32 eligible participants. Consecutive and purposive sampling were used in this study. Women who were confirmed to have a diagnosis of GDM for the first time and who met the inclusion criteria were approached to consider participating in the study.

## **4.6 Duration of Study**

The length of the study was approximately 24 weeks (minimum 18 weeks to maximum 24 weeks) and a little longer for those with delayed delivery. This duration considered the gestation of the participant at the start of the study, the gestation at delivery and the last contact with the participant at 6 to 8 weeks post-partum. Pregnant women from 26 to 28 weeks of gestation were eligible to be included in the study.

## **4.7 Recruitment**

Pregnant women with risk factors for GDM undergoing an OGTT at the ante-natal Medical Disorders Clinic in the maternity department of the Countess of Chester Hospital were approached to participate in this study. Recruitment was consecutive.

### **4.7.1 Identification of patients**

The nurses working in the ante-natal clinic are usually responsible for performing the OGTT and informing the women of their results via telephone either on the same day or the following day. The ante natal nurses were informed about the study via internal email and their help was sought in identifying women who had a positive test. Other members of staff involved in the study included diabetes and obstetric Consultants, the diabetes research nurse, diabetes midwife and the midwives in the antenatal department who had been informed prior to the start of the study via internal e-mail.

A list of patients who were undergoing the OGTT was obtained from the ante-natal Medical Disorders Clinic on a daily basis. Women who had a positive OGTT were



identified by the diabetes midwife and ante-natal nurses and verified by the researcher. Further background information about the women were obtained from their case notes. Eligible women included women who had been diagnosed with Gestational Diabetes (GDM) for the first time based on a positive oral glucose tolerance test (OGTT) and met the inclusion and exclusion criteria as described previously.

#### **4.7.2 Discussion of Study with women with GDM**

The researcher approached the eligible women by phone and requested permission to discuss the study. Once the women agreed to have a conversation, the following points about the study and their involvement should they agree to participate were discussed:

- They were informed they would either receive education in a ‘**Group**’ session or in a ‘**One-to-One**’ (face to face) session.
- They would be interviewed which will be audio recorded and would be required to complete 2 questionnaires.
- They were also reassured that every effort would be made to schedule their interviews on the same day as their clinic appointments.
- They were informed that irrespective of the type of session they would attend, they would receive the same information related to gestational diabetes.
- It was emphasized that their participation in the study would be voluntary, and they could decline to take part, and this would not affect their future care within the Trust.
- They would have to sign a consent form prior to the start of the study.

#### **4.7.3 Provision of information**

- Permission was also obtained for a Patient Information Leaflet to be sent by post for those women who agreed to participate. A sample of the Patient Information Leaflet Version 2 [PIF V2] is included in **Appendix D**.
- Participants were encouraged to read the patient information leaflet prior to start of study and contact the diabetes research department if they have any queries regarding the study.

- They were reassured that all information provided would be kept confidential should they decide to participate.
- Their identities would remain anonymous but data from the recordings would be quoted word for word for analysis and writing purposes.
- The women were informed their participation was voluntary and they could withdraw from the study at any time without providing any reason. They were reassured their withdrawal from the study would not affect their current or future treatment.
- They would be provided 48 to 72 hours to make an informed decision before deciding to participate in the study.

The women who had a prior preference for a ‘Group’ session or a ‘One-to-One’ session were not included in the study. Their details were passed on to the diabetes nurses who arranged for them to have their preferred education sessions.

## **4.8 Consent Process**

The women were invited to consent for the study on the day their education session was scheduled. This was because the gap between first discussion with the women about the study and attendance at the education session was a minimum of one week. To ensure there was no delay in receiving the education session it was convenient for the day of the consent to be on the same day the education session was due to be held. This was also arranged in this way to avoid extra visits to the hospital solely for the purpose of consent.

The participants were requested to attend one and half to two hours before the education session. The women were asked if they had any questions about the study. Once they agreed to participate, they signed the consent.

## **4.9 Randomisation process**

The letter G was inscribed on each of 15 sheets of paper and the letter F was inscribed on each of another set of 15 sheets of paper. These sheets of papers were securely folded and shuffled in a large envelope. G and F represented the ‘Group’ and the ‘One-to-One’ session, respectively. The participants were requested to pick out one folded

sheet of paper from this envelop and reveal whether they were in the ‘Group’ or ‘One-to-One’ session.

## **4.10 Intervention**

Following the randomisation process, the women would receive education in either the ‘Group’ or ‘One-to-One’ session.

- The women were randomised to the ‘Group’ session would proceed to the first interview and completion of questionnaires before attending the ‘Group’ education session on the same day.
- The women who were randomised to the ‘One-to-One’ session would also complete the questionnaires and participate in the interview. They would proceed to their education session on the same day or another day of their choice, within the same week.

### **4.10.1 ‘Group’ Education Session**

A group structured education session for women with GDM was introduced in 2013 at the Countess of Chester Hospital. This session is led by a dietician working in the diabetes department. The key features of the ‘Group’ education session are as follows:

- The ‘Group’ sessions were delivered once weekly and consisted of a PowerPoint presentation lasting for 30 to 40 minutes.
- At the end of the session the women are taught how to check their capillary blood glucose levels with a glucometer and record their blood sugar levels in a diary.
- They are provided with appropriate leaflets containing information about GDM. This whole process takes approximately one hour. The ‘Group’ session runs once a week throughout the year.
- The content of the presentation includes the definition of GDM, its complications, management with diet, information about different types of food especially carbohydrates and the range of blood sugar levels they should aim for.

- The curriculum of the presentation was developed by the diabetes dietician and the diabetes consultants based on recommendations made by the NICE guidelines (34) and other sources.
- The partners of the women with GDM can also attend the ‘Group’ session. The number of women attending this session can range from 2 to 10.

A copy of the contents of the presentation is included in **Appendix E**.

#### **4.10.2 ‘One-to-One’ Education session**

Traditionally the diabetes team had used a ‘One-to-One’ session to educate pregnant women about GDM. Appointments would be offered to women to attend to these sessions. These sessions could be delivered either by a diabetes specialist nurse, diabetes dietician, or diabetes consultant.

- For the purpose of this study the contents covered in the ‘One-to-One’ session were similar to the ‘Group’ session but delivered verbally without the help of any multimedia.
- The dietician or diabetes specialist nurse mostly delivered the sessions.
- The participants were also provided with the same leaflets as the patients in the ‘Group’ session.
- The session typically lasted 20 to 30 minutes.
- The women were taught how to use a glucometer to check their capillary blood glucose levels after at the end of the education session. Their target blood glucose levels were also discussed.

#### **4.11 Questionnaire Choice and Design**

This study used two questionnaires in addition to interviews to investigate the aims of the study. The first questionnaire explored knowledge, risk factors and treatment about gestational diabetes (GDM) in women who had been newly diagnosed with this condition [**Appendix A**]. Due to lack of an existing validated questionnaire related to knowledge in GDM we designed one based on information obtained from the NICE CG 63 diabetes in pregnancy guidelines (34) and the validated Adult of Diabetes Knowledge (ADKnowl) questionnaire (423).

The second questionnaire [**Appendix B**] inquiring about the women's attitude towards being tested for GDM has been taken from a previous study (217) and modified to include few other questions regarding changes in lifestyle following a diagnosis of GDM. These questionnaires were reviewed and discussed by the supervisor, the diabetes specialist nurses and dieticians. It would take 5 to 10 minutes to complete both questionnaires

All the participants would be requested to complete questionnaires at interviews 1, 3 and 4 either before or after the recorded interviews [**Figure 6**]. If the recorded interview was scheduled on the day of the education session, they would be requested to complete the questionnaires at the end of the interview and before their education session.

#### **4.11.1 Piloting of Questionnaires**

The two modified questionnaires could not be piloted but due to limited time. However, the 2 questionnaires, the Patient information Sheet and the consent Form were reviewed by non-medical staff and a woman with previous history of GDM who provided feedback on these documents. This was documented in my IRAS (Integrated Research Application System) application for the current project. In the IRAS section regarding the aspects of research process where 'I have actively involved patients, service users, and/or their carers, or members of the public,' the following had been documented:

The modified version (version 2) of the Patient Information Sheet, Consent Form and the two questionnaires have been reviewed by the following lay individuals:

- A woman who currently has gestational diabetes and attending the antenatal clinic
- A woman with post gestational diabetes who attended for a 6 weeks post-natal oral glucose tolerance test.
- Three medical secretaries.

They all found the documents easy to read and understand and non-technical.

#### **4.12 Interviews**

Interviews are a common qualitative method of gathering information. However, interviews have specific objectives in phenomenological studies. Interviews can be

used to gain a better understanding of a particular phenomenon by exploring and collecting narrative data. Interviews can also help develop a conversational relationship with the interviewee who reveals his meaningful experiences (317).

A semi-structured interview as opposed to an unstructured interview was selected for this study. Semi-structured interviews enable the researcher to strike a balance between focusing on the phenomenological question and simultaneously allow the interviewee to give their narratives in a spontaneous manner (424).

A few pointers were provided to the participants prior to the start of the interview, for instance, "How did you feel when you received the news about having been diagnosed with gestational diabetes? or "what were your thoughts during the education session?". The aim of these questions was to help overcome any nervousness/anxiety that the participants may experience due to the prospect of being recorded whilst they are speaking. These pointers were open ended but could also provide the participants a sense of direction to start their thought process without influencing them in any way.

Prior to the start of the interview the participants were informed that if they felt uncomfortable at any point during the interview, they can wave as a sign indicating that they would like the interview to be paused or stopped.

## **4.13 Interview schedule**

Every effort had been made to reduce the burden on participants by keeping contact to a minimum and by scheduling interviews on clinic appointment days. The timing of the interview was also flexible for their convenience.

### **4.13.1 Interview 1**

This took place within a week of the diagnosis of GDM after the participant had read the Patient Information Leaflet (PIL) and provided written informed consent. Interview 1 was conducted prior to attending the 'Group' education session. Depending on the participant's choice and availability, the first interview could also take place few days (1 to 2 days) prior to the 'Group' education session.

For the patient who was randomized to the 'One-to-One' (face-to-face) education session, the first interview could take place on the same day they were randomised or a different day which was convenient for the patient but preferably within a week.

### **4.13.2 Interview 2**

This would take place within 1 to 2 weeks following attendance at the ‘Group’ or ‘One-to-One’ education session. A convenient date and time were agreed with the participant. All efforts were made to schedule the interview on the days they were attending for their clinic appointments to minimize extra visits to the hospital. They would be able to reschedule their appointment if it was within the time frame of the study.

### **4.13.3 Interview 3**

The third interview was scheduled 4 to 6 weeks following attendance at the education session. The interview was scheduled on the days they are attending their clinic appointments to minimize extra visit to the hospital. They would be able to reschedule their appointment if it is within the time frame of the study.

### **4.13.4 Interview 4**

Interview 4 would ideally take place at 6 to 8 weeks post -delivery. Prior to scheduling interview 4 it would be ensured that there had been no maternal or neonatal complications. This would involve close follow up of the neonate and the mother through in-patient post-natal reviews or retrospectively from the hospital maternal and paediatric records. This would be carried out by the researcher. The GP practice would also be contacted to ensure the well-being of the mother and the baby in the post-natal period (6 weeks) following discharge from the hospital.

Interview 4 would be cancelled if any issues are identified with the mother or the baby.

The relevant specialties involved in the care of the participant as well as the GP would be informed by email of the participant’s involvement in the study. An alert would also be placed on the hospital computer system to inform the researcher if the participant is admitted in hospital or any other hospital attendance.

## **4.14 Patient Safety**

The participants could become overwhelmed or upset whilst talking about their new diagnosis. Prior to the start of the interview the participants were informed that if they felt uncomfortable at any point during the interview, they could wave as a sign

indicating that they would like the interview to be paused or stopped. If the participant experienced any distress or anxiety following the recorded interview, they would be offered a debriefing session by a member of the midwifery team, or they might be referred for counselling sessions with the diabetes psychology team. The issues would be discussed with the relevant individual and appropriate help and/or counselling offered.

Information provided regarding their increased risk of type 2 diabetes especially if they are learning about this for the first time could potentially be upsetting or worrisome. The distress of this new knowledge would be counterbalanced by explaining the modifiable risks that exist by providing lifestyle and dietary advice to assist participants in reducing their risk of developing type 2 diabetes in the future.

The time commitments of the participants may be a risk in data collection. Some women may not have enough time to complete the questionnaires on the day. In these cases (except for those to be completed prior to the education session) will be offered the option of completing the questionnaires at home and sending them back in pre-paid envelopes provided. Potentially, this can in turn result in low return turnover rates. Contacting participants by phone will be an option to increase patient engagement and participation.

The list of women attending for the test is usually kept securely in the maternity outpatient department at the Countess of Chester Hospital. Other healthcare professionals (diabetes consultants, diabetes midwife, midwives, ante-natal nurses, and diabetes specialist nurses) who can help identify eligible participants are directly involved in the routine ante-natal care of the participants and are aware and compliant with the Data Protection Act (1998) (425), the Caldicott Report (1997) (426) and the NHS Confidentiality Code of Practice (2003) (427). It was ensured that only the researcher and healthcare professionals directly involved in the care of the participants would have access to identifiable personal information of the participants which would minimise the risk to breach of confidentiality.

In circumstances where confidentiality must be broken, appropriate departments will be contacted directly. Participants will be made aware of the departments that have been contacted. The participants will be asked for their consent prior to be referred to any other services.



## **4.15 Confidentiality during interviews**

The interviews occurred between the researcher and each participant only. This was carried out in a research office in the Diabetes department at the Countess of Chester Hospital. The participants were aware from their written consent forms that any information pertaining to them and what they would discuss during the interview would remain strictly confidential. They had also been informed and agreed for their words or sentences only to be quoted verbatim for the purposes of writing up of the findings.

The audio-recorded interviews were transcribed by one person only (medical secretary) who formed part of the diabetes department. The audio tapes were automatically erased as they were typed. No copies of the audio tapes were made.

## **4.16 Data Storage**

Data will be anonymized through codes. Participants involved in the research study will be assigned a subject number which will be used exclusively throughout the research. Electronic data relating to the participants will be stored on NHS computers within limited access folders on a computer network with a password-protected login. Most data collected would be stored electronically in files which are password protected. The recorded tapes would be erased at the end of the study.

Completed questionnaires would be stored in the Diabetes Research Unit which is a secure facility that requires codes for access. These codes are known to members of the diabetes research team only.

Paper documents and electronic data were archived and sent to a storage facility (Data Space Storage). These will be destroyed after 15 years.

## **4.17 Validity of Study**

There are different ways to ensure the validity and reliability of a qualitative study. These methods will be applicable to the type of study (428). Prolonged engagement and observation in the field is one of the methods. In my study I tried to spend as much quality time with the participants whilst undertaking the semi-structured interviews. The ideal way is to spend time with patients in their natural environment but due to

the nature of this study and for the convenience of the participants, the interviews had to be taken in the hospital settings. During the interviews, their expressed feelings or emotions were verified or clarified by further questioning within the same interview.

I also revealed my presuppositions and biases prior to the start of my study through the process of bracketing as previously discussed (314, 428). My main bias was that I was a specialist in GDM but had to conduct the interviews by suspending my prior knowledge on the subject. I did not assume any comments made by participants but probed further for clarification within the interview sessions. Due to the nature of the study and strict timeline for the interviews it was not possible to share the transcripts with the participants. Rich descriptions of the women's 'lived experiences' have been provided in the results in the form of narratives or quotes obtained from the transcripts (428). Themes and sub-themes were revealed following contextual analysis of the transcripts. During the data analysis of the transcripts the themes that were emerging were discussed and peer reviewed by one of my supervisors. The neutral and objective feedback on the findings provided a fresh perspective on the findings.

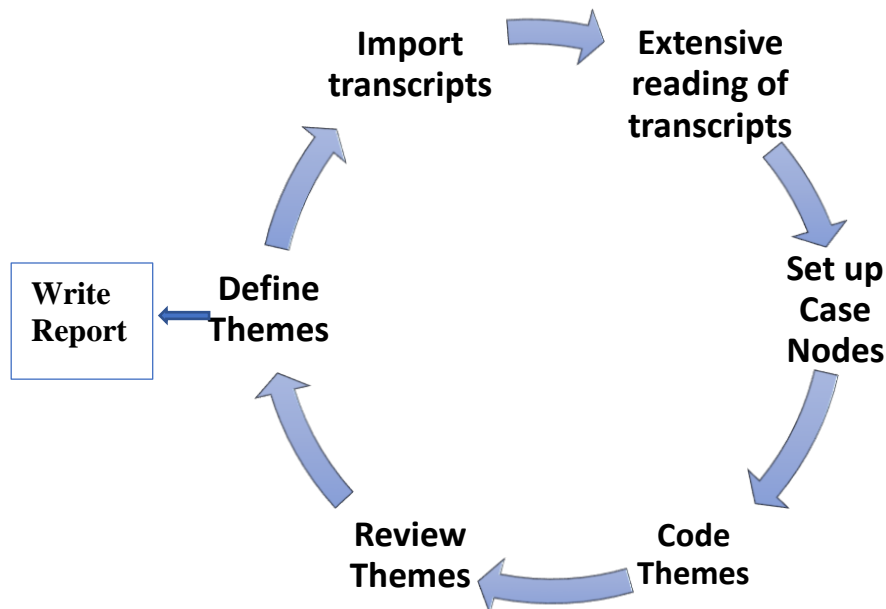
Van Manen advocates that the validity of a phenomenological study cannot be fulfilled by predetermined procedures such as 'members check' or 'triangulation of methods' (317, 428). Instead, validity can be sought from the insightful and thorough interpretive processes used during the phenomenological study to obtain original insights about the phenomenon or lived experience (317).

## **4.18 Thematic Analysis**

The quantitative analysis of the questionnaires was performed using Excel and SPSS (429). Excel was used to collect data from the 2 questionnaires. Paired t -Test was used to calculate the difference in mean scores for only question 1(1b) from the 'Impact of diagnosis of GDM' questionnaire.  $P < 0.05$  was considered significant. The study sample was not large enough to do more statistics.

The aim of the thematic analysis was to gain insight into the women's lived experiences by revealing the 'phenomenon or lived experience' under study in the form of 'Lived Experience Descriptions' (LED) (317). Thematic analysis was conducted using the NVivo 12 Software (430) and guided by principles outlined by van Manen (317). The verbatim transcripts obtained from the audio recorded interviews from all the women were transferred into the NVivo 12 software (430).

Extensive reading of the transcripts and subsequent line by line analysis was carried out leading to nodes. Nodes represented phrases or words that were repeated by a majority of the women. These nodes or sub-nodes represented the themes that represent the LEDs (317). The themes were used to write a reflective text. The steps, using NVivo software, to conduct a thematic analysis is shown in **Figure 10**.



*Figure 10: Steps involved in thematic analysis using NVivo software*

## 4.19 Summary

In chapter 4, I have described the stepwise processes involved in the conception and execution of this study. This was made possible by an appropriate design of the study which had Ethics approval. Several processes were put in place to ensure the safety of participants and that of data collected. Eligible women were well informed before they were randomised, and they provided informed consent. Several steps were taken to ensure the women's interviews took place at a convenient time. Every effort was made to make them comfortable during the interviews including the option to stop the interview. Steps were taken regarding data confidentiality, storage, and disposal.

All these methodological processes contributed to the smooth and safe conduction of this study within a healthcare setting. The data collection process in terms of timely completion of questionnaires and conduction of semi-structured interviews was also described. The software used for quantitative and qualitative analysis has also been detailed. In chapter 5 and 6, I will be presenting and discussing the results from the quantitative and qualitative analysis respectively.

## Chapter 5 Quantitative Data Analysis

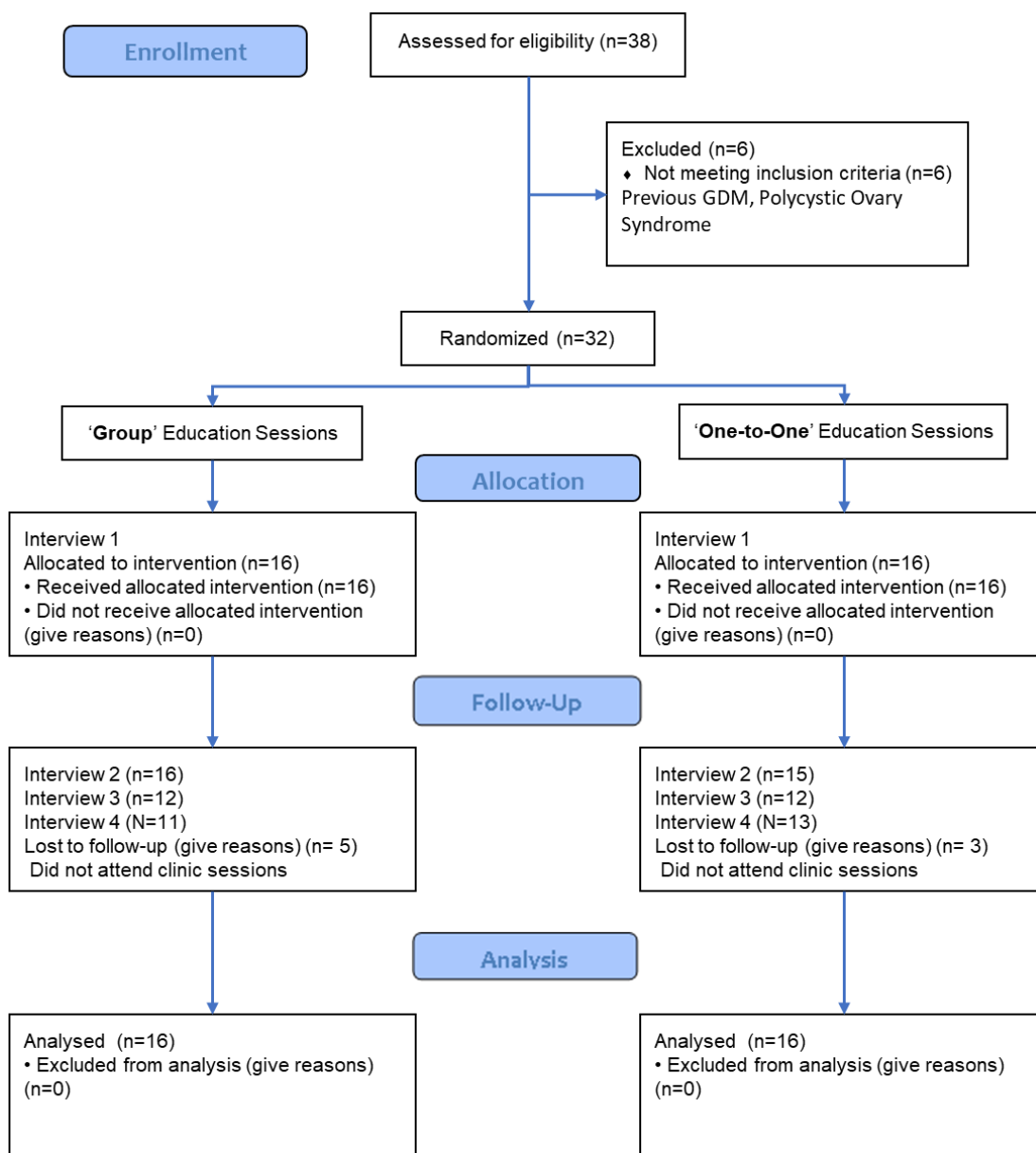
Chapter 5 will present the quantitative findings from this study. This involves exploring the demographic details of the women as well as their risk factors for developing GDM. Another important aspect of the quantitative analysis was the analysis of the two questionnaires which were completed by the women at specific intervals during the course of the pregnancy. The results from the questionnaires will help evaluate the knowledge of the women about GDM pre and post education intervention. Further comparative analysis of the answers would provide more information regarding any differences in knowledge between the women attending the 'Group' or 'One-to-One' education sessions.

### 5.1 Demographics

32 participants were recruited and randomised in this study. 16 (50%) of the participants attended the 'Group' sessions. The remaining 16 (50%) attended the 'One-to-One' sessions. A total of 38 women who had undergone an OGTT were approached (**Figure 11**). 6 women were excluded from the study as 4 of them had previous GDM and 2 women had Polycystic Ovaries Syndrome as per the exclusion criteria. The women were recruited from middle of January 2016 to the middle of February 2016. There were 32 women (16 in the 'Group' and 16 in the 'One-to-One' session) at the beginning of the study. 24 women (11 in the 'Group' and 13 in the 'One-to-One' session) were followed up in the post-partum interview.

Lack of time, personal reasons, and maternal or the child related health issues were the main reasons for these 8 women not attending for their post-natal OGTT. These women were contacted by the ante-natal nurses and their post-natal OGTT were re-arranged. There were no adverse events reported during the course of the study. None of the women withdrew from the study. There was no missing data.

## CONSORT Flow Diagram



*Figure 11: Consort Flow diagram showing recruitment, randomisation and number of participants remaining at each stage*

**Table 3** summarizes a comparison of the demographic features including age, ethnicity, gravida (G) status, Body Mass Index (BMI) and marital status of the participants in the ‘Group’ and ‘One-to-One’ education sessions.

*Table 3: Participant demographics by intervention (‘Group’ and ‘One-to-One’)*

<b>Demographics</b>	<b>‘Group’ session (N=16)</b>	<b>‘One-to-One’ session (N=16)</b>
<b>Ethnicity</b>		
<b>White British</b>	16 (100%)	12 (75%)
<b>Black</b>		2 (13%)
<b>Indian</b>		1 (6%)
<b>Other</b>		1 (6%)
<b>Age (years)</b>		
<b>Mean (SD)</b>	33.0 (6.5)	30.7 (3.5)
<b>Range</b>	24.0 – 54.0	25.0 – 40.0
<b>Gravida status</b>		
<b>Median</b>	2	2
<b>Range</b>	1 - 4	1 - 6
<b>BMI (Kg/M<sup>2</sup>)</b>		
<b>Mean (SD)</b>	31.0 (9.6)	29.0 (6.9)
<b>Range</b>	20.8 – 55.6	20 – 46.2
<b>Marital status</b>		
<b>Married</b>	13 (81%)	9 (56%)
<b>Co- habiting</b>	3 (19%)	3 (19%)
<b>Single</b>	0 (0%)	4 (25%)
<b>Employment Status</b>		
<b>Employed</b>	14 (87.5%)	14 (87.5%)
<b>Unemployed</b>	2 (12.5%)	2 (12.5%)
<b>English Speaking</b>		
<b>Native</b>	14 (87.5%)	12 (75%)
<b>Non-native</b>	2 (12.5%)	4 (25%)

SD- Standard Deviation. BMI- Body Mass Index

The age range of the women in the ‘Group’ session was wider. Although the women were randomised it appears that most of the women were predominantly Caucasian in both ‘Group’ and ‘One-to-One’ attenders. The median gravida status in both ‘Group’ and ‘One-to-One’ attenders was 2. The BMI in both cohorts of participants was similar but the BMI range was much larger in the “Group” participants.

28 participants were employed. Their jobs were mostly in the following categories: clerical, healthcare settings, and administrative. Only four of the participants (2 from each cohort) were unemployed. The majority of the women were native English speakers [Group: 87.5%; One-to-One: 75%] [Table 3].

**Table 4** describes the risk factors which were the indications for an Oral Glucose Tolerance Test (OGTT) in these women.

*Table 4: Indications for OGTT in women attending ‘Group’ and ‘One-to-One’ sessions*

<b>Indications for OGTT: risk factors</b>	<b>‘Group’ session (N=16)</b>	<b>‘One-to-One’ session (N=16)</b>
<b>BMI &gt; 30 only</b>	3 (18.7%)	3 (18.7%)
<b>BMI &gt;30 + FHx of diabetes</b>	3 (18.7%)	4 (25.0%)
<b>FHx of diabetes</b>	4 (25.0%)	4 (25.0%)
<b>Glycosuria X 2</b>	3 (18.7%)	2 (12.5%)
<b>Glycosuria + polyhydramnios</b>	0 (0.0%)	1 (6.3%)
<b>Previous macrosomia</b>	1 (6.3%)	0 (0.0%)
<b>LGA</b>	2 (12.5%)	2 (12.5%)

BMI- Body Mass Index (BMI); FHx- Family History; LGA- Large for Gestational Age

The most common indications in terms of risk factors for GDM in all the women were a BMI > 30 and a Family History [FHx] of diabetes or a combination of high BMI and family history of diabetes (‘Group’ session 19% and ‘One-to-One’ session 25%). The proportion of all the participants in the ‘Group’ with a BMI of > 30 M<sup>2</sup>/Kg was 40.6% (13/32). In UK the prevalence of women with a known BMI ≥35 at any point during pregnancy who give birth ≥ 24 weeks’ gestation is 4.99% and the prevalence in a pregnancy BMI ≥40 (Class III is 2.01%) (431). Obesity can result in poor maternal and foetal outcomes. Women who are obese have an increased risk of GDM, hypertensive disorders (pre-eclampsia), hyperlipidemia and circulating inflammatory markers during pregnancy (432). Obesity can also lead to increased rate of caesarean sections and shoulder dystocia (432).

## **5.2 GDM Knowledge and Self-Management**

### **Questionnaire Analysis**

All the 32 women (100%) completed the baseline ‘GDM Knowledge and Self-Management Questionnaire’ prior to the 1<sup>st</sup> interview. 97% (31/32) of the women completed the questionnaire at the 3<sup>rd</sup> interview. Only 72% (23/32) of the women completed the questionnaire in post-natal period. The women who were unable to attend for their interviews due to personal reasons did not complete the questionnaires.

#### **5.2.1 All participants data at Baseline, Follow-up 3 and 4**

The data analysis from the ‘GDM Knowledge and Self-Management Questionnaire’ is summarised in **Table 5**. The ‘GDM Knowledge and Self-Management Questionnaire’ consisted of 6 main questions with multiple parts to them. These 6 questions were related to general knowledge about GDM, risk factors for GDM, maternal and foetal effects of GDM, management of GDM, the risk of T2DM development following GDM and the effects of different foods and drinks on blood sugar levels.

The results showed the baseline knowledge of all the women about GDM (Question 1) was quite good with women answering the questions correctly in proportions ranging from 84% to 100%. These proportions increased after each education session (94% to 100%) and were sustained in the post-partum period (96% to 100%) except for a decrease in the proportion of women answering the question about GDM being a life-long condition (91%). This demonstrates good recall about general information about GDM in the short and medium term.

All the participants demonstrated good awareness of risk factors in question 2 (obesity, previous GDM, FHx of diabetes) with high proportions at baseline (88% to 97%) which increased post education session (97 to 100%) and remained similar (96% to 100%) in the post-partum period. The two risk factors which the women were less knowledgeable about were ‘previous macrosomia’ and women from ‘certain ethnic group in high-risk areas’ with baseline proportions of 59% and 56% respectively. Following the education sessions there was an increase in the number of women answering this question correctly (71% to 87%) but remained suboptimal in the post-partum period (78% to 82%).



*Table 5: Proportion of women providing correct answers to the GDM Knowledge and Self- Management Questionnaire*

<b>Gestational Diabetes (GDM) Knowledge and Self-Management</b>			<b>Baseline (Interview 1)</b>		<b>Follow-up 1 (Interview 3)</b>		<b>Follow-up 2 (Interview 4)</b>	
<b>Question</b>	<b>Answer</b>	<b>n=32</b>	<b>n=31</b>	<b>n=31</b>	<b>n=23</b>			
<b>Q1.</b>	Which of the following applies to gestational diabetes?							
	It is a lifelong condition?	No	32	100.0%	30	96.8%	21	91.3%
	It only occurs during pregnancy and goes away after giving birth.	Yes	27	84.4%	30	96.8%	22	95.7%
	It is due to an imbalance between insulin and glucose levels in the body.	Yes	29	90.6%	29	93.5%	23	100.0%
	It may require medication as part of its treatment.	Yes	29	90.6%	31	100.0%	23	100.0%
<b>Q2.</b>	The following can increase the risk of developing gestational diabetes:							
	Women who are overweight/obese or have a body mass index (BMI) above 30 kg/m <sup>2</sup>	Yes	31	96.9%	30	96.8%	22	95.7%
	Women who have previously given birth to a baby weighing 9 pounds (4.5 kg) or more	Yes	19	59.4%	22	70.9%	18	78.3%
	Women who have previously been diagnosed with gestational diabetes	Yes	28	87.5%	31	100.0%	22	95.7%
	Women who have a family history of diabetes (blood relative with diabetes)	Yes	29	90.6%	31	100.0%	23	100.0%
	Women who come from an area where the prevalence of diabetes is high (such as Pakistan, India, South Asia, Bangladesh, Caribbean, and the Middle East)	Yes	18	56.3%	27	87.1%	19	82.6%
<b>Q3.</b>	Gestational diabetes can have risks to the pregnant women as well as the developing baby?							
		Yes	27	84.4%	30	96.8%	21	91.3%
<b>Q4.</b>	Are the following interventions important in managing gestational diabetes?							
	Restricting calorie intake and taking moderate exercise (of at least 30 minutes daily).	Yes	28	87.5%	31	100.0%	20	87.0%
	The need to start on anti-diabetic tablets to control blood sugar levels?	Yes	9	28.1%	29	93.5%	20	87.0%

### Gestational Diabetes (GDM) Knowledge and Self-Management

			Baseline (Interview 1)		Follow-up 1 (Interview 3)		Follow-up 2 (Interview 4)	
Question		Answer	n=32		n=31		n=23	
	The need to add insulin if blood glucose levels are not well controlled?	Yes	24	75.0%	30	96.8%	23	100.0%
<b>Q5.</b>	Did you know that women who have GDM have an increased risk of developing type 2 diabetes in the next 5 to 10 years' time?	Yes	27	84.4%	29	93.5%	22	95.7%
<b>Q6.</b>	Please respond to each of the following statements about the effects of food on blood glucose levels:							
	Sugary foods raise blood glucose levels.	TRUE	32	100.0%	31	100.0%	23	100.0%
	Starchy foods (e.g. potato, bread, etc) raise blood sugar levels.	TRUE	25	78.1%	26	83.9%	20	87.0%
	Protein foods (e.g. meat, cheese, etc) raise blood glucose levels.	FALSE	21	65.6%	23	74.1%	17	73.9%
	Alcohol-free wines and lagers have no effect on blood glucose levels.	FALSE	16	50.0%	24	74.4%	20	87.0%
	Full fat foods affect blood glucose levels more than low fat foods.	FALSE	13	40.6%	16	51.6%	11	47.8%
	Any amount of fresh fruit can be eaten with little effect on blood glucose levels.	FALSE	22	68.8%	29	93.5%	20	87.0%
	Fresh, unsweetened fruit juice can be drunk freely with little effect on blood glucose levels.	FALSE	22	68.8%	24	77.4%	18	78.2%

With the women being Caucasian, they may not have been familiar with 'ethnicity and high prevalence areas' being a risk factor and probably not relevant for them to recall this information. Previous macrosomia is an important risk factor for GDM (6) (42) and with all women being monitored on a regular basis for the foetal dimensions it was surprising that the women did not answer this question correctly. There was a moderate improvement in the women's knowledge about GDM affecting both the mother and the baby (Question 3) with baseline proportions of 84% rising to 97% post education session and decreasing to 91% in the post- partum period.

Regarding management of GDM (Question 4), the women were aware of the need for calorie restriction and exercise as well as the 'need for insulin if required' at baseline (75% to 87%) and these proportions increased post education session (97% to 100%). These proportions remained sustained for 'insulin use' in the post-partum period (100%) but a reduction (87%) was noted for the question of 'calorie restriction and exercise'. The latter is an important part of lifestyle modification which the women are advised to continue in the post-partum period and life-long to prevent obesity and T2DM. This highlights the need for some form of continual education in these women post- partum. The women's knowledge about the need to start on anti-diabetic medication to treat GDM was quite low at 28% which increased to 94% after the education sessions but reduced slightly in the post-partum period (87%). This demonstrates a positive effect of the education session on the knowledge of the women.

Question 5 was related to the women's knowledge about the effect of various food products on blood sugars levels. Other than sugary and starchy foods raising blood glucose levels, the women's knowledge about other food products' (protein, alcohol-free wine, fresh fruit juice, full fat food, unsweetened fresh juice) effect on blood glucose levels were lower at baseline with proportions ranging from 41% to 69%. A major improvement was noted in the women's knowledge about the 'amount of fresh fruit juice' and 'alcohol-free wines' affecting blood sugar levels with proportion of 94% and 74% respectively following the education session. These proportions remained reasonably high at 87% in the post-partum period. The proportions of women answering correctly for the remaining food products (protein, full fat food, fresh unsweetened juice drunk freely) at baseline was low (40 %to 69%). These showed a rise following the education sessions (74% to 94%) but remained suboptimal

in the post-partum period (48% to 78%). Knowing about the sugar content and effects of blood sugar levels on various food types can be challenging and needs appropriate education and reiterations for longer term recall.

The women's baseline knowledge about the risk of developing T2DM after having had GDM was reasonably high at 87% and this increased to 94% post education session and sustained in the post-partum period (96%). It is very important for women with a history of GDM to be aware of the increased risk of T2DM in the future. This should remind them to have an annual check for T2DM.

### **5.2.2 Participants data by education intervention, 'Group' or 'One-to-One', at Baseline, Follow-up 3 and 4**

**Table 6** summarises the data analysis of the GDM Knowledge Questionnaire with a breakdown of the 'Group' and 'One-to-One' attenders. The baseline knowledge about risk factors for GDM (Question1) was different in the 'Group' and 'One-to-One' attenders. The proportion of women in the 'Group' and 'One-to-One' attenders were relatively comparable at baseline for the following risk factors: high BMI (94% v/s 100%); FHx (94% v/s 88%) and having previous GDM (88% v/s 88%).

The study results showed the women's knowledge about previous macrosomia being a GDM risk factor was low at baseline in the 'One-to-One' (63%) and lower in 'Group' attenders (50%). These proportions increased post education session but remained suboptimal in the 'One-to-One' women (67%) in the post-partum period but were higher in the 'Group' attenders (90%).

The proportion of 'Group' attenders knowing about GDM resulting in maternal and foetal risks was low (69%) compared to the 'One-to-one' attenders (94%) at baseline. These proportions increased following the education session and were 100 % for the 'Group' and 92% for the 'One-to-One' attenders in the post-partum period.

The proportion of women in the 'Group' session knowing about the 'need to add in insulin if blood sugar levels were not controlled' were lower (75%) compared to the 'One-to-One' attenders (81%) at baseline. This knowledge improved to 100% in the post-partum responses.

**Table 6: Proportion of women in ‘Group’ versus ‘One-to-One’ session providing correct answers to the GDM Knowledge and Self- Management Questionnaire**

Gestational Diabetes (GDM) Knowledge and Self- Management		Answer	Baseline (Interview 1)		Follow-up 1 (Interview 3)		Follow-up 2 (Interview 4)	
			Intervention		Intervention		Intervention	
Question			‘One-to-One’ (n=16)	Group (n=16)	‘One-to-One’ (n=15)	Group (n=15)	‘One-to-One’ (n=12)	Group (n=10)
<b>Q1.</b>	Which of the following applies to gestational diabetes?							
	It is a lifelong condition?	No	16 (100%)	0 (0.0%)	15 (100%)	14 (93.3%)	10 (83.3%)	9 (90.0%)
	It only occurs during pregnancy and goes away after giving birth.	Yes	13 (81.3%)	13 (81.3%)	15 (100%)	13 (86.7%)	12 (100%)	9 (90.0%)
	It is due to an imbalance between insulin and glucose levels in the body.	Yes	15 (93.8%)	14 (87.5%)	15 (100%)	13 (86.7%)	12 (100%)	10 (100%)
	It may require medication as part of its treatment.	Yes	15 (93.8%)	14 (87.5%)	15 (100%)	15 (100%)	12 (100%)	10 (100%)
<b>Q2.</b>	The following can increase the risk of developing gestational diabetes:							
	Women who are overweight/obese or have a body mass index (BMI) above 30 kg/m2	Yes	16 (100%)	15 (93.8%)	14 (93.3%)	15 (100%)	11 (91.7%)	10 (100%)
	Women who have previously given birth to a baby weighing 9 pounds (4.5 kg) or more	Yes	10 (62.5%)	8 (50.0%)	10 (66.7%)	10 (66.7%)	8 (66.7%)	9 (90.0%)
	Women who have previously been diagnosed with gestational diabetes	Yes	14 (87.5%)	14 (87.5%)	15 (100%)	15 (100%)	11 (91.7%)	10 (100%)
	Women who have a family history of diabetes (blood relative with diabetes)	Yes	14 (87.5%)	15 (93.8%)	15 (100%)	15 (100%)	12 (100%)	10 (100%)

**Gestational Diabetes (GDM) Knowledge and Self-Management**

Question	Answer	Baseline (Interview 1)		Follow-up 1 (Interview 3)		Follow-up 2 (Interview 4)		
		Intervention 'One-to-One' (n=16)	Group (n=16)	Intervention 'One-to-One' (n=15)	Group (n=15)	Intervention 'One-to-One' (n=12)	Group (n=10)	
	Women who come from an area where the prevalence of diabetes is high (such as Pakistan, India, South Asia, Bangladesh, Caribbean, and the Middle East)	Yes	9 (56.3%)	9 (56.3%)	14 (93.3%)	11 (73.3%)	10 (83.3%)	9 (90.0%)
<b>Q3.</b>	Gestational diabetes can have risks to the pregnant women as well as the developing baby?	Yes	15 (93.8%)	11 (68.8%)	15 (100%)	14 (93.3%)	11 (91.7%)	10 (100%)
<b>Q4.</b>	Are the following interventions important in managing gestational diabetes?							
	Restricting calorie intake and taking moderate exercise (of at least 30 minutes daily).	Yes	13 (81.3%)	14 (87.5%)	14 (93.3%)	15 (100%)	9 (75.0%)	9 (90.0%)
	The need to start on anti-diabetic tablets to control blood sugar levels?	Yes	4 (25.0%)	6 (37.5%)	13 (86.7%)	14 (93.3%)	9 (75.0%)	9 (90.0%)
	The need to add insulin if blood glucose levels are not well controlled?	Yes	13 (81.3%)	12 (75.0%)	15 (100%)	13 (86.7%)	12 (100%)	10 (100%)
<b>Q5.</b>	Did you know that women who have GDM have an increased risk of developing type 2 diabetes in the next 5 to 10 years' time?	Yes	12 (75.0%)	13 (81.3%)	13 (86.7%)	13 (86.7%)	11 (91.7%)	9 (90.0%)
<b>Q6.</b>	Please respond to each of the following statements about the effects of food on blood glucose levels:							
	Sugary foods raise blood glucose levels.	TRUE	16 (100%)	16 (100%)	15 (100%)	15 (100%)	12 (100%)	10 (100%)
	Starchy foods (e.g. potato, bread, etc) raise blood sugar levels.	TRUE	11 (68.8%)	14 (87.5%)	11 (73.3%)	13 (86.7%)	9 (75.0%)	9 (90.0%)

**Gestational Diabetes (GDM) Knowledge and Self-Management**

Question	Answer	Baseline (Interview 1)		Follow-up 1 (Interview 3)		Follow-up 2 (Interview 4)	
		Intervention 'One-to-One' (n=16)	Group (n=16)	Intervention 'One-to-One' (n=15)	Group (n=15)	Intervention 'One-to-One' (n=12)	Group (n=10)
Protein foods (e.g. meat, cheese, etc) raise blood glucose levels.	FALSE	10 (62.5%)	10 (62.5%)	12 (80.0%)	11 (73.3%)	8 (66.7%)	7 (70.0%)
Alcohol-free wines and lagers have no effect on blood glucose levels.	FALSE	9 (56.3%)	8 (50.0%)	12 (80.0%)	13 (86.7%)	10 (83.3%)	9 (90.0%)
Full fat foods affect blood glucose levels more than low fat foods.	FALSE	3 (18.8%)	4 (25.0%)	8 (53.3%)	7 (46.7%)	7 (58.3%)	4 (40.0%)
Any amount of fresh fruit can be eaten with little effect on blood glucose levels.	FALSE	12 (75.0%)	11 (68.8%)	15 (100%)	13 (86.7%)	10 (83.3%)	9 (90.0%)
Fresh, unsweetened fruit juice can be drunk freely with little effect on blood glucose levels.	FALSE	11 (68.8%)	12 (75.0%)	11 (73.3%)	12 (80.0%)	9 (75.0%)	8 (80%)

The knowledge about the need to start anti-diabetic medications for GDM was low in both cohorts at baseline [‘Group’: 38% and ‘One-to-One’: 25%]. Following the education sessions, the proportion of correct answers increased [‘Group’: 93%; ‘One-to-One’: 87%] but these proportions dropped in the post-partum period, more so in the ‘One-to-One’ attenders [‘Group’: 90%; ‘One-to-One’: 75%].

Less than 90% of women at baseline [‘Group’: 88%; ‘One-to-One’: 82%] were aware of ‘calorie restriction and moderate exercise’ being used in the management of GDM. The ‘Group’ attenders scored 100% after the education session but dropped down to 90% in the post-partum responses. The proportion of women providing correct answers after the ‘One-to-One’ education session increased to 93% but there was a decline to 75% in the post-partum period.

The study findings also showed that knowledge about the effect of certain foods (protein, fat, alcohol free wine) on blood sugar levels (Question 6) were low at baseline in both the ‘One-to-One’ (19% to 63%) and the ‘Group’ attenders (25% to 63%). The proportion of women answering correctly improved after both the education sessions but unfortunately remained suboptimal in the ‘One-to-One’ attenders (58% to 67%) and low in the ‘Group’ attenders (40% to 70%) in the post-partum period. Knowledge about calorie restriction and the variable effects of different food types on blood sugar levels is paramount in the acute management of GDM but also in the post-partum period. Applying this knowledge into life-long behavioural changes will help to prevent or reduce the risk of developing T2DM and to maintain healthy BMI. The decline in the proportions emphasizes the need for follow up education sessions post-partum. With a stressful pregnancy, the women may not always recall what they learnt in their first and only education session.

The knowledge of the risk of T2DM development post GDM in the ‘Group’ attenders (81%) was slightly higher than those from the ‘One-to-One’ session (75%) at baseline. There was a mild improvement in proportion of ‘Group’ attenders post education session (87%) and in the post-partum period (90%). The proportion of correct responses were higher following the ‘One-to-One’ education session (87%) and in the post-partum period (90%).



### 5.3 Impact of the Diagnosis of GDM Questionnaire

The “Impact of the diagnosis of Gestational Diabetes” questionnaire consisted of questions related to the women’s feeling about being diagnosed with GDM, feelings about being tested for GDM and future testing. IT also consisted of questions about the effects of GDM on their health, their baby’s health, finances, social life and smoking and drinking habits. They were also asked about stigma associated with GDM. **Table 7** is a summary of the analysis of the ‘Impact of the diagnosis of GDM’ questionnaire.

The women were asked to rate their feelings a scale of 0 to 100 [0 means “Not worried at all” and 100 means “As worried as I have ever felt”] (Question 1b). The women were asked about how they felt when they were ‘first diagnosed’ and at the time they were completing the questionnaires. At baseline which was a week after the diagnosis and just prior to the education session the women gave a median score of 69 after diagnosis and 68 at the time of completing the questionnaire. The similarities in the scores were as expected and reflect the persisting negative feelings associated with GDM. The corresponding scores at interview 4 were a median score of 48 and 28 respectively. A paired sample t-test was performed to compare ‘feelings (0-100) now they have GDM’ at Baseline (Interview 1) and Follow-up 2 (Interview 4). There was a significant difference in ‘feelings (0-100) now they have GDM’ between Baseline (Interview 1) ( $M = 50.53$ ,  $SD = 20.943$ ) and Follow-up 2 (Interview 4) ( $M = 29.21$ ,  $SD = 22.127$ );  $t(df) = 2.883$ ,  $p = .010$ .  $df = 18$

The initial high scores were related to worry associated with GDM. The significant reduction in worry levels as the pregnancy progressed, was as a result of gaining information from various sources but mainly from the education session as described by the women during the interviews. Good management of blood sugar levels was also a contributing factor. This reduction in worry levels was consistent with a previous study (217).

In the post-partum period, the women scored worry levels at the lowest (median score-28) at the time they were completing the questionnaire. This reflected the fact they had a safe delivery, did not have to constantly worry about their blood glucose levels and control their diet.

*Table 6: Proportion of women providing correct answers to the GDM Psychological Questionnaire*

Impact of the diagnosis of Gestational Diabetes (GDM)			Baseline (Interview 1) n=32	Follow-up 1 (Interview 3) n=31	Follow-up 2 (Interview 4) n=23			
Question	Answer							
<b>Q1a.</b>	How did you feel when you were first told you had gestational diabetes? Mean (SD)	0 to 100*	29	68.97 (21.769)	29	70.00 (20.222)	22	67.73 (22.452)
<b>Q1b.</b>	How do you feel now? Mean (SD)	0 to 100*	29	48.00 (21.785) <sup>a</sup>	29	39.83 (20.937)	22	27.73 (21.532) <sup>a</sup>
<b>Q2.</b>	Are you glad you had a test for gestational diabetes?	Yes	31	96.9%	31	96.9%	22	95.7%
<b>Q3.</b>	Do you wish you had never had a test for gestational diabetes?	Yes	3	9.4%	0	0.0%	2	8.7%
<b>Q4.</b>	Do you want to be tested for gestational diabetes if you become pregnant again?	Yes	31	96.9%	30	96.8%	22	95.7%
<b>Q5.</b>	Do you think having gestational diabetes in this pregnancy might influence your decision whether or not to have more children?	Yes	5	15.6%	7	22.6%	5	21.7%
<b>Q6.</b>	Are you surprised you were diagnosed with gestational diabetes?	Yes	20	62.5%	18	58.1%	15	65.2%
<b>Q7.</b>	Had you heard about gestational diabetes before?	Yes	26	81.3%	25	80.6%	18	78.3%
<b>Q8.</b>	Do you think you will enjoy your pregnancy less now that you have been diagnosed with gestational diabetes?	Yes	12	37.5%	9	29.0%	8	36.4%
<b>Q9.</b>	Do you think gestational diabetes is going to or has affected the following aspects of your life?							
	Diet	Yes	31	96.6%	29	93.5%	22	95.7%
	Exercise Routine	Yes	22	68.8%	19	61.3%	19	82.6%
	Sex life	Yes	5	15.6%	0	0.0%	2	8.7%

Impact of the diagnosis of Gestational Diabetes (GDM)			Baseline (Interview 1) n=32	Follow-up 1 (Interview 3) n=31	Follow-up 2 (Interview 4) n=23			
Question	Answer							
	Alcohol intake	Yes	8	25.0%	10	31.3%	12	54.5%
	Social life	Yes	7	21.9%	6	19.4%	5	21.7%
<b>Q10.</b>	If you were smoking before would consider stopping now?	Yes	9	28.1%	9	28.1%	6	18.8%
<b>Q11.</b>	Do you feel you have been labelled with a disease?	Yes	8	25.0%	6	19.4%	4	17.4%
<b>Q12.</b>	Do you think people would judge you if they knew you have gestational diabetes?	Yes	6	18.8%	6	19.4%	4	17.4%
<b>Q13.</b>	Are you concerned about any health problems as a result of gestational diabetes occurring?							
	To You?	Yes	15	46.9%	10	32.3%	9	39.1%
	To the growing baby?	Yes	31	96.9%	20	90.3%	20	90.9%
<b>Q14.</b>	Are you worried you might need an injection as part of treatment?	Yes	17	53.1%	15	48.4%	9	45.0%
<b>Q15a.</b>	Will this diagnosis have financial implications for you?	Yes	0	0.0%	5	16.1%	4	17.4%
<b>Q15b.</b>	If you have answered yes to question 15, are you worried about it?	Yes	0	0.0%	1	3.1%	1	3.1%

\* Scale - 0 means “Not worried at all” and 100 means “As worried as I have ever felt”

“ p 0.01 Paired Samples t-Test (baseline vs follow-up 2)

The women were asked about a series of questions regarding their feelings about being tested for GDM. All women were glad they had been tested for GDM at baseline (97%) and in the postpartum period (96%). A few women wished they had not been tested for GDM at interview 1 (9.4%) and at their 4<sup>th</sup> interview (9%). The proportions of women who wanted to be tested for GDM in their future pregnancies were high at baseline (97%) and remained sustained in the post-partum period (96%). These findings were consistent with those of a previous study (217).

16% of women felt GDM will affect their decision to have children in the future at their first interview and 22% felt the same in the post-natal period. The proportion of women who were surprised with their diagnosis of GDM were considerably high at 63% at baseline and these remained sustained in the post-partum period (65%). This high baseline number is quite surprising because the women would have been informed of the indication or reason prior to the OGTT. The high proportions in the post-partum period are particularly surprising because the risk factors for GDM were discussed during the education session and the women would by that time have realised what their individual risk factors were for getting GDM. The proportion of women who had heard about GDM were high at baseline (81%) but slightly lower in the post-partum period (78%). It was surprising that the proportions were not higher in the post-partum period for this question.

More than a quarter of the women felt they would enjoy their pregnancy less because of GDM with baseline proportions of 38% and similar proportions in the post-partum period (36%).

The women were asked whether GDM would affect certain aspects of their life (Question 9). The majority of women stated their **diet** will be affected with baseline and post-partum proportions at 96%. 69% of the women thought GDM would affect their **exercise routine** at baseline and these proportions increased to 83% in the post-partum period. The women had been advised to continue with moderate exercise during their pregnancy which would help control their blood sugars. A minority of women (16%) thought their **sex life** will be affected because of GDM but these numbers reduced to 9% in the post-partum time. A quarter of the women (25%) felt their **alcohol intake** would be affected by GDM and these numbers doubled (54%) in the post-partum period. This was surprising as the women would have been advised

to avoid alcohol during pregnancy by their midwives, doctors and during the education session. 21% of women at baseline and during the post-partum period felt their social life would be affected because of GDM. Women were asked whether they would consider smoking cessation if they were a current smoker and 28% of women answered yes to this question at baseline and fewer in the post-partum period (18%). This is another surprising aspect as most people are aware of the harmful effects of smoking, especially during pregnancy.

25% of the women at baseline felt they had been labelled with a disease after their diagnosis of GDM and 17% of the women felt the same in the post-partum period.

18% of women at baseline and in the post-partum period felt that people would judge them following a diagnosis of GDM. Although these numbers are small, this can indirectly affect the management of GDM in these women. This is an issue that should be addressed during consultations.

The proportion of women who were worried about the health consequences of GDM on themselves was 47% and that on their baby was 97% at baseline and the corresponding proportions in the post-partum period were 39% and 91% respectively. These findings showed that the women were still worried about themselves and their baby after delivery.

53% of the women were worried about requiring an injection as part of their treatment and these proportions remained relatively sustained in the post-partum period (45%). None of the women at baseline and 17% in the post-partum period thought GDM would have financial implications for them. Lastly very few women were worried about any financial implications in the post-partum period only (3.1%).

Comparative analysis of the question between the “Group” and “One-to-One” attenders did not show any major differences between baseline and the post-partum answers except for questions related to ‘future pregnancies’, ‘surprised by diagnosis’ and ‘associated stigma’. At baseline fewer One-to-One attenders (6.1%) compared to the ‘Group’ (25%) felt GDM would affect their decision about future pregnancies. The corresponding proportions were slightly higher with 9% and 31% in the post-partum period. A higher proportion of women from the ‘One-to-One’ session (81%) were surprised to be diagnosed with GDM than the ‘Group’ attenders (44%) at baseline. These proportions remained high for the ‘One-to-One’ attenders (72%) but higher for

the ‘Group’ attenders (58%) in the post-partum period. This was surprising because by this time the women should have known about the underlying risk factors for having been diagnosed with GDM. Fewer ‘One-to-One’ attenders (13%) compared to the ‘Group’ attenders (25%) felt they would be judged for having GDM. There was an increase in the proportion of ‘One-to-One’ attenders who felt the same way in the post-partum periods compared to a reduction in the ‘Group’ attenders (8.3%). The underlying reasons for this are unknown.

## **5.4 Summary**

In chapter 5, I have presented important demographic details about the participants in this study. The main finding was that the women in this study were mostly Caucasian which could potentially be a limitation of this study. The main risk factors or indications for OGTT in these women was a raised BMI of greater than 30 and/or a Family history of diabetes amongst others. The analysis of the GDM knowledge questionnaires showed all the women had a good baseline knowledge about GDM.

Following the education sessions, the knowledge of the women in areas such as risk factors, complications, and risk of developing T2DM improved and were sustained in the post-partum period as demonstrated by the data analysis. Minor variations in responses were present between the ‘Group’ and ‘One-to-One’ attenders. The women’s knowledge about the effects of certain food products remained suboptimal in the post- partum period despite the education session. This is an important of aspect in the management of GDM which needs reinforcement in clinical practice. There was a significant reduction in worry levels from the time of diagnosis to the post-partum period. In chapter 6, I will present and discuss the qualitative analysis of the four semi-structured interviews of the women obtained throughout the course of their pregnancy.

## Chapter 6 Qualitative Interview Analysis

Chapter 6 will present and discuss the qualitative results of this study. This consists of the thematic analysis of the verbatim transcripts obtained from the semi-structured interviews of the women with GDM. This analysis was guided by the analytic-reflective principles of van Manen's phenomenology of practice. The interview transcripts provided experiential narrative material that were the resource to develop a rich and deep understanding of the phenomenon of 'being diagnosed with GDM and having an education intervention' (316). The processes involved in thematic analysis described by van Manen have been discussed in detail in chapter 4.

The aim of thematic analysis was to discover underlying patterns and 'structures of meanings' of the phenomenon in the form of 'lived experience descriptions' or 'themes' from the transcripts, whilst maintaining an open mind through the process of 'reduction and epoche'. (316, 317, 398). Verbatim quotes from the interview transcripts will also be presented to substantiate the emergent themes. The descriptive themes that emerge from each set of interviews will be analysed and presented from 3 perspectives:

- (1) Specific timeline
- (2) Intervention received i.e Group versus One-to-One education session
- (3) Max van Manen four life existentials (lived body, time, space and relations)

The interviews were conducted at different stages of the pregnancy and after delivery. Hence the themes are presented a temporal manner which also represent the experiential journey of the women throughout their pregnancy. The analysis is also comparative and will highlight the 'common' emerging themes from either of the cohorts. It will also show themes that might be unique to a particular cohort of women. These emergent themes are demonstrated in the **Figures 12 to 15**. Following the randomisation process the women attend the Group education session which is the intervention group or the One-to-One session which is the control group.

Max van Manen's 4 life existentials which include lived space (spatiality), lived time (temporality), lived body (corporeality) and lived human relation (relationality or communality) will be used as reflective guide to analyse the emerging themes and explain the 'lived meanings' and 'lived experiences' of these women at various stages of their pregnancy journey (317).

Whilst analysing the transcripts, I ensured I remained focused and orientated towards the research questions. I used the process of 'bracketing' which enabled me to identify and suspend my preconceived ideas or assumptions about the phenomenon under investigation (377, 379, 433). The stance I took was to remain in the role of the 'researcher' and not a 'Doctor' throughout the interviews and other conversations with the women.

As part of my reflexive process, I made a declaration of my pre-suppositions which was to acknowledge that having specialist knowledge about GDM made me close to the subject under study. One of the methods I used was to refrain completely from being involved in any active medical care of the participants other than directing them to the correct HCPs if such a circumstance occurred. Although challenging, I had to suspend any assumptions I had about women being diagnosed with GDM. I had to 'go through' these interviews in an objective and unbiased way in order to delve deep into their 'lived experiences'.

I also used journaling to reflect on any own biases or assumptions I may have had about a participant prior to the interview. For instance, from the demographic data already available about participants, I was about to interview one of the participants who was a General Practitioner and assumed she would be more knowledgeable about GDM, which might not necessarily be the case. This reinforced the notion of abstaining from any pre-conceived notions.



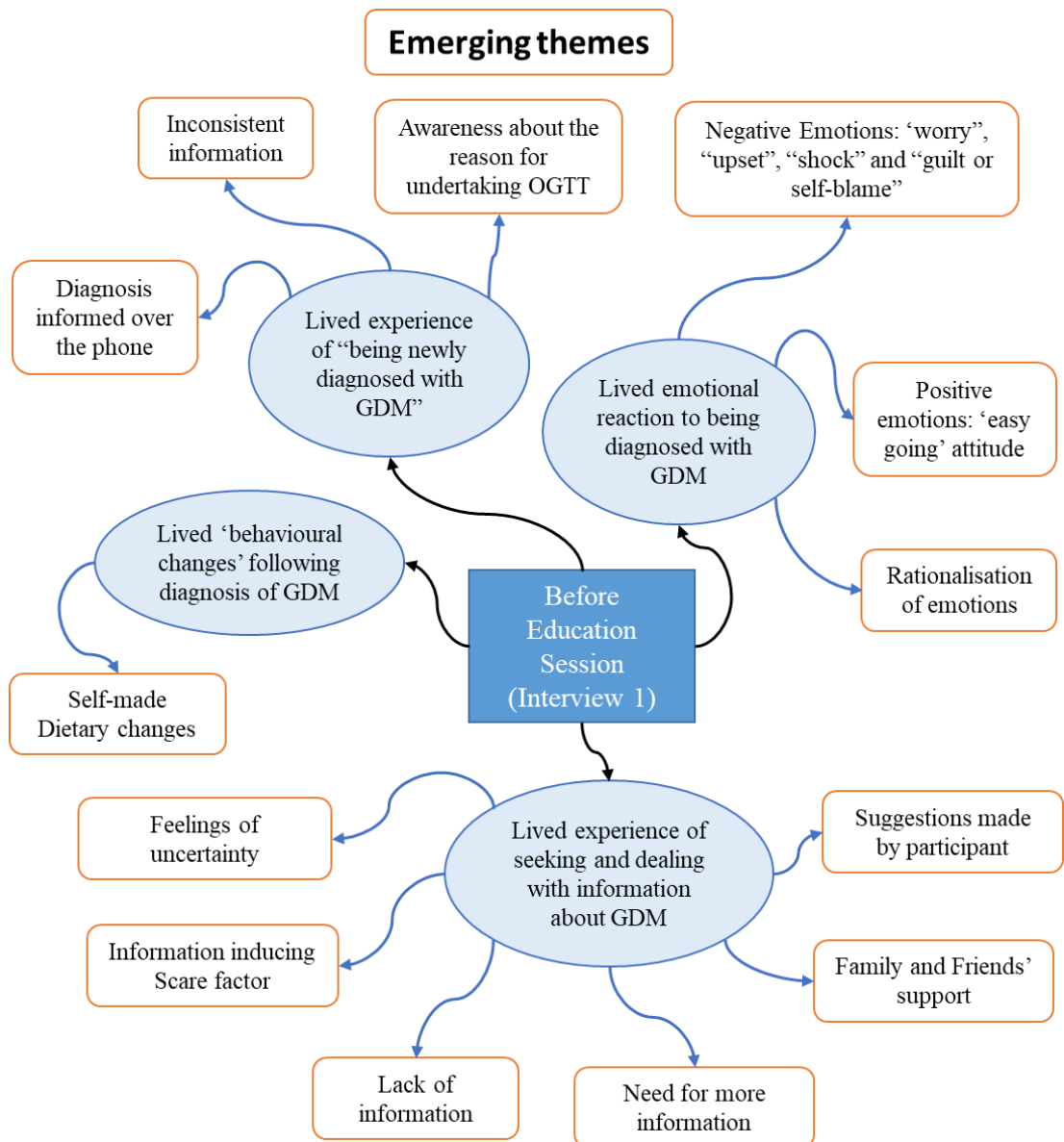


‘body, time, space, relation’ experiences which have clearly emerged as themes related to ‘information’, ‘emotional reaction’ and ‘behavioural changes’. These themes as they unfolded through their pregnancy journey will be presented in this section.

The women were asked about their initial thoughts and feelings when they were first informed of their diagnosis and if they took any immediate actions. Quotes from the narratives from these women will be presented. Further analysis of these quotes led to the emergence of themes which provided illumination on the phenomena of the “lived experience of having a new diagnosis of GDM.” **Figure 12** shows the themes that emerged following the thematic analysis of the verbatim transcripts from the first interview. The initial questions asked were related to body or space experiences (316). The following questions were used as prompts during the first interview:

When you first found out you had gestational diabetes:

- What were your initial thoughts at the time?
- How did you feel about being diagnosed with GDM?
- Is there anything you did?
- How are you feeling now?



*Figure 12: Emerging themes describing the ‘lived experiences’ of women following a diagnosis of GDM (Interview 1)*

### 6.1.1.1 Diagnosis informed over the phone

The women were very keen to describe their journey from the time they underwent the OGTT to the way they were informed of the diagnosis. They were particularly descriptive about the circumstances in which the results had been provided to them. All the women had received a phone call from the maternity department at the Countess of Chester Hospital. The reactions of the women to the phone call varied. Two patterns in the way the women received their diagnosis emerged from the analysis

– the women were either fairly satisfied or not satisfied at all with the way they had been informed.

The women who were satisfied were those who received a phone call from either a midwife or ‘someone’ from the maternity department who informed them of the diagnosis of GDM. This person either directly told them they had GDM without any other explanation [Quote 1] or stated there were abnormalities in the blood glucose levels which meant they had GDM [Quote 2]. In addition to being given the diagnosis most of the women were informed they will receive an appointment soon to attend the diabetes clinic [Quote 3].

*Quote 1*

“ Erm I got a phone call last week after my blood glucose test to tell me that I had erm gestational diabetes.” [P5\_Group]

---

*Quote 2*

“ They called me 2 hours later and told me that I had diabetes. The said if you haven’t got gestational diabetes your score is 5.1 and they said mine was 5.6, so there is nothing too much to worry about..” [P14\_One-to-One]

---

*Quote 3*

“When I got my phone call the same day it was from a midwife and they said your 7.9 so you are classed as diabetic in your pregnancy and we will arrange for you to see the diabetic team” [P19\_One-to-One]

---

The women also remembered how they felt about the person who provided them the news about GDM. Most of the women described how the person had been ‘nice’ or ‘kind’ and enquired about their wellbeing [Quote 4]. Some women had also been provided some reassurance and practical advice until they were reviewed in the diabetes clinic [Quote 5].

*Quote 4*

“They tried to call me, but I couldn’t answer, and I tried to call them back and they answered it then. They told me in a very kind way.

They asked me if I was feeling alright and am I ok so I said that I didn't expect that." [P13\_Group]

---

*Quote 5*

"That day I did get a phone call....., the lady that rang me was lovely and put my mind at ease a little bit although I was still quite shocked to have received the phone call, I felt a little bit teary."  
[P25\_Group]

---

### **6.1.1.2 Inconsistent information**

Despite having the same diagnosis, not all the women received the same information during the first phone call. There were several reasons for the dissatisfaction with the phone call regarding their diagnosis including lack of understanding of blood results, lack of information and the way they had been informed. Not all the women understood what the abnormality in the OGTT meant when informed over the phone [Quote 6]. In addition to the lack of understanding, many women were left frustrated with a lack of information about what was going to happen [Quote 7].

*Quote 6*

"I had a phone call of a member of the team from the Countess who informed me that I did have it and my levels were raised. Erm I didn't really understand a lot about it....." [P9\_One-to-One]

---

*Quote 7*

" didn't really give any other information about it just kind of like oh right ok somebody will be in touch, that was about a week ago now."  
[P4\_One-to-One]

---

Some women had been left voicemail messages to call the hospital back which they felt had led to delay in being informed of the diagnosis as well as causing them anxiety and mental distress [Quote 8]. Moreover, some of them described the phone call as being short and abrupt which left them frustrated and stunned [Quote 9]. These women felt helpless as they had been given a diagnosis and left waiting for any more information [Quote 10].

*Quote 8*

“ Erm the language used by the, I presume it was the nurse that left me the voicemail, she said my second result was slightly raised erm and didn’t actually didn’t use, you know didn’t say I had gestational diabetes, so I was kind of wondering from that if I was kind of a borderline result or not, .....hearing it actually said very bluntly to me was you know that was when it sunk in a little bit the next day.”  
[P3\_Group]

---

*Quote 9*

“Erm I felt I did not get as much information over the phone just it was a bit high, they didn’t tell me how high, what it was, they just said I’d have to have more scans and they will be in touch and that was kind of it.” [P1\_One-to-One]

---

*Quote 10*

“I was fine about it just a bit oh, more the thing like oh well is that it, is that why I am getting a phone call you know you will hear from us again and that was it, I was kind of like left in limbo.” [P1\_One-to-One]

---

To be informed of a new diagnosis of GDM can be a life changing moment for a pregnant woman. The way this diagnosis is imparted can have a significant impact on a woman. From the transcripts in this first interview, it appears that information was provided via quick phone call to which the women reacted in various ways. The person at the end of the phone was not always identified by the women or perhaps in the heat of the moment they could not remember who they spoke to. These women’s initial experience from a lived body, space and relations perspective appeared to be less positive than one would have expected. Their ‘lived time’ experience in terms of ‘the lack of information’ for a week ‘felt longer’ (387) and influenced their initial opinion about the health care services in a negative way, which in turn influenced their ‘lived relationality with the HCPs’ .

There were inconsistencies in the way they had been informed of the diagnosis. There was no standard way of providing the diagnosis over the phone. Some were provided more details about the OGTT results whilst others did not receive any explanation.

Some were briefly advised to cut down on sugars and carbs. Most of them were told to wait to for an appointment from the diabetes team.

### **6.1.1.3 Awareness about the reason for undertaking OGTT**

Almost all the women stated they were aware of the reason they were being asked to have an OGTT. Some women explained how the midwives had discussed the rationale for doing the OGTT. Other women described how the midwives had discussed the possibility of having GDM in view of glucose in the urine or having a family history of diabetes or a raised Body Mass Index [Quote 11]. Some of the women had had the test in their previous pregnancies but had never had a positive OGTT results. The majority of the women described they had a family history of diabetes, high BMI and or a large for gestational age baby which required this test [Quote 12].

#### *Quote 11*

“Erm she said not to worry.....not a popular erm ah what is the word, erm it’s quite familiar erm problem within erm high BMI ladies etc and that my mum had just recently been diagnosed with diabetes type 2 last summer, so ...” [P6\_Group]

---

#### *Quote 12*

“I had 2 episodes of glucose in my urine so that was the time they said that they needed to do the blood test to check why I was having so much glucose in my urine.” [P32\_One-to-One]

---

The women’s first ‘lived body’ experience of undergoing an OGTT was overall positive. It was quite reassuring that almost all the women were aware of the reason why they were having the OGTT. This indicated good communication between the HCPs and the pregnant women regarding their ongoing management.

However, interestingly none of the women used ‘risk factor’ or ‘have a higher chance of having GDM’ to describe the underlying reason for the test. Although the women knew they were being tested and there was a chance they could be diagnosed with diabetes during pregnancy they did not do any research on GDM prior to their test. If they did any research, they did not mention it during this interview.

## **6.1.2 Lived emotional reaction to being diagnosed with GDM.**

Receiving a diagnosis of any medical condition can have a multitude of effects on a person, particularly a negative emotional impact. However, in pregnant women this impact would be further accentuated and potentially result in stress and anxiety. A major part of the discussion during the first interview was about the women's reactions and experiences after having been given a diagnosis of GDM for the first time.

### **6.1.2.1 Negative Emotions: “worry”, “upset”, “shock” and “guilt or self-blame”.**

Knowledge of the diagnosis of GDM transforms the temporality of the initial excitement of their pregnancy into negative emotions which are vividly described by the women. These emotions also impact negatively on their ‘lived body, time and relation’ experience (317). These “lived emotions and feelings” were expressed by repeated use of words such as ‘worry’, “upset”, “shock” and “guilt” or self-blame. The women also described how they were concerned about the potential effect of GDM on the baby and other perinatal complications.

After learning about their diagnosis most of the women were worried [Quote 13]. Each woman had her own main reason or reasons to be worried including additional risk to the pregnancy, fear of medications especially insulin, complications of GDM, the need for extra appointments and scans [Quote 14], lack of knowledge about GDM, potential changes in their diet and the effect on the baby [Quote 15].

#### *Quote 13*

“ I think perhaps if I’d have had the diagnosis of diabetes without being pregnant it would have been, I don’t know, may be easier to deal with because I am not growing another human being. I think that adds a layer of worry for me.” [P12\_One-to-One]

---

#### *Quote 14*

“ I was a little bit worried ..... on the website they mentioned you could end up having caesarean or you know any complications. Now obviously all this is causing extra appointments, extra scans where



with my first baby I only had 2 scans, I never had any, you know any concerns.” [P8\_Group]

---

*Quote 15*

“ I was worried about the impact it would have on the twins”  
[P32\_One-to-One]

---

Other women expressed their negative emotions by describing how upset they and their partners felt upon hearing the diagnosis [Quote16] and often teary [Quote 17]. Some explained they were upset due to inadequate information on GDM [Quote 18] whilst a few felt they knew too much about GDM. Others were upset as they felt having diabetes during pregnancy would result in restrictions on certain social events [Quote G19]

*Quote 16*

“ My emotions from when I first got told were really upsetting and I was distraught about it. It has taken me a good 2 weeks for it to accept it.” [P19\_One-to-One]

---

*Quote 17*

“ As soon as I got the phone call I cried and I think that is probably because I know so much about it. [P17\_Group]

---

*Quote 18*

“ I just didn’t know anything about it because I have never really known anything about diabetes anyway erm so obviously I was upset, and I told her you know..” [P1\_One-to-One]

---

*Quote 19*

“ I think I have been more upset about the thought of missing out on you know socialising with friends around a piece of cake you know we often get together we will have coffee and we will have cake and its, and you know you just go to a coffee shop and you like I just need a little snack” [P3\_Group]

---

Another recurring sentiment that was described by the women was that of ‘feeling guilty’ or ‘blaming’ themselves whilst they were discussing their diagnosis. After

learning about the diagnosis some of the women explained how they started wondering if they were directly or in some way responsible for the diagnosis [Quote 20].

The women described how they thought their own actions such as consuming sugar foods [Quote 21] might have led to the diagnosis and potentially harming the baby [Quote 22]. Some women felt they had let themselves, the baby or their family down [Quote 23]. The women who had high BMI felt guilty and wondered whether they should have lost weight before becoming pregnant [Quote 24].

*Quote G20*

“Erm I am gutted that I have got it, I really am, I was so disappointed and at first I kind of like blamed myself about it, (teary) erm I thought it was something that I had done (teary)” [P6\_Group]

---

*Quote 21*

“ I was quite disappointed really in myself erm I felt quite guilty erm because it’s thinking that I have brought it on myself erm I do have a bit of a love of cakes and chocolates so err ..” [P7\_Group]

---

*Quote 22*

“ ....where you stand you think you know what has happened to the baby, have I done damage and that was worrying.” [P10\_One-to-One]

---

*Quote 23*

“I think I was just, I was kind of annoyed with myself and I was disappointed you know I felt like I had let them both down” [P1\_One-to-One]

---

*Quote 24*

“ Yeah erm I think it is guilty a little bit as well because I know I have been overweight .....although I have lost 2 stone actually when I first got pregnant by eating better ....I thought I had a better chance of not testing positive if you know what I mean” [P15\_Group]

---

The women also described how they were less concerned about themselves but much more worried about the effect of GDM on the baby [Quote 25]. They described their concerns about having already caused harm to the baby, having a large baby [Quote 26], not completing full term [Quote 27] and any other distress to the baby. Some of

the women had done their own internet search on GDM whilst others were waiting to hear from the HCPs.

*Quote 25*

“Erm I was worried erm that I was only just finding out, I wondered if maybe I might have already done damage to the baby.....because I don’t know how long I have had this condition, whether it has been for the whole pregnancy or.....” [P18\_Group]

---

*Quote 26*

“ When I heard about it and researched it then obviously the main effect being possibly a big baby and having the problems of when they are born of the blood sugar dropping, that did worry me .....” [P31\_One-to-One]

---

*Quote 27*

“ Erm the main thing that concerns me is it says there is a chance that I may not go full term, or I may have to be induced and because I have never thought of things like that, it’s more the distress on the baby. “ [P9\_One-to-One]

---

### **6.1.2.2 Positive emotions: “easy going” attitude**

Although the majority of the women were contemplating worse case scenarios there were few women who had a rather positive or neutral outlook to the situation. These women described being not overly worried about having GDM. Within this cohort some women worked in the health care system and had some knowledge about the subject [Quote 28]. Others had an ‘easy going’ attitude of taking things as they come by [Quote 29]. Some of the women described they did not want their stress levels to impact on the baby [Quote 30]. some women were focussed more on the positive aspects and adopted a more practical attitude of taking one day at a time [Quote 31].

*Quote 28*

“ I don’t think I was that upset or anxious about it because I do work in health care myself and I deal with people with diabetes,..” [P5\_Group]

---

*Quote 29*

“ So, it is not something that I am going to get overly stressed about... I take things in my stride full stop. I have been given worse case scenarios with previous pregnancies, so this is a very minor one on my list ” [P4\_One-to-One]

---

*Quote 30*

“ I try not to think about it. I don't want to get worried and stress myself as it is not good for the baby.” [P27\_Group]

---

*Quote 31*

I am feeling a bit more positive... I try not to think about it to be honest. I am just trying to think of what I can do now .... [P28\_Group]

---

A few women stated how there were not surprised at all to have a positive OGTT results [Quote 32]. These women explained they did not find the results unexpected because they were aware of their family history of diabetes [Quote 33], obesity or other underlying causes.

*Quote 32*

“ It was not unexpected when it came back.....” [P15\_Group]

---

*Quote 33*

“ I knew a little about it anyway because it runs through my family both sides, so I sort of had an inclination that the possibility of getting it was high.” [P17\_Group]

---

The women experienced a range of emotions upon receiving their diagnosis. Worry appeared to be the predominant negative emotion felt by the majority of the women. They expressed their surprise, shock, disappointment, and guilt about their OGTT results. A few were neutral or not surprised about the results as due to knowledge about their risk factors or having prior knowledge of GDM. What was also strongly emphasized by the women was a discontentment in the way the diagnosis was imparted and also the associated lack of information which increased their anxiety levels in some women.

### 6.1.2.3 Rationalisation of emotions

There was a cohort of women who rationalised their reactions and emotions after receiving the diagnosis. These women described how despite the news being worrisome they overall felt glad about the timely diagnosis [Quote 34]. They went on to explain that following the diagnosis they would now be able to control their blood sugars and deal with the condition.

#### *Quote 34*

“ so, it’s erm an added worry and an added complication for us that we didn’t need really erm but it’s been found and the best thing is that it has been found and we can do things about it..” [P7\_Group]

---

#### *Quote 35*

“...when I read in to it and they said it can be monitored and you will be monitored from the day you are diagnosed up until after birth, its kind of put my mind at rest and I suppose it is better to find it now than when I have given birth and something happened with the baby. “ [P3\_One-to-One]

---

From an emotional point of view, few women in this cohort recovered very quickly following the initial news of the diagnosis and were fairly calm about the whole situation [Quote 35]. Some women who had done some research on GDM explained they thought diabetes was manageable [Quote 36] and others reasoned that the complications of GDM can also occur in a normal pregnancy [Quote 37] and therefore there was no need to be overly concerned. Some women described how they felt this diagnosis was a wake-up call for them and their partners to make some lifestyle changes [Quote 38].

#### *Quote 36*

“ Erm but I know with diabetes it is manageable as well erm yeah I did have a look online to see certain things, but it is more of a problem if it is undiagnosed not really if it is diagnosed. “[P4\_One-to-One]

---

#### *Quote 37*

“ the different scenarios with premature labour and erm big babies and them getting stuck in the birthing canal and things like that but

equally you don't have to be diabetic to have problems like that in labour anyway so it's just one of them, you have to take it as it comes and see what happens." [P5\_Group]

---

*Quote 38*

"...it was kind of a negative to start but you know it has made us kind of go well you know we did need to change a couple of things really erm so it has just made us do it now you know sooner rather than er it has given us a bit of a kick up the bum to do it" [P1\_One-to-One]

---

### **6.1.3 Lived experience of behavioural changes following diagnosis of GDM**

The women's lived corporeality at this stage of their lifeworld after learning about their condition provides insight into their current thought processes and future plans, specifically about managing their condition. This situation also makes them aware of the corporeal possibilities and limits of the decisions they have to make [van Manen, 2014]. Despite experiencing a range of emotions, they were quite reactive in their actions. The instinct to have a safe pregnancy outcome urged them to find information about management of GDM. Irrespective of the initial source of information or the lack of it, they quickly realised they needed to make a lot of changes in their lifestyle. These changes would mainly involve making existing dietary changes and adopting healthier eating habits.

#### **6.1.3.1 Self-made Dietary changes**

After hearing about their diagnosis, the majority of the women described they quickly realised that they had to make significant changes in their lives including behavioural changes towards their diet and daily routine. They acquired further information on GDM either via online research or from family members who had diabetes.

The majority of the women explained they had not been given any instructions on any immediate actions to take following the news of the diagnosis. Hence, they explained how they felt they had to be proactive and make lifestyle changes immediately including reducing sugar intake [Quote G39].

*Quote G39*

“...erm so I have just kind of taken the steps of cutting as much sugar out as possible and you know I do not know whether I am doing the right thing or not” [P3\_Group]

---

Based on their individual research the women explained how they focused their attention on dietary changes [Quote G40]. A lot of the women found it difficult to cut down on sweets, particularly chocolates [Quote G41]. Although it was challenging, they cut back or gave up sugary food & snacks for the sake of the baby. Others explained they started experimenting on low Glycaemic Index (GI) food which would keep their blood sugars down [Quote 42]. Some women including those who were still working were including exercise, mostly walking in their daily routine [Quote 43].

*Quote G40*

“ So, since that time I have tried to be on a diet and eat healthier. Before that I eat a lot of sweets but after that I stopped all the sweets and fat things.” [P13\_Group]

---

*Quote G41*

“ It has just made me think about what I eat which I suppose in a way is a good thing as well. I have started cutting down on biscuits and chocolates. My downfall is definitely chocolate.” [P31\_One-to-One]

---

*Quote 42*

“ I am sort of sticking to a low GI diet. I am finding that is working. My body is used to it now. I think definitely a website would really benefit people.” [P17\_Group]

---

*Quote 43*

“ I try and pick out the positive bits and hope I can control it with diet and exercise. I have made changes with the sugar and going out with my work colleagues for a walk a dinner time, trying to keep active.” [P20\_Group]

---

The women quickly inferred from their limited research that diet was important in the management of GDM. They made changes in their regular meals but most importantly cut down on snacks such as chocolates and fizzy drinks. They realised the gravity of

the situation and started making positive behavioural changes. They reduced their sugar intake and started to be more physically active. These changes were mostly their own initiative whilst they eagerly waited for further information and instruction on how to properly manage GDM.

### **6.1.4 Lived experience of seeking and dealing with information about GDM.**

After the shocking news about their diagnosis, the lived body experience of all the women was the desperate need to take some form of action to deal with their condition. Their ‘lived relationality’ showed how the women experienced the ‘diagnosis of GDM’ with the people who formed part of their lives. They felt the instinctive need to share this news with their loved ones. This involved speaking to someone for some emotional support or gaining information from sources such as relatives and mostly the internet. Having been given a diagnosis over a phone call without associated relevant information, the women described how important it felt to quickly gain as much information as possible to answer their questions about GDM. Most women went on ‘google’ whilst some spoke to relatives, but the majority did both. However, obtaining information from the internet itself had its own consequences. The women described how they were further emotionally affected by what they read online which influenced further actions.

#### **6.1.4.1 Feelings of uncertainty**

After receiving the diagnosis of GDM the women experienced a spectrum of emotions such as anxiety, worry, fear, shock and distress. Whilst dealing with these emotions they felt frustrated with the lack of information which led them to search for information online or through friends and family [Quote 44]. They felt they had been left without any concrete information following their diagnosis. However, despite finding some form of information about GDM, the recurring theme that emerged amongst the women was the feeling of “uncertainty” about everything [Quote 45].

They felt uncertain about 3 aspects: accuracy of the information obtained online, appropriateness of the changes they had made and knowledge of what was going to happen next from a practical viewpoint. The women were also very anxious to find out how their condition would be managed in the health care settings [Quote 46]



*Quote 44*

I Googled it and everything and I tried to Google information of what I can eat and what I can't eat and I couldn't really find anything to be honest with you so if I am being honest,..” [P11\_One-to- One]

---

*Quote 45*

“...hopefully I will get more from them but up to now I am still unsure what is going to happen. so, I am panicking about that I have not really been reassured, no don't worry you will be fine..” [P2\_Group]

---

*Quote 46*

“...just to get some clarification of if at the moment I am doing the right things with my diet and not erm and finding out about you know the next steps and what happens now and you know my care throughout the rest of the pregnancy....” [P3\_Group].

---

The women felt the information they obtained from the internet regarding their diagnosis was not particularly clear and they questioned the accuracy of the information [Quote 47]. Most of the women explained they had cut down on sugar and certain types of food but were still unclear whether it was the right thing to do or the correct way to do it [Quote 47]. This in turn increased their uncertainty and anxiety levels and the need for more accurate information. They all felt they had been left too long and they were eager to have some information through the education session [Quote 48]. The women also described how eager they were to find out how and where their condition was going to be managed in the hospital [Quote 44G].

*Quote 47*

“ still sort of wondering about right ok what kind of diet is right for you, yeah like you say there is certain information online but it is not definite sort of information and you don't know whether, how much of it to trust and how much of it not to trust, so..” [P4\_One-to-One]

---

*Quote 48*

“ Erm really ready to have this meeting tomorrow erm just to get some clarification of if at the moment ...” [P3\_Group]

---

#### 6.1.4.2 Information inducing Scare factor

After receiving their diagnosis, the women described how they instinctively felt the need to look up more information about GDM. They expected more information would help appease their anxiety. A few of the women understood how to interpret the information they found online [Quote 49] but others were more distressed and scared after reading the online information [Quote 50].

The women described how scared they felt for their baby after reading about the various complications of GDM including risk of stillbirth, early induction and macrosomia [Quote 51]. The women explained how reading about the complications scared them from reading more information online and made them more eager to have reliable information to understand their condition and management [Quote 52].

##### *Quote 49*

“ Well you just have to learn to digest the information you get online don’t you, erm there is always going to be a worst-case scenario that you are going to find anywhere else.” [P4\_One-to-One]

---

##### *Quote 50*

“ so, I went on to Google and the first thing that I saw which petrified me is that gestational diabetes can cause stillbirths so I obviously the first thing that goes in to your head is oh my god is my baby going to be okay...” [P11\_One-to-One]

---

##### *Quote 51*

“ Erm some of it was a bit, I think it was more scare factor than anything erm for the things that could happen, all the different scenarios with premature labour and erm big babies and them getting stuck in the birthing canal and things like...” [P5\_Group]

---

##### *Quote 52*

“ I just started reading but then the more you read to it I think the more scared you get because there is so much information on the internet, then obviously they mention about possible erm you know complications with the labour, the baby could be bigger because of obviously the insulin I am not producing the baby you know

obviously all those aspects and I was a little bit concerned... I just want to speak to a professional..." [P8\_Group]

---

### **6.1.4.3 Lack of information**

It is always difficult for anyone to come to terms with any new diagnosis. Following a diagnosis, the most important next step is to acquire as much information around the investigations and management for a better understanding. During their first interview, the women strongly described how they had been left almost helpless without much information [Quote 53]. The women emphasized how they felt the gap in time from the time of diagnosis to obtaining any form of information felt really long [Quote 54]. One cohort of women explained how they thought the phone call announcing their diagnosis was short and devoid of relevant information [Quote 55].

#### *Quote 53*

"I just at the time I just, I just felt like I didn't know anything, I wasn't given information so I didn't really know what to do." [P11\_One-to-One]

---

#### *Quote 54*

"I would have liked some information straightaway because I have not known what I have been able to like eat or drink or what has been safe to eat, or drink and it has been nearly a week and I have not known what I should have been doing." [P26\_One-to-One]

---

#### *Quote 55*

"it was literally a 2-minute phone call erm yeah she said not to worry but that was literally it, there was no guidance, no help, you know over phone and I was a just a bit kind of taken back at the time." [P6\_Group]

---

There were specific aspects of information that the women felt they needed. Part of the information which they felt was missing was an explanation about the OGTT results and its significance and implications [Quote 56]. They went on to describe how they had multiple questions including complications of GDM, their plan of care in the hospital including schedule of scans etc [Quote 57]. Not having this information

increased their anxiety and they felt they were in the dark especially in terms of their diet [Quote 58]

*Quote 56*

“ So basically you are just left out on a limb really to just try and work out for yourself before anybody gets in touch with you erm to try and work out what is the situation and how high is the bloods, there is no explanation of what it all means erm and how it does really effect everything like yeah I might have a large baby but if you are prone to having large babies anyway what difference.” [P4\_One-to-One]

---

*Quote 57*

“ Erm I felt I did not get as much information over the phone just it was a bit high, they didn’t tell me how high, what it was, they just said I’d have to have more scans and they will be in touch and that was kind of it.” [P2\_Group]

---

The women felt they had been abandoned as they had not heard any relevant information about their care since their diagnosis had been made [Quote 58]. They described their frustration about the lack of direction regarding their condition [Quote 59].

*Quote 58*

“ Well it has been about a week since I was first diagnosed and still not heard anything else so you just kind of think well how important it is if you are not actually going to be in touch with me to say right this is what we need to do, this is what is going to happen.” [P4\_One-to-One]

---

*Quote 59*

“...I just at the time, I just felt like I didn’t know anything, I wasn’t given information so I didn’t really know what to do and what will happen [P11\_One-to-One]

---

A cohort of women particularly worried about the lack of information regarding treatment of GDM [Quote 60]. In the absence of information, they felt this represented

a delay in the management of their condition. Those women who went online to look for information also felt frustrated by the lack of information on GDM [Quote 61].

*Quote 60*

“ Erm my only concern really was that it has been a week without any information in between erm b..... and because no one has sort of said that to me it is now you have been diagnosed with something and left for a week without any treatment kind of feeling that went through my head...” [P5\_Group]

---

*Quote 61*

“ There was a lack of information about gestational diabetes really. Even on Diabetes UK and things like that there is only a small bit compared to the coverage of type 1 and type 2. [P17\_Group]

---

#### **6.1.4.4 Need for more information**

With most of the women emphasizing the lack of information they went on to explain how they felt the need for more information urgently. They explained how they had many questions in their mind that needed answers and they were therefore very keen to attend the education session [Quote 62]. The women were very eager to find out about their blood sugar levels and how to manage them [Quote 63].

*Quote 62*

“I am hoping the education session will tell me what I can and can't eat because that is the main thing with diet because it is drummed in to you to have a varied diet when you are pregnant because the baby needs all different kinds of nutrients. Also, how to monitor it because I have never taken my blood sugars before. I hope the class will clear up the foggy areas.” [P20\_Group]

---

*Quote 63*

“ Erm I just want everything to be, I just want to know where my sugars are, and I think once I know I can control my sugars and I know that I am going to be ok and again it's more the baby.” [P10\_One-to-One]

---

Most women wanted to know what their schedule of care was going to be as they were worried about the health of the baby [Quote 64]. The majority of them had realised that diet was important in the context of GDM and they were wanted to find out whether they had made the right dietary changes [Quote 65]. Mostly the women were keen to acquire all relevant information about GDM from health care professionals [Quote 66].

*Quote 64*

“..but I don’t know when that is going to happen or who was going to contact me. I was kind of eager to know what the next steps were and also to find out. I think I was quite keen to find out about the dietary advice as soon as possible so I can start looking after myself properly.” [P18\_Group]

---

*Quote 65*

“ Erm really ready to have this meeting tomorrow erm just to get some clarification of if at the moment I am doing the right things with my diet and not erm and finding out about you know the next steps and what happens now and you know my care throughout the rest of the pregnancy erm I am just really waiting for that information now so I can manage it” [P3\_Group]

---

*Quote 66*

“ I am hoping you get some specific information on gestational diabetes and ask a few questions.” [P17\_Group]

---

#### **6.1.4.5 Family and Friends’ support**

After being given the diagnosis over the phone the women felt the urgent need to speak to people closest to them. It was natural to share the diagnosis due to the lived relation (relationality) that the women maintain with their close ones in the interpersonal space they share with them (317). They described how they discussed the diagnosis with their partners or parents. Most women first rang their mothers [Quote 67]. A lot of women had family members who had diabetes and they felt it was useful to obtain

some immediate advice [Quote 68]. They spoke to those who may have had GDM before [Quote 69].

*Quote 67*

“..obviously everyone phones their mum (laugh). So, I phoned my mum and she was like oh you know the doctors will sort you out and everything will be fine.” [P11\_One-to-One]

---

*Quote 68*

“ I spoke to my mum because she is, she is type 2 I think, just to see what could happen. Erm even my mum asked me what my readings was, I said they didn’t tell me they just said it was raised,..” [P2\_Group]

---

*Quote 69*

“ My sister-in-law has type 2 diabetes (cough) erm she said a few things because with one of my nephews she had late on stage, I think she was around the same weeks as I am, erm they diagnosed it later on in her.....” [P9\_One-to-One]

---

Most women discussed their diagnosis with their partners or husbands who provided emotional support but had different reactions. Most of the partners were equally worried and frustrated about the diagnosis and delay in being seen. One cohort of women described how their partners helped in researching GDM and in making dietary changes [Quote 70]. Other women felt their partners misunderstood GDM from other types of diabetes [Quote 71,72].

*Quote 70*

“ he has been very supportive, he has been very good. you know he has been there with me so, but he is doing the same things, so we will go for a walk with the dog, you know we will be trying to eat the same things and bits and erm he has also said that er he will do double whatever I do exercise wise..” [P1\_One-to-One]

---

*Quote 71*

“ I have spoken to my husband erm but my husband has got it in his head that diabetes is either you know it is a genetic you know type 1

or it is for people who are obese, so in his mind (laugh) he is thinking well it is my fault I have been eating too much sugar and you know I have been letting myself go through pregnancy and I don't think he quite understands.." [P3\_Group]

---

*Quote 72*

" I discussed it with my mum and my partner, erm my partner again because he doesn't understand, he is just sort of see what happens today and keep him informed on it as well." [P5\_Group]

---

Women discussed their diagnosis with other family members from whom they found emotional and practical support [Quote 73]. The women described how reassuring it was to have support from their close relatives [Quote 74]

*Quote 73*

" Erm my husband told his mum erm I spoke to my brother later on in the night erm to see to get must a rough diet plan for what I could temporarily do until I spoke to someone erm so everything all the fizzy drinks all of the sugars have been cut out, so I am having wholemeal bread erm strawberries.." [P10\_One-to-One]

---

*Quote 74*

" Erm well my mother-in-law because she had it, wasn't particularly concerned I don't think, she said oh they will keep a close eye on you. My mum and dad because my dad have got diabetes, probably again they were like oh it could be worse. " [P18\_Group]

---

The women also obtained information as well as emotional support [Quote 75] from their friends and acquaintances. They rang friends who previously had some experience with GDM [Quote 76, Quote 77]. The women described they got some information from their friends' experiences about complications such as big babies [Quote 78]

*Quote 75*

" On that same day I called a friend and started explaining everything to my friend. Since then I have started to control the type of meal I



am eating so that this will not affect the baby or the size of the baby..”

[P29\_One-to-One]

---

*Quote 76*

“ I spoke to a friend I knew who’d had it and said that I will have more scans, it’s just to check the baby doesn’t get too big and other complications that can happen and that’s how it was left” [P2\_Group]

---

*Quote 77*

“ Erm I also know quite a bit about it because a good friend of mine is also pregnant and she has got gestational diabetes. Erm so she has told me quite a lot about it. Erm she has been doing the finger prick tests.....” [P18\_Group]

---

*Quote 78*

“I have a friend and she said to me she had 5.6 and they took the baby out about 20 days early. The lady on the phone she said to me we have to monitor this. “ [P27\_Group]

---

#### **6.1.4.6 Suggestions made by participants**

Whilst the women carried their own research online, they realised there was a lot of information out there to digest and some parts of it was quite scary which increased their anxiety. The women described how they would have liked to be approached with this diagnosis. A minority felt giving a diagnosis was not the correct way but at the same time realised that that was the quickest way [Quote 79]. A lot of women described how they would have preferred that the person providing the diagnosis over the phone call provided some key information and some reassurance [Quote 80].

*Quote 79*

“ I don’t think the phone call works really, I think I would have been better with a letter but then given the nature of it, you can’t there is no time.” [P11\_One-to-One]

---

*Quote 80*

“ Well yeah it would have put your mind at rest a bit to say right don’t worry about it, this is what your diagnosis is but don’t worry about it because we will be able to manage it, we will be there for you so it’s

not you know, it's something you need to keep an eye on but don't panic so much." [P4\_One-to-One]

---

Others even suggested that provision should have been made for some form of written information to via post or email [Quote 81]. This would have provided them with the correct start to the appropriate advice and some reassurance until they were seen in clinic [Quote 82]. Some women recommended a website where they would find all the necessary information about GDM [Quote 83].

*Quote 81*

" Well just a bit more information really. Even if it is a case of saying not to worry it is something that could be sorted out erm we can either email you a list of information or this website is a good website for you to have a look at so you can work out what you can, you know what your dietary requirements are." [P4\_One-to-One]

---

*Quote 82*

" Even if I had been sent some information of what to avoid or what I can eat or what I can't eat. If I got something in the post, a list of the best food to avoid or the best foods to eat that would have been perfect for me whereas at the minute I just don't know.." [P11\_One-to-One]

---

*Quote 83*

" I think there should be a website that you register online on the website and it then explains what is going to happen and in the meantime this is what you can start doing, change your diet in this way. Also, may be put your hospital number in and you can keep track online of your sugar and put your test results on. I think that would be really beneficial because you are not using human resource then. Because I have found the internet is so conflicting." [P17\_Group]

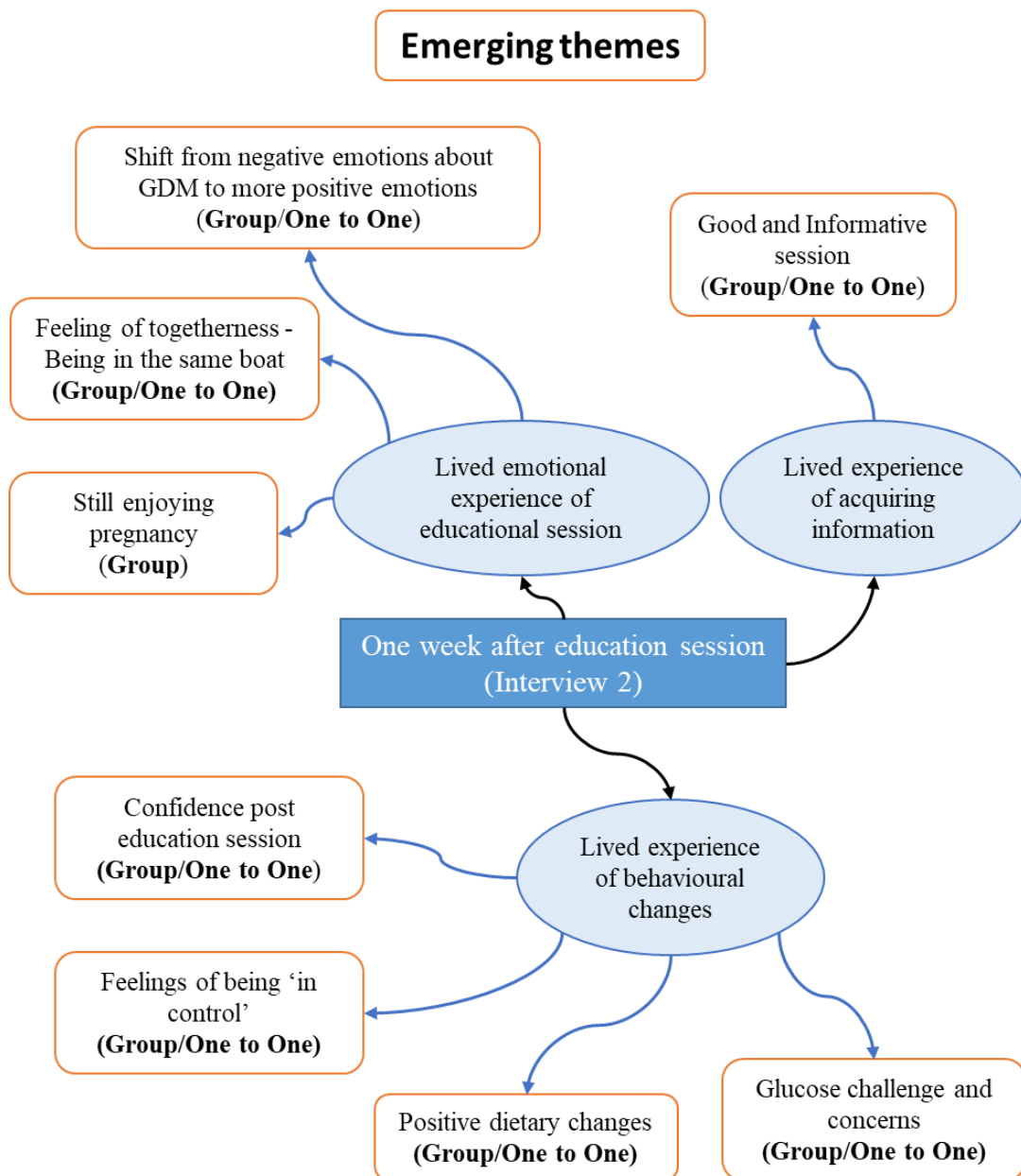
---

The findings from the narratives obtained from the first interview were very insightful. Some women felt satisfied whilst some were not so satisfied about the way they had been informed of the diagnosis. Almost all women were aware of the reason why they were being tested for GDM. Following their diagnosis, the women exhibited positive or negative emotions whilst a cohort rationalized their emotions. After finding out about their diagnosis, the women emphasized the lack of information at the outset and

also the need for all kinds of information. They were quite proactive and sought information from people or online. Most women obtained support from their friends or family members. The women had some good suggestions about improving the services, particularly about provision of information.



- Would you have preferred a different session?



*Figure 13: Common emerging themes describing the ‘lived experiences’ post ‘Group’ and ‘One-to-One’ Education Session (Interview 2)*

### 6.2.1 Lived emotional experience of education session

Attending the education session was a landmark event which drastically changed the lifeworld of these women. Their ‘lived time, space, relation and body’ experiences of ‘being diagnosed with GDM’ started to change after the session. The knowledge gained impacted on the physical, emotional, psychological and behavioural aspects of their lives. The themes that emerged in relation to their ‘lived emotion following the

education session' reflects their 'lived experiences' at this key stage of their pregnancy journey.

### **6.2.1.1 Shift from negative to positive emotions about GDM**

#### **'Group'**

Although individual reactions were different three types of emotional pattern emerged describing the 'lived experience of GDM after attending the 'Group' education session' in these women. These patterns showed a shift in emotions from negative to neutral, from negative to very positive and those that remained persistently less positive. The first cohort which consisted of the majority of the women initially experienced negative emotions whereby they felt 'scared', 'anxious', 'upset' and like they were 'being on a roller coaster' [Quote 84]. Following the education session this cohort felt somewhat more positive, describing their emotions towards GDM as 'not a big deal now', 'it's fine', 'possible to control' and 'manageable' [Quote 85]. This change in emotions was attributed to obtaining GDM related knowledge.

#### *Quote 84*

“ It has been a bit of a roller-coaster in the first couple of weeks trying to get your head around it and then obviously with weight loss and things like because you are not on a diet per se, but you have to cut out so much.” [P20\_Group]

---

#### *Quote 85*

“I was very anxious initially when I was diagnosed despite knowing quite a bit about type 2 diabetes ..erm my mum has it. But after the education session and talking to the midwife, diabetes nurses and doctors I feel less anxious. I think it can be managed. I feel more confident now as I can check my sugars and control my diet.” [P6\_Group]

---

The second cohort of women initially experienced negative thoughts about GDM but felt much more positive following the education session. They described feeling less anxious and more 'confident' and 'in control' [Quote 86]. The control and confidence came from the knowledge of how to manage GDM, being able to check the blood sugars and actually bringing the blood sugars to desired levels.

*Quote 86*

“After the education session, I felt more reassured that I could actually change my diet and control the sugars. After the session I felt more confident with all the information provided. Being able to check my sugars gave me more control. It reduced my fears and anxiety.. and I was less worried about having GDM.” [P30\_Group]

---

A minority of the women in the third cohort continued to experience GDM less positively and experienced mixed feelings despite having the education session due various underlying factors. One participant felt quite overwhelmed and found day to day management challenging [Quote 87]. Other women with pre-existing medical problems also experienced GDM as an added worry [Quote 88]. Anxiety levels were high and confidence levels low in these women.

*Quote 87*

“I struggle with taking the measurements an hour after because you know sometimes I just physically can’t do that which.. you have to take it four times a day. I don’t really feel in control more, obviously I am watching what I am eating but the whole diabetes in pregnancy I don’t feel any more confident to be honest with you.” [P8\_Group]

---

*Quote 88*

“ I am an older mum therefore still anxious about the pregnancy and worried about complications such as my blood pressure. Now gestational diabetes adding to my stress I am not feeling confident at the moment.” [P22\_Group]

---

**‘One-to-One’**

The women who attended the ‘One-to-One’ session were asked about their feelings about GDM and particularly if they had changed in any way. The women described three patterns of ‘live emotions’:

- (i) they were still worried,
- (ii) felt more positive,
- (iii) or remained neutral or not worried.

In the first cohort, the participants were still worried following their diagnosis [Quote 89]. The second cohort of women described being anxious in the beginning but after the education session felt more positive and accepted the diagnosis [Quote 90].

The women described several reasons for their positivity including well controlled bloods sugar readings which made them feel more in control [Quote 91]. A minority of women which constituted this third cohort of women explained they were not overly worried with GDM to begin with and did not feel GDM had affected them in any major way [Quote 92].

Quote 89

“At the moment I am still feeling a little bit shocked really because I have been trying hard with my diet but my blood sugars have still remained elevated. I have been started on one tablet of Metformin today. “ [P32\_One-to-One]

---

*Quote 90*

“Erm I feel alright about it now you know I have just come to accept it (laugh) erm you know I am doing everything that we can to try and change things erm [P1\_One-to-One]

---

*Quote 91*

“ I am a lot more positive about the whole thing. Blood readings have become part of my daily routine now, so I don't really think about it. I think having that control is a lot easier than when I was first told I have GD. I am feeling a lot more positive. I am not as emotional and as tired as I was, probably because of my readings were quite high as well, so I feel a lot brighter in myself as well.” [P10\_One-to-One].

---

*Quote 92*

“ Erm I don't know really. I couldn't really say because it is not really affecting my life. I don't mind cutting out food or giving things up..” [P14\_One-to-One]”

---

### **6.2.1.2 Feeling of togetherness - Being in the same boat**

This theme which emerged from the ‘Group’ session only. The women enthusiastically described how they felt “a sense of togetherness” which they



described as “being in the same boat” [Quote 93]. The women explained they felt somewhat reassured in the presence of other women who had just been diagnosed with GDM and they had been able to have various discussions regarding their diagnosis, share their experiences such as recent dietary changes [Quote 94]. They described how being and conversing with other women in similar situation helped them feel less lonely and more at ease. In addition to sharing their feelings and emotions about their diagnosis, the women were able to share new experiences such as learning to check their capillary blood sugar levels by finger prick, which could be daunting for some [Quote 95]. They were able to alleviate any fears by reassuring and providing support to each other.

*Quote 93 (135)*

“ In a strange way it was nice to know that there were other women in the same boat. I liked the fact that were able to ask questions. We learnt more through these questions and answers”. [P6\_Group].

---

*Quote 94*

“ Erm there were aspects of it being a “Group” session that was nice, it was nice to meet other women that were going through the same thing and talk to them.” [P3\_Group]

---

*Quote 95*

“..it was nice to actually look around the room and see that everyone else was terrified of doing that first reading and thinking is it going to hurt and things like that as if you were on your own, I might have felt a little silly feeling like that. I don’t think I would add or change anything in the session. [P7\_Group]

---

### **6.2.1.3 Still enjoying pregnancy**

#### **‘Group’**

One of the questions the women were asked was how they felt about their pregnancy so far, especially after having attended an education session. The majority of the women in the ‘Group’ session felt happy at this stage of their pregnancy [Quote 96]. Each one of them had their own additional issues and challenges but overall, they all described how joyful they felt about the pregnancy [Quote 97]. A cohort of women

still felt burdened by the thoughts of having GDM but explained that they were now feeling less anxious about it and normalising their lives [Quote 98].

*Quote 96*

“ I am still enjoying the pregnancy so far.” [P20\_Group]

---

*Quote 97*

“ Even though pregnancy is hard, and it is stressful, and it is worrying, I love being pregnant. I don’t love the first 16 weeks because that makes me feel quite ill but you know I quite enjoy it....” [P7\_Group]

---

*Quote 98*

“ I feel more calm after that to be honest. I walk a lot and go for swims. I am enjoying my pregnancy I try not to think about this. I am eating normal.” [P27\_Group]

---

**‘One-to-One’**

The majority of the women who attended the ‘One-to-One’ session described how they were still enjoying their pregnancy despite the circumstances at that point in their life [Quote 99]. Most women described that irrespective of their high blood sugars or struggle with change in diet they were still enjoying their pregnancy [Quote 100]. A few women explained they were not particularly enjoying their pregnancy so far. The underlying reasons described included GDM [Quote 101] and nausea or feeling unwell during pregnancy

*Quote 99*

“ Oh yes...despite everything I am enjoying my pregnancy.”  
[P24\_One-to-One]

---

*Quote 100*

“ No not at all. I feel like I have got it under control. I am happy with my pregnancy.” [P14\_One-to-One]

---

*Quote 101*

“ Having gestational diabetes has me worried more now and I am not really enjoying this part of the pregnancy.” [P32\_One-to-One]

---

## 6.2.2 Lived experience of behavioural changes

The women started experiencing ‘changes’ immediately following attendance at the education session. In addition to new knowledge gained, they had acquired other skills such as checking their blood sugars. Their lived body experiences demonstrated less anxiety and boost in confidence levels following the session. From a temporality and spatiality perspective they felt the urgent need to implement everything they had learnt particularly regarding actively monitoring their sugars in a consistent way and making changes to their diet. This was the beginning of multiple behavioural changes that would influence their lived spatiality, corporeality, relationality and temporality in their lifeworld at this stage in the pregnancy (317).

### 6.2.2.1 Confidence post education session

#### ‘Group’

The ‘Group’ session provided information on GDM management and diagnosis. The women gained a lot of information, and their questions were clarified during the session. They were also taught how to check their blood sugars at the end of the session. At the time of the second interview the women had been self-monitoring their blood sugar (SMBG) levels regularly. The women described how good they felt after having acquired GDM related information [Quote 102]. They expressed their feeling of satisfaction and increased confidence following the GDM session [Quote 103]. The women were now focusing on monitoring their blood sugars regularly. The blood sugar levels were affecting the emotions of the women. Some were happy with their blood sugar levels whilst others were worried about their high blood sugars [Quote 104].

#### *Quote 102*

“After the session I was feeling fine because I have got more information now and I feel more confident.” [P13\_Group]

---

#### *Quote 103*

“ Yes, I think the education session made me more confident and also because when I am taking my bloods. I can see that they are in the

normal range which helps make me feel more confident.”  
[P25\_Group]

---

*Quote 104*

“ Initially when I found out I was disappointed and guilty and then I kind of after the session I felt confident and then over the last few days because things like the bloods have been going a little higher again, I felt a little bit down about it”. [P15\_Group]

---

**‘One-to-One’**

The women who attended the “One-to-One” session described several positive changes in their feelings following the session, the women who were asked about how they felt at the time and if there had been any major change in their feelings. In addition to feeling more positive [Quote 105] the women described how they felt more confident after attending the education session [Quote 106]. They explained how the knowledge gained contributed to their confidence levels [Quote 107]

*Quote 105*

“ Erm session again was really really positive, .....I have no complaints and I felt really secure which I think has helped my state of mind improve over the last week with getting used to the new diet.”  
[P10\_One-to-One]

---

*Quote 106*

“ I have obviously had a 1-1 session which made me feel a lot more confident about the whole gestational diabetes.” [P11\_One-to-One]

---

*Quote 107*

“ It gave me a lot more knowledge. I wouldn’t really say there was any suggestions on how to improve it, it was all great and fine. I am feeling a lot better and more confident now that I know more information.” [P26\_One-to-One]

---

### 6.2.2.2 Feelings of “being in control”

#### ‘Group’

During the second interview, it was interesting to note that when the women were asked about how they were feeling, they immediately started discussing their blood sugar levels. The women by now were performing self-monitoring of blood glucose levels (SMBG) 3 to 4 times daily. They described how SMBG was providing them with valuable information which in turn made them feel more ‘confident’ after the session [Quote 108]. Those women whose blood sugars were in range felt satisfied and confident [Quote 109]. Knowing about the blood sugar levels gave them the confidence to distinguish what type of food to avoid and which ones to consume and a reassurance that they were on the right track [Quote 110]. The combination of information about GDM, ability to make dietary changes and SMBG boosted their confidence levels and helped lower their anxiety levels [Quote 110].

#### *Quote 108*

“ Yes, I think the education session made me more confident and also because when I am taking my bloods. I can see that they are in the normal range which helps make me feel more confident.”  
[P25\_Group].

---

#### *Quote 109*

“ Now that I have been doing my finger pricking I feel much better.....I am a bit of a control freak so I like the fact that I can check it myself rather than having to wait for an appointment for them to say yes or no” [P28\_Group]

---

#### *Quote 110*

“ After the education session, I felt more reassured that I could actually change my diet and control the sugars.; .I felt more confident with all the information provided. Being able to check my sugars gave me more control. It reduced my fears and anxiety.. and I was less worried about having GDM.” [P30\_Group]

---

### **‘One-to-One’**

Once the women in the ‘One-to-One’ started monitoring their blood sugars they described feelings of positivity and a sense of control [Quote 111]. Knowing what their blood sugar levels were and how different foods were affecting the bloods was very helpful but above all being able to make changes in terms of food or introduction of medication provided a higher degree of control and confidence in these women [Quote 112]. Other women described how monitoring of their blood sugar levels ‘impacted positively on their mental state [Quote 113].

#### *Quote 111*

“ I am feeling more positive and more in control. I am happy now I have got the kit and I am able to measure my levels. I can see what is making me spike and what is not making me spike and it is putting me a lot more in control of that which is really nice.” [P24\_One-to-One]

---

#### *Quote 112*

“ I would definitely say I am in more control now that I am coming in each week and my sugars being checked by a nurse or a doctor and them being able to tell me everything is ok or to do something a bit different or switch things around, it is a lot better.” [P9\_One-to-One]

---

#### *Quote 113*

“ and also gave me a blood monitor to keep my readings in check erm so I know where about I need to be. This has made me more again in control which is better than where I was a week ago and I am in a lot better state of mind as well than where I was a week ago.” [P10\_One-to-One]

---

### **6.2.2.3 Positive dietary changes**

#### **‘Group’**

One key aim of the education session was to teach the women about the dietary intervention required in the management of GDM. A large proportion of the presentation was on the types of food and their effect on blood sugar levels. From a dietary point of view the education session influenced the women in multiple ways.

The women described how they felt enlightened with the ‘knowledge’ they discovered about the various types of food one should be consuming in general and particularly during GDM. They described how the dietary knowledge acquired did not only benefit the women but had an impact on the other family members [Quote 114]. They were particularly impressed to learn the examples of different types of carbohydrates, vegetables, and fruits they should eat or substitute [Quote 115]. One cohort explained how the knowledge gained allowed them to reflect on their previous dietary habits which were not optimal and how they were now prompted to make immediate changes [Quote 116].

*Quote 114*

“Yeah definitely because I didn’t know very much about the GI levels in different foods so that was very interesting and it has had a knock-on effect with my family because obviously my husband and my son ending up eating the same things, so I think it is benefiting the family being that little bit healthier.” [P3\_Group]

---

*Quote 115*

“The bit about the content of sugar in food and what proportion of food to eat was helpful too. It was interesting to learn that our food should consist of one third carbs, one third protein and one third vegetables & fruits & nuts. ....changing white bread to brown and seeded preferably. I also liked that they mentioned examples for low sugar snacks...they advised things like humus, carrots, celery, nuts etc. I have made changes in my diet based on these.” [P6\_Group]

---

*Quote 116*

“I found out about many things, like what kind of fruits should I eat, what kind of veg and many many things. I think it helps a lot because before that I did not know what to eat, I ate everything and now I watch what I eat.” [P13\_Group]

---

**‘One-to-One’**

The women who attended the ‘One-to-One’ session felt the latter was instrumental in making them reconsider and change their diet and lifestyle in general. There were two patterns of behaviour change that emerged. In the first cohort the women mentioned

that they were already on a ‘semi healthy diet’ and therefore they had to make only minor changes following their education session [Quote 117]. In the second cohort, the women described how they made drastic changes and particularly ‘cut down’ on various foods that formed part of their daily consumption [Quote 118]. The women in this cohort described how it was challenging to cut back on sweet food such as chocolates and biscuits presented real challenge for them [Quote 119]. However, with the knowledge gained about the effects of various types of carbohydrates on blood sugar levels the women described how they became more vigilant in their diet and more conscious of the sugar contents of foods [Quote 120]

*Quote 117*

“ I have changed my diet slightly, I mean I was on a pre-healthy diet anyway but I have just made some changes to improve it, like cutting out white bread, fizzy drinks – not that I was a big fizzy drinker anyway but it has helped.” [P10\_One-to-One]

---

*Quote 118*

“ I immediately changed my diet. My diet wasn’t really that bad anyway erm we eat really healthily, and I have been brought up in a diabetic household so we had to erm but I suppose I had a weakness to chocolate which I had a bit of everyday (laugh), but I cut that out.... I have stripped all sugars from my diet.” [P12\_One-to-One]

---

*Quote 119*

“ I have struggled quite a lot with carbs I think because I think at first I thought it would be easy to cut out sugary cakes and drinks but things like bread have been making my levels go too high which has been quite difficult.” [P21\_One-to-One]

---

*Quote 120*

“ The first shop I did after the diagnosis I was looking at all the labels, the sugar content which I didn’t do before because I thought if you buy healthy food that looks healthy it will be ok but actually I am shocked that tinned tomatoes have a lot of sugar in, things like that that you do generally eat in your diet have to be doubled checked. It



has changed me and I will be looking more and this has affected me for life now.” [P12\_One-to-One]

---

#### **6.2.2.4 Glucose challenge and concerns**

##### **‘Group’**

As previously discussed, many women felt very happy and very often ‘in control’ when checking their blood sugars. However, SMBG and knowledge of their blood sugars had deeper effects on their emotions, behaviour and action. The women described how they felt safer checking their blood sugars and that a strict management plan was being instigated [Quote 121]. However, another cohort of women explained how they were struggling with their blood sugar levels in general or at particular times of the day. The women who were experiencing high blood sugars were quite worried and stressed [Quote 122]. They were feeling that circumstances were “out of control” [Quote 123]. Some of these women explained how they were struggling to understand why their blood sugars were still high despite optimizing their diet which prompted them to look for answers online [Quote 123]. Whilst they understood the importance of checking blood sugars, a minority of women described how they found it difficult and overwhelming to juggle with daily activities and regular SMBG [Quote 124]

##### *Quote 121*

“I feel better with that and as I say I feel better knowing that the sugar levels are monitored a lot more closely and they are more strict in pregnancy than normal.” [P5\_Group]

---

##### *Quote 122*

“ I am not feeling confident at the moment. My sugars are erratic. I am trying to eat healthy in order to bring them down. At the moment I wouldn't say I am enjoying my pregnancy that much.” [P22\_Group]

---

##### *Quote 123*

“.....I cut down the sugars and then I started doing testing after the first week of cutting sugars down. I was a bit disappointed because the sugars were high in the morning and it felt really deflating and ...I managed to find all the information out via NHS website which

says some mums just can't control it so don't beat yourself up about it basically. [P20\_Group]

---

*Quote 124*

“ I feel more confident about the fact of checking my bloods erm that's fine. Erm fitting it in can be quite difficult, last night I was a bit late checking it because I was putting my little girl to bed and then I am panicking that I need to get this done. Erm so it is on your mind all the time.” [P7\_Group]

---

Erratic blood sugar levels prompted women to have more discussions around management with the HCPs, especially the Diabetes Specialist Nurse [Quote 125]. The women described how they discussed management of their blood sugars in relation to their diet and most importantly consideration for diabetes medications [Quote 126]. Whilst some women understood that they had to start on medications to bring their blood sugar levels down others did not feel too keen on diabetes medications, safety being their main concern as well as side effects [Quote 127].

*Quote 125*

Erm I have struggled with breakfast, I am a bit of cereal lover..... has resulted in three high readings over the last seven days, ..... and need dealing with but I made a note of exactly what I have eaten so the nurse could see and she has told me exactly where to change things. [P7\_Group]

---

*Quote 126*

“Although the bloods are still high in the morning we are going to try Metformin just after the evening meal just to try and bring them down a bit. I am not too worried, I won't say I feel more in control of it because in the mornings I just thought right I can take my blood sugars and then I will control it but yeah it's obviously somewhat out of my control. [P15\_Group]

---

*Quote 127*

“ it's just the breakfast reading and I can't get that down....., so I have been prescribed Metformin. I am a bit dismayed that I have got to take it. I know it is supposed to be safe for pregnant ladies to take but the

idea of taking it does not fulfil me with joy and the idea that I will probably be more nauseous and sick after taking it, I don't like that either. So, at the moment I don't feel more in control, I feel a little bit out of control..." [P18\_Group]

---

### **'One-to-One'**

Although checking blood sugar levels provided a degree of control and confidence as previously described, it also led to a new set of issues and concerns. The majority of the women had variable levels of blood sugar levels (hyperglycaemia). The women described facing 4 types of concerns and challenges. One of the concerns highlighted was how they found it intriguing to understand the daily fluctuations in their blood sugar levels despite keeping to a routine diet [Quote 128]. The challenge here was to continue checking their blood sugars and learn which foods caused their sugars to rise. In the second cohort the women were concerned with high blood sugars but remained quite determined and took up the challenge to bring the blood sugar levels down by sticking to a healthy diet [Quote 129]. In the third cohort, the women who had not yet recovered from their initial shock were frustrated and anxious about hyperglycaemia which had a negative impact on their morale [Quote 130]. The fourth concern was that of starting on medications for hyperglycaemia which was smooth for some women but challenging for others. The women were still struggling with hyperglycaemia despite changes in their diet had to face starting medications [Quote 131].

#### *Quote 128*

" what it is and you know why it happens erm and just a little bit of information kind of about the fluctuations and things like that because you know when I started doing my monitoring I was quite surprised at how variable things were as well, yeah and despite the fact that you know you had eaten the same thing..." [P1\_One-to-One]

---

#### *Quote 129*

" On Monday I saw the diabetes specialist.... she was a bit concerned that my levels were still quite high. She would have been happy with them if they were an hour after food but with it being 2 hours after food they were quite high, so now I have gone even tighter on my diet this week and they have gone down." [P11\_One-to-One]

---

*Quote 130*

“ At the moment I am still feeling a little bit shocked really because I have been trying hard with my diet but my blood sugars have still remained elevated. I have been started on one tablet of Metformin today.” [P32\_One-to-One]

---

*Quote 131*

“I have just been told that I need to start taking Metformin to help control my blood sugar which is quite frustrating because I have really tried my best to control it just by diet alone and I would be quite interested to see how stress relates to diabetes because I have had a really stressful week so I do not know if that has made my glucose levels increase.” [P17\_Group]

---

### **6.2.3 Lived experience of acquiring information**

From the time of diagnosis, the women were desperate for information about how to manage GDM. The education session was instrumental in bringing about a lot of changes physically and emotionally in the women, primarily by answering most of the questions they had. The education session was responsible for a shift from negative to positive lived experiences in terms of ‘lived body, time space and relationality’.

#### **6.2.3.1 Good and Informative session**

##### **‘Group’**

The eagerly awaited education session was welcomed with overwhelming response by the majority of the women who attended the ‘Group’ session. The women expressed their feelings about various aspects of the education session including the content, overall presentation, length of session and its effect on them. An emerging theme that resounded amongst the women was their vivid description of the education session, which most of the women described as “very good” and “informative” [Quote 132]. They all liked the well-illustrated slides of the PowerPoint presentation which was used for the education session [Quote 133]. The women thought the content of the slides was ‘self- explanatory’ and enlightening.

The women expressed their satisfaction with the type of information that had been provided in terms of different types of food, especially carbohydrates and the

examples of food that should be consumed [Quote 134]. The effect of various types of food on the blood sugars was discussed during the session. A lot of women in this cohort were pleased with the knowledge gained and felt more reassured.

*Quote 132*

“ The session itself was really informative, the slide show was really good, there was a lot of pictures and it was really simplified. Everyone else in the group seemed to be enjoying it as well and they seemed to leave with a lot more knowledge.” [P25\_Group]

---

*Quote 133*

“ I had a group education session which was full of information. I liked the power-point presentation ...eh it was well illustrated.” [P30\_Group]

---

*Quote 134*

“ Hmm it was a very really good session.... The bit about the content of sugar in food and what proportion of food to eat was helpful too. It was interesting to learn that our food should consist of one third carbs, one third protein and one third vegetables & fruits. Our diet should also contain nuts. She gave some examples like ...hmmm changing white bread to brown and seeded preferably. I also liked that they mentioned examples for low sugar snacks...they advised things like humus, carrots, celery, nuts etc. I have made changes in my diet based on these. The presentation was very good with many illustrations. I learn more with pictures.” [P6\_Group]

---

**‘One-to-One’**

The majority of the women who attended the ‘One-to-One’ session found the session educational and informative [Quote 135] for various underlying reasons. Some women felt more knowledgeable about GDM and learnt to differentiate the types of diabetes [Quote 136]. Others who had previously read about GDM on the internet and had been anxious felt happy with the clarity obtained during the education session [Quote 137]

*Quote 135*

“I had a 1-1 session. I was given some information that I didn’t really know so it was quite educational actually.” [P14\_One-to-One]

---

*Quote 136*

“ I had a 1-1 session last week and I found it very helpful actually, just as a general overview to gestational diabetes. I learnt new things, for example that gestational diabetes is completely different to the other types of diabetes whereas I put it more in line with type 2” [P12\_One-to-One]

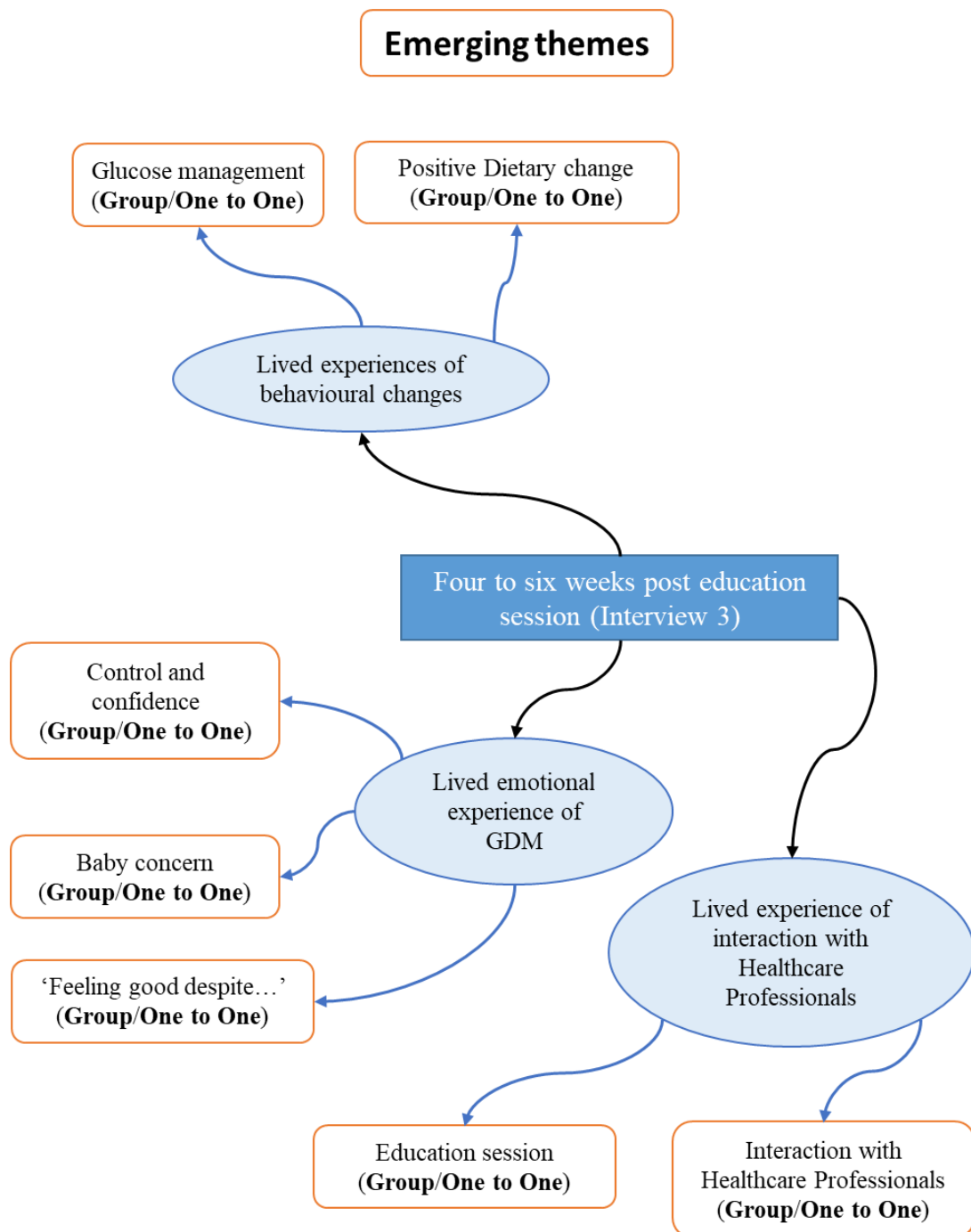
---

*Quote 137*

“ It was really a good insight in to what everything concerns and after me readings things on the internet it cleared my mind a lot more. I wouldn’t say there was anything to change on the 1-1,...” [P9\_One-to-One]

---





*Figure 14: Common themes emerging following the ‘Group’ and ‘One-to-One’ education session (Interview 3)*

### **6.3.1 Lived experiences of behavioural changes**

Four to six weeks after attending the education session, the women had the opportunity and time to make substantial changes including their diet and established a routine around self-monitoring of blood glucose levels. Their lifeworlds including their ‘lived body, time and relation’ experiences had been influenced by the information acquired



from the education session. With the knowledge about the type of foods, particularly the types of carbohydrate, the women had made behavioural changes towards their diet and their food shopping routine. This in turn had influenced their lived relationality in that the other members of the family were also affected by these changes. From a corporeality perspective they were feeling more confident in dealing with their condition which contributed to less anxiety and worry.

### **6.3.1.1 Glucose management**

#### **'Group'**

Glucose management was the prime focus for women with GDM at this stage. They were expected to manage their blood sugars and know what to expect if the sugars start rising. The women were experiencing three patterns of blood sugar levels: (i) blood sugars within range, (ii) blood sugars starting to rise, (iii) persistent high blood sugars. The women from the 'Group' session were either on diet only, metformin only or a combination of metformin and insulin for management of their blood sugars. Glucose management affected the women's emotions, action, and behaviour in various ways. The women's whose GDM was purely diet controlled were undoubtedly pleased with their control and hoped they would not require any medication in any form (Quote 138)". The women whose blood sugar levels were rising did not seem overly anxious. They accepted the fact that their glucose management would need the following changes: introduction of metformin, increasing the dose of metformin or addition of insulin to metformin [Quote 139]. The women with hyperglycaemia demonstrated an underlying understanding of the stepwise medical management of their blood sugars. They appeared to have excellent rapport with the diabetes consultants and diabetes specialist nurses with whom they discussed blood sugar management including mutual negotiations to consider or start medications [Quote 140].

#### *Quote 138*

" I am managing to control my blood sugars through diet. All of my readings have been within the normal range. I have just been told today that hopefully it will continue like this as long as my diet stays similar to it is now it should hopefully continue without any need for medication" [P25\_Group]

*Quote 139*

“ I take Metformin 2 twice a day, 2 in the morning and 2 at evening meal. The day ones are fine so I am doing something right there, just my fasting ones seem to be a little bit high so again I am not bothered about the insulin, if it is all a good sign” [P2\_Group]

---

*Quote 140*

“ I .....I mean the sugar level is still high in the morning, that is why after seeing the consultant now, he said I need to increase the evening dose, so I am going to take 500mg in the morning and 1000mg in the evening and hopefully that should do the trick” [P8\_Group]

---

**‘One-to-One’**

As with the women in the ‘Group’ session glucose management remained central to the care and focus of the women attending the ‘One-to-One’ session. More than half of the women with GDM in this cohort were diet controlled and the rest were taking metformin. Almost all these women seemed quite satisfied with their blood sugar control. They described their emotional state as feeling ‘alright’, ‘well’, ‘confident’ and ‘happy’. Some women were specifically happy since their blood sugar levels had improved after starting metformin [Quote 141] or with increased doses of metformin. The majority of the women who had controlled their blood sugars with diet only were also particularly pleased with their efforts and felt confident. They emphasised the control was achieved by dietary changes, exercise [Quote 142] and controlling their sugary urges [Quote 143].

*Quote 141*

“I am currently on Metformin 1g in the morning and 500mg in the evening and I am a lot happier because my blood sugars are great. I do get side effects with Metformin but it’s not forever.” [P1\_One-to-One]

---

*Quote 142*

“I am controlling my gestational diabetes by diet and some exercise and at the moment the levels are stable so that’s good and I am feeling quite well at the moment. [P12\_One-to-One]

---

*Quote 143*

“The diabetes side of things in under hand now because I know what to do and when to take my bloods and things like that. I think I am controlling the blood sugars well. Obviously, it is still hard when you want a piece of chocolate or something like that.” [P11\_One-to-One]

---

### **6.3.1.2 Positive Dietary change**

#### **‘Group’**

Dietary change is closely linked to and often directly impacts on glucose management. At this stage of pregnancy discussion around diet and any changes or challenges related to diet was emphasised by the HCPs. Similar to glucose management, dietary changes were found to be another primary focus for the women. Dietary changes had a significant effect on the women’s lives and impacted on their emotions, behaviour, and action. The majority of the women felt the dietary change they had made had a positive impact on their general health but mostly on their blood sugars which were much better controlled. The women felt ‘good’, ‘healthier’, ‘energetic’ and ‘happy’ with their diet [Quote 144]. Those women in this cohort whose blood sugars were controlled by diet alone were quite pleased with their efforts and wished they would continue being diet controlled [Quote 145]. Driven by their motivation to stay off medications in general or due to intolerance some women resorted strict changes to their diet to achieve their target their blood sugars [Quote 145 142]. Driven by their motivation to stay off medications in general or due to intolerance some women resorted to strict changes in their diet to achieve their target their blood sugars [Quote 146].

#### *Quote 144*

“In general, I am feeling really energetic because obviously my diet has changed, so I am feeling great in myself. I am keeping an eye on my weight. I am not putting any weight on. I have stopped eating sugary things and bread.” [P17\_Group]

---

#### *Quote 145*

“I am managing to control my blood sugars through diet. All of my readings have been within the normal range. I have just been told today that hopefully it will continue like this as long as my diet stays

similar to it is now it should hopefully continue without any need for medication” (P25\_Group)

---

*Quote 146*

“I tried Metformin for a week and I didn’t feel like it was making any difference so I just became more strict with my diet, particularly at breakfast when I was getting high readings. I have totally cut carbs out all together which is a bit of a challenge but it is only for a few weeks, so it’s fine.” [P18\_Group]

---

**‘One-to-One’**

The majority of the women attending the ‘One-to-One’ session were diet controlled with a few on metformin as mentioned previously. The women in this cohort made a lot of changes to their diet which they described as ‘strict’ and ‘big’ [Quote 147, 148]. They were driven to maintain their blood glucose levels under control mainly to prevent the complications of GDM [Quote 148]. The fact that their dietary changes resulted in keeping their blood sugars within target made them feel happy and more confident [Quote 149].

*Quote 147*

“No just diet controlled. I have made a lot of changes to my diet based on the advice that was given by the diabetes nurse.” [P30\_One-to-One]

---

*Quote 148*

“I was really worried at the beginning and I made sure that it will not affect my baby in anyway so I was very strict on diet and I have taken the steps to really control the blood sugar level and it made me feel more confident.” [P23\_One-to-One].

---

*Quote 149*

“I made changes many things and my diet and I now I feel more confident,...my sugar is under control” [P16\_One-to-One]

---

## 6.3.2 Lived emotional experience of GDM

From a lived body perspective all the women felt protective towards their unborn child and were willing to behave or change in any way to minimize maternal and perinatal complications. This primordial sense of security for their child provided the motivation to make drastic changes to their diet and lifestyle, finger-prick 4 to 6 times per day for SMBG and manage their blood sugar levels with oral medications or insulin. This resulted in feelings of confidence and control. Despite ongoing concerns about the baby, the women demonstrated resilience and felt ‘good overall’.

### 6.3.2.1 Control and confidence

#### ‘Group’

After attending the education session, the initial negative emotions seem to subside with the women feeling more “confident and in control”. The women stated they felt confident and in control by learning about GDM and checking their blood sugar levels including understanding the underlying reasons for doing so [Quote 150]. Through their own leaning process and experience some of the women felt knowledgeable and confident enough to help others in similar situations [Quote 151]. Being able to monitor their blood sugars and taking appropriate actions made them feel ‘in control’ of their blood glucose levels and of themselves. Through experiential learning this also led to behavioural changes whereby the more they learnt which food made their blood sugar levels go high or kept them stable they accordingly modified their diet [Quote 152].

#### *Quote 150*

“My original concerns from the very first interview when I got upset etc.....they have definitely gone now. What I learnt from the education session was very useful. I am doing everything I can. I feel much more confident about the process I am going through.”

[P6\_Group]

---

#### *Quote 151*

“.....I feel more in control now I have been monitoring my blood sugar levels. I can see the things that spike my blood sugars. I do feel in control.” [P3\_Group]

---

*Quote 152*

“I feel confident in checking my bloods. I feel more confident in trying to maintain glucose level. The education session was very good and gave us a good grounding in the importance of good blood sugar control to prevent complications. The diet side was good too. Knowing I can have that or I can’t have that. I feel more confident in doing that now I am 4 weeks down the line.” [P7\_Group]

---

**‘One-to-One’**

The women who attended the ‘One-to-One’ session stated how they felt more confident at this stage of their pregnancy. They described three underlying reasons for this feeling of confidence. Firstly, they had made significant dietary changes [Quote 153] and learnt a lot about different type of foods. Secondly, they felt confident by just checking their blood sugars and knowing what changes to make [Quote 154]. Thirdly they felt more confident and in control when their blood sugars levels were controlled either with diet or metformin [Quote 155]. The women also demonstrated they made changes in diet changes from what they learnt from the education session and tried to maintain a routine to try to sustain these positive changes [Quote 156].

*Quote 153*

“I obviously learnt about diet control and things and I was able to turn it round pretty easily. I feel more in control of the whole diabetes situation” [P31\_One-to-One]

---

*Quote 154*

“...the diet is going really well. I stick to the same thing every single day, so I know where I am, and I am in a routine. Everything has become part of the norm now and I am taking my blood sugars as and when, so I feel a lot more in control with everything at the moment.” [P10\_One-to-One]

---

*Quote 155*

“I think I feel much more confident now that I am regularly checking my blood sugars and taking the metformin.” [P21\_One-to-One]

---

*Quote 156*

“I obviously learnt about diet control and things and I was able to turn it round pretty easily. I feel more in control of the whole diabetes situation” [P30\_One-to-One]

---

### **6.3.2.2 Baby concern**

#### **‘Group’**

Analysis from the transcripts showed the women had 3 main areas of concern with related to the baby (foetus). Firstly, they were hoping for the baby to grow and be born healthy i.e. without any other complications [Quote 157]. Secondly, they were particularly concerned about the possibility of having a large baby (macrosomia). Thirdly, they had concerns about the time and mode of delivery for the baby.

The women were well aware of the possibility of having a large baby (macrosomia) which is one of the complications of GDM. Following their growth scans, the women described their concerns about their baby being slightly on the big side and feared having a large baby [Quote 158]. They also knew that macrosomia was directly related to high blood sugar levels, and they clearly expressed how they were trying their best to maintain their blood sugars down in avoid having a big baby [Quote 159].

*Quote 157*

“ Any concerns about the baby that I have are just that I hope when he is born there are no complications with him, I just want to make sure he is healthy and feeding properly.” [P3\_Group]

---

*Quote 158*

“I don’t really have any concerns about myself but from our last scan which was about 2 weeks ago, the baby’s belly circumference was measuring slightly above what it should be in comparison to everything else so I am a little bit concerned about that.” (P25\_Group)

---

*Quote 159*

“I am looking forward to the scan which I am having next because hopefully that will ease any concerns about the baby and finding out if he does have to come early, so I am hoping that because my levels have been good that he hasn’t grown too bit ....” [P18\_Group]

---

### **‘One-to-One’**

The third trimester can be a stressful time for women with GDM. They have scheduled foetal ultrasound scans to monitor the growth of the baby. The women were aware of the complications of GDM including the risk of having a baby large for gestational age or macrosomia. Assessing the size of the baby is fundamental in planning the timing and mode of delivery of the foetus. Women were eager to know the results of their growth scans, particularly to know if the baby is big.

The main concern the women in the “One-to-One” cohort had been that of having a big baby [Quote 160]. The women continued to worry about how GDM as well as the associated complications might affect the baby [Quote 161]. Other issues that were causing anxiety were the possibility of induction of labour [Quote 162] or C section. Those women who thought they were going to be induced were particularly worried

#### *Quote 160*

“ I am looking forward to the next scan. Of course, I will worry about the baby until it is born. I am worried that the baby might big.”

[P21\_One-to-One]

---

#### *Quote 161*

I think I will always have concerns about the baby until it comes safely...” [P12\_One-to-One]

---

#### *Quote 162*

I am still worried and anxious about having a big baby. The midwife said I might need induction early if that happens.” [P29\_One-to-One]

---

### **6.3.2.3 “Feeling good despite...”**

The women enjoying their pregnancy more of at this stage of their pregnancy.

### **‘Group’**

At the start of interview 3 all the participants were asked how many weeks pregnant they were and how they were feeling. All the women stated they were feeling well in one way or another before they proceeded to describe their recent experiences up to that point during their pregnancy.



Our analysis showed the women used terms like feeling “OK”, “really good” and “fine” to describe their state of mind at that point in time. However, the underlying reason why they felt well was not always something positive [Quote 169]. Some of the women felt positive and great in themselves due to good blood sugar levels due to being on a good diet [Quote 170], on metformin or improvement in high blood sugars after starting insulin [Quote 171].

*Quote 163*

“I feel good, sometimes I have back pain, especially in the evening time.” (P13\_Group)

---

*Quote 164*

“I am 36 weeks pregnant now. I am feeling pretty good. The last few weeks have probably been the best of the pregnancy because I am not feeling sick so much. I think I am actually feeling quite good because my diet is very healthy at the moment.” (P18\_Group)

---

*Quote 165*

Generally, I am feeling fine. I feel quite good actually. Blood sugars since starting insulin I think about 6 days ago, it has started bringing them down in the morning which is where I was having the problems, so that’s quite good and it feels better.” (P15\_Group)

---

**‘One-to-One’**

The women in the ‘One-to-One’ session described “feeling good or OK in general” similar to the women in the ‘Group’ session [Quote 172]. Unlike the ‘Group’ attenders, the women in the ‘One-to-One’ session did not express any other concerns such as back pain, tiredness, or other underlying problems. The main reasons for their happiness were either good or stable blood sugars [Quote 173], knowing the baby was in good health or being on an optimal diet [Quote 174]

*Quote 166*

“ I am 35 weeks pregnant and I feel OK in general.” (P21\_One-to-One)

---

*Quote 167*

“I am 37 weeks and 5 days pregnant now. I am feeling ok with the diabetes side of things.” [P11\_One-to-One]

---

*Quote 168*

“ I am feeling quite well at the moment. Generally, I feel well and I feel like I am getting used to the diet” [P12\_One-to-One]

---

### **6.3.3 Lived experience of interaction with Healthcare Professionals**

The education session was the first reliable source of information for these newly diagnosed women with GDM. The education session covered a lot of information which was adequate for some, overwhelming for others or not enough for some. Nevertheless, the lifeworld of each of the women attending the education session was transformed in one way or another. The experience of attending education session positively influenced the women’s ‘lived space, time, body and relation’. From a spatiality perspective the education session was experienced as a ‘safe place’ where they learnt about the management of GDM. They subsequently felt reassured which in turn made them enjoy their time during the session. The education session was their first physical contact with the health care professions, with whom they would develop a relationship for the duration of their pregnancy. Interactions with multiple HCPs forming part of a multidisciplinary team would become part of their lifeworld and help support them in the management of GDM.

#### **6.3.3.1 Education session**

##### **‘Group’**

During our analysis we found around half of the women who were describing their ‘lived experience of glucose management’ or any other emotions at this stage in the pregnancy made frequent references to the education session. They described the education session as ‘helpful’ and ‘useful’ [Quote 163]. The women gave credit to the education session for preparing them in how to deal with GDM during pregnancy [Quote 164]. Some women described their feelings about the positive impact of the education session at this stage in their pregnancy. For instance, some of the women

seemed well aware of the long-term complications of GDM such as development of T2DM in the future and risk of obesity in the child [Quote 165].

*Quote 169*

“What I learnt from the education session was very useful. I am doing everything I can. I feel much more confident about the process I am going through” [P6\_Group]

---

*Quote 170*

“The education session was very good and gave us a good grounding in the importance of good blood sugar control to prevent complications.” [P7\_Group]

---

*Quote 171*

“The future worry too... like am I going to end up with diabetes like my grandmother, is my baby going to be effected like with obesity,. This had been mentioned in the education session. so, I have concerns but at the moment I am trying to stay positive.” [P8\_Group]

---

**‘One-to-One’**

The women in this cohort would have attended their ‘One-to-One’ education session 6 to 8 weeks before their third interview. The women previously mentioned how the education session contributed towards changing their negative feelings to positive ones. In addition to commending the information from the education session in general there were three areas which were highlighted by the women during this interview: blood sugar control, dietary change and complications or implications.

The women felt more at ease to manage their anxieties around management of GDM once they better understood the complications and implications [Quote 166] involved. Some of them recalled that GDM was associated with risk of T2DM and were thinking long term [Quote 167]. Some women described how they were able to cope with the stress of their blood sugars rising as this had been explained to them during the education session, including their target levels [Quote 168].

*Quote 172*

“...I am reassured on the implications of it and how it can be controlled. I feel like I have got all the knowledge that I didn’t have at the beginning and I understand it far better “ [P12\_One-to-One]

---

*Quote 173*

“ From what I learnt from the education session I know I now have a higher risk of type 2 but I knew I had more of a risk with the family history anyway. If we do decide to have more children obviously I will want to the test again...” [P31\_One-to-One]

---

*Quote 174*

“ .. “They are creeping up a little bit I noticed but I was told in the education session that they would do generally anyway, but they are still under target, so fingers crossed with it being under target” [P4\_One-to-One]

---

### **6.3.3.2 Interaction with Healthcare Professionals**

#### **‘Group’**

From the moment the women were diagnosed with GDM, interaction with the different types of HCPs became a norm. These HCPs included midwives, diabetes specialist nurses, diabetes consultants, obstetric consultants and dieticians amongst others constituted the multidisciplinary team.

The women in the ‘Group’ session were unanimously happy with their interactions with the various HCPs which they described as ‘brilliant’, ‘friendly’, ‘helpful’ and ‘reassuring’ [Quote 175]. The women found the appropriate information and guidance which was very helpful in the management of their GDM [Quote 176]. An important aspect of the care that the women valued was that of reassurance. The women expressed how they felt reassured by the MDT members during their clinic appointments [Quote 177].

*Quote 175*

“I just have to take every day as it comes really but the people looking after us have been absolutely brilliant right from the beginning from everybody we have seen.” [P7\_Group]

---

*Quote 176*

“The interaction with the health care team has been great. The education session was very useful at the start. I feel that I have been well informed.....” [P25\_Group]

---

*Quote 177*

“The interaction with the healthcare has been great. I am here every week seeing the diabetic team and I have their number to call if I feel I need any extra help or guidance. They have been really good and they have explained everything.” [ P6‘One-to-One’]

---

As previously discussed, the women with GDM had scheduled and unscheduled interactions with the obstetric and diabetes multidisciplinary team within clinic consultations. The majority of the women in this cohort highly commended their interactions with the HCPs. They described their interactions as ‘brilliant’, ‘very good’, ‘helpful and ‘friendly’ which mirrors how the women in the ‘Group’ session felt [Quote 178]. The women felt understood and well supported by the various members of the MDT [Quote 179]. Some of them were pleasantly surprised how the MDT team was easily accessible for advice and support outside clinic set settings [Quote 180].

*Quote 178*

“ Interaction with the health care team has been brilliant. I could not have asked for anything better to be honest. They seem to have understood everything from my point of view. Anytime I have had any problems, the doctor I have seen has been great with it.” [P9\_One-to-One]

---

*Quote 179*

“ My blood sugars have been up and down. But I am getting support from the diabetes team at Chester..... I found the diabetes team very helpful although I see someone different all the time.” [P29\_One-to-One]

---

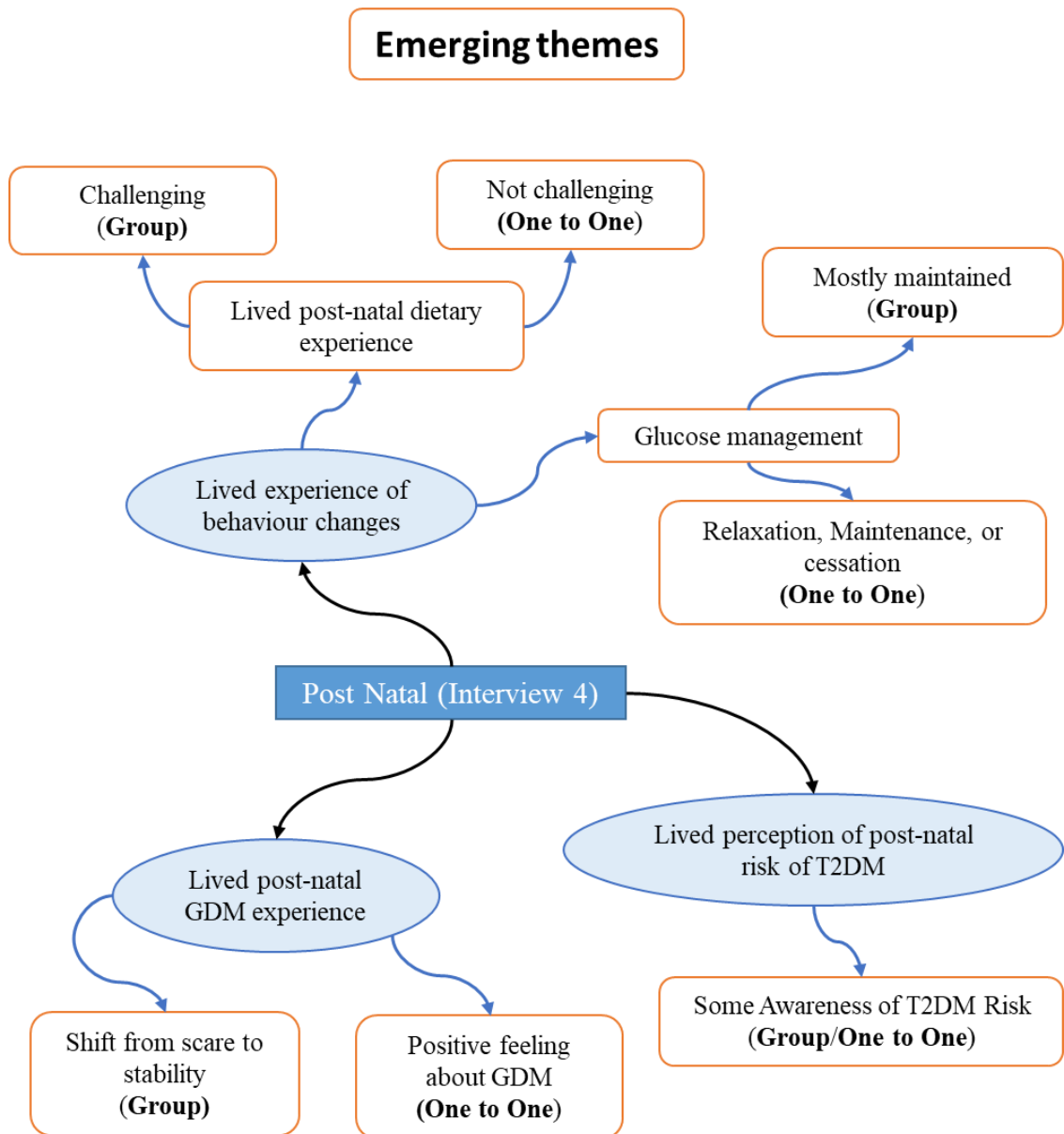
*Quote 180*

“It has been brilliant. I can’t fault it really. If I have had to ring up someone has always got back to me usually within a couple of hours

which shocked me about because sometimes I think you are really busy but yeah I can't fault it." [P31\_One-to-One]

---





*Figure 15: Themes emerging from post-natal interview (Interview 4)*

The post-partum stage has its own challenges and stresses. Many women did not attend.

### 6.4.1 Lived experience of behavioural changes

Unlike the experiences during their pregnancy the women were now experiencing a completely different lifeworld after giving birth. From a lived body, space, time and relationality perspective the women had embraced motherhood with the addition of a new family member and were now orientated to a new post-pregnancy journey. As part of their new ‘lived post-natal lifeworld’ the women were experiencing a social sense of purpose as mothers in a family and/or community setting (316). The women’s



previous lived experiences are important to understand as they influence their current and future behaviour. Gaining insight into these lived experiences helps inform the Healthcare professionals towards making changes to improve these experiences and their care in general.

### **6.4.1.1 Glucose Management**

#### **'Group' - Challenging**

During the post-natal interview, the women were asked about their experiences around glucose management. The majority of the women in the 'Group' session found several aspects of glucose management challenging: dietary changes, checking blood sugars and diabetes medications. All the women had to make major dietary changes in order to control their blood sugars to the target levels however, a lot of them did not manage to achieve this throughout the day which led to the use of pharmacotherapy [Quote 181]. Women found it hard to try to find the type of food that would not increase their blood sugar levels out of proportion which led to the start of insulin [Quote 182]. Women had to check their blood sugars pre-meals and after meals and this amounted to between at least 4 to 8 times per day. In addition to being painful the women felt checking blood sugars was taking up a lot of their time and made them feel fed up as the pregnancy progressed [Quote 183]. A minority of women managed to successfully control their blood sugars by diet only. They felt their experience was better as once they understood what GDM was and how to manage it [Quote 184].

#### *Quote 181*

“ It was a challenge. Initially it was fine with the diet and getting the food right but once we got the diet sorted out it was fine it was just then that I was obviously you know struggling being quite hungry all of the time . So, then we had to introduce the Metformin because I was just struggling maintaining the numbers.....” [P7\_Group]

---

#### *Quote 182*

Yes, I did actually, as healthy as I was eating I still couldn't get the readings as low as they needed to be. For me mainly it was the morning one. So, I ended up on insulin for the last couple of weeks... [P6\_Group]

---

*Quote 183*

“ difficult Injecting myself. Sometimes it got painful and towards the end I was just a little bit fed up of having to jab my sides and take my blood test 4 times a day.” [P2\_Group]

---

*Quote 184*

“At first but once I had read everything about it and I found out about it I thought it was quite easy to manage...” [P25\_Group]

---

**‘One-to-One’ – Not challenging**

Unlike the women in the ‘Group’ session, the women in the ‘One-to-One’ session described how they did not find their glucose management particularly challenging. Instead, they felt quite interested to learn how different types of food influenced their blood sugar levels which prompted them to experiment with different types of food [Quote 185]. During the education session the different types of carbohydrates and their effect on blood sugar levels had been discussed. The women explained how having the relevant knowledge helped them smoothly manage their glucose levels [Quote 186]. Others thought glucose management was challenging in the beginning but eventually became more manageable [Quote 187].

*Quote 185*

“ Not really. no, it wasn’t challenging it was interesting I suppose to see how certain food affected me.” [P4\_One-to-One]

---

*Quote 186*

“ No not at all. Once I had set my mind to it and worked things out I wouldn’t say it was very challenging at all to be honest. [P9\_One-to-One]

---

*Quote 187*

“ I suppose initially may be but not really because we do have a healthy diet, so it was just adapting that and thinking more carefully about the sugar content of things.. ” [P12\_One-to-One]

---

### 6.4.1.2 Lived Post-natal dietary Experience

#### **'Group' – Mostly maintained**

Maintaining a good diet was central to the management of GDM for all the women. When discussing their dietary experience during pregnancy, the women emphasized how they had to make significant changes to their usual diet. Many of them described how they cut down on sugary foods and switched to healthier food options such as wholemeal based products instead of refined flour [Quote 188]. The 'Group' attendees explained how they had to be vigilant regarding the sugar content of any food they consumed which they are continuing to do after delivery [Quote 189]. Most of the women stated how they were maintaining their dietary changes and opting for a healthy diet for themselves and their family [Quote 190]. However, a minority of women had reverted back to their pre-pregnancy diet [Quote 191].

#### *Quote 188*

“ I watched what I ate and cut out sugary food and changed to wholemeal breads and pasta and rice. Changing what I had for breakfast as well.” [P3\_Group]

---

#### *Quote 189*

““ With the diet now I just watch everything, the sugar. I try and go for sugar free. I look at my coffee in the morning when I put my sugar in it like do I really need it.” [P2\_Group]

---

#### *Quote 190*

“ “ We continued to stay on our healthy diet, myself and my husband, he is doing it with me..... I have maintained the healthy food.” [P6\_Group]

---

#### *Quote 191*

“ I still buy wholemeal pasta and brown rice, but I have basically gone back to where I was before.” [P3\_Group].

---

### **‘One-to-One’ – relaxation, maintenance, or cessation**

All the women in the ‘One-to-One’ session were aware that they were meant to maintain a healthy diet after delivery due the future risk of developing diabetes and to prevent GDM in future pregnancies. There were 3 patterns of behaviour which emerged from this cohort of women: some relaxation, maintenance, and cessation of optimal diet post-partum. Some of the women admitted quite honestly that they had become slightly more relaxed about their diet compared to their strict pregnancy diet. However, despite their relaxation some of them were aware of the future risk of diabetes and what needed to be done [Quote 192]. Some of them who admitted having indulged in sugary food had sensibly started to make healthier lifestyle changes [Quote 193]. For those women who continued to maintain an optimal diet described these positive changes had impacted not only on them but the other family members [Quote 194]. These women also described how looking at food labels had become second nature to them whilst shopping [Quote 194]. However, not all the women were able to maintain a strict or healthier diet post-partum. These women described how challenging it was especially for those with small children who may not adhere to the desired diet [Quote 195]. They also highlighted the fact that maintaining a strict diet requires organisation and preparation which is again hard when one has to look after many small children.

#### *Quote 192*

“After the delivery I did have a few weeks when I was a bit more relaxed, but I have started back on cutting out the sugar, if I fancy a little treat I will but I have gone back to thinking about what I am eating.” [P31\_One-to-One]

---

#### *Quote 193*

““After the delivery I did have a few weeks when I was a bit more relaxed, but I have started back on cutting out the sugar, if I fancy a little treat I will but I have gone back to thinking about what I am eating.” [P31\_One-to\_One]

---

#### *Quote 194*

“Well since I have been eating a bit better everybody has because I have been buying stuff that is better and it has probably rubbed off on

my eldest son as well because he doesn't have as much as he was having, and I look at the labels more when I am shopping.”  
[P30\_One-to-One]

---

*Quote 195*

“Yeah I mean a little bit harder after delivery because I have a toddler and a new born so trying to eat healthy all of the time is quite difficult because it does take quite a bit more preparation, but it is changes I am hoping to build in to my lifestyle now.” [P24\_One-to-One]

---

## **6.4.2 Lived perception of post-natal risk of T2DM**

The women had experienced a relatively problematic pregnancy because of GDM but this perception improved with the knowledge that GDM was manageable. The women experienced experiential learning throughout their pregnancy journey. During the education session they learnt about the risk factors and the future risks of having had GDM. Each woman's understanding of the risk perception of T2DM is different. At the time of the interview the women were in a completely different lived space and time in that their priorities and problems were different. They were heavily involved in looking after a baby which was very challenging in the face of tiredness and lack of sleep. In such states not all the women would be thinking of or prioritising the risk of future diabetes in their minds. However, to have the knowledge of this perceived risk of future T2DM is expected and desirable as it had been taught during the education session and at other times during pregnancy.

### **6.4.2.1 Some awareness of T2DM risk**

#### **'Group'**

A minority of the 'Group' attenders expressed their awareness of the risk of T2DM in the future. This was especially in the context of making dietary changes and weight management to minimize the risk of T2DM [Quote 196]. The women also discussed the risk of developing GDM and the risk of developing T2DM in future pregnancies [Quote 197]. This small cohort of women maintained they would still go ahead with another pregnancy despite the risk of T2DM in the future [Quote 198]. A minority felt they would be more prepared for a future pregnancy and would manage it better [Quote 199].

*Quote 196*

“Yes, I am not eating cakes and sweets and drinking fizzy drinks which I was previously. For two reasons, for wanting to get rid of the baby weight and also because of the risk of diabetes. [P7\_Group]

---

*Quote 197*

“It has made me think about what I eat now and drink just to make sure I keep my risk factors low because there is the risk of developing diabetes in the future.” [P7\_Group]

---

*Quote 198*

“I don’t have diabetes now it has gone before I was obviously more concerned. I know that it could obviously affect in the future and obviously if I do have another baby it is more likely I am going to get it again.” [P8\_Group]

---

*Quote 199*

“You just need to be careful what you are doing. In the future if I have it again I know now what I have to do [P22\_Group]

---

**‘One-to-One’**

Similar to the ‘Group’ session only a minority of women actively mentioned the risk of developing T2DM having had recent GDM. Some of the women had eased off their pregnancy diet in the post-partum period but expressed an awareness about this risk of T2DM [Quote 200].

Those women who were overweight and were actively involved in their weight management post-partum seemed to be more aware of the risk of T2DM [Quote 201]. A few of the women discussed the need to maintain a healthy diet and lifestyle due to the increased risk of developing T2DM in the future [Quote 202].

*Quote 200*

“I must admit I have relaxed a little bit about strict diet after my delivery.....but I am aware of the risks of diabetes now and will be watch what I eat in the future.” [P29\_One-to-One]

---

*Quote 201*

“I have managed to keep my weight exactly the same so I haven’t lost or gained anything which has been good. I also know I might get type 2 diabetes so I want to prevent that.” [P10\_One-to-One]

---

*Quote 202*

“I think it made me think a lot about my diet a lot more and obviously the complications with having gestational diabetes and being pregnant and especially the risk of T2DM” [P31\_One-to-One]

---

### **6.4.3 Lived post-natal GDM experience**

During this last interview, it was important to understand how the women retrospectively felt about their ‘lived experiences of GDM’ during their and how this might have changed in the post-partum period. As previously discussed, the women were now experiencing a different lifeworld of motherhood with different priorities. The women during this post-natal interview were asked to reflect on and describe their feelings towards GDM throughout their pregnancy and the effects of GDM on their lives now. The women still remembered certain specific ‘lived body, time, space and relationality’ experiences that had left an impression on them which would impact on their present and future feelings, behaviour and attitude towards GDM.

#### **‘Group’ - Shift from scare to stability**

Most of the women compared their current feelings with what they felt at the beginning of their pregnancy. In general, the women retrospectively described that their initial feelings about GDM had been negative but after delivery they had been more positive. The women expressed how they were scared and worried upon acquiring the diagnosis but that now they were no longer worried [Quote 203].

The reasons for their initial negative feelings included the shock of a diagnosis of GDM, not knowing anything about GDM or feeling guilty about it [Quote 204]. Some women felt that after having lived a diagnosis of GDM, they knew the condition well and how to manage it. The women described how the more they learnt about the condition and managed their blood sugars on a daily basis they became more confident in the management of GDM [Quote 205]. After delivery they felt mostly relieved and safe and less worried about their next pregnancies despite the fact that they had an increased risk of developing T2DM [Quote 206].

*Quote 203*

“I look at it now and it is so treatable. It doesn’t scare me if I continue to have it but luckily I have not. I look back and it scared me whilst I was pregnant, but I am alright about it now.” [P2\_Group]

---

*Quote 204*

“Mentally it made me feel guilty at first but then after speaking to doctors I was made to realise that it wasn’t something that I had done myself it was something that was naturally going to happen.....” [P6\_Group]

---

*Quote 205*

“ “.....after speaking to people, I felt a lot better and more confident with the pregnancy as it went on.” [P6\_Group]

---

*Quote 206*

“ Initially I was really worried about it and now the baby is here and she is safe and well you know it would make me worry less in a future pregnancy knowing that we got through that ok.” [P7\_Group].

---

**‘One-to-One’ – Positive feeling about GDM**

Overall, most of the women who attended the ‘One-to-One’ session seemed to have a positive attitude towards their ‘lived experience with GDM’ despite their initial concerns. As previously discussed, most women were anxious or shocked upon learning about their diagnosis. However, now on retrospection the women in tis cohort felt less negative about GDM towards the end [Quote 207].

The women described they were not particularly concerned about the effect of GDM on themselves but more on the negative effects on the baby [Quote 208]. A minority seemed to have a reduced perceived seriousness about having GDM. They felt GDM did not have much effect on them, and their main worry was about the safety of the baby [Quote 209]. The women highlighted how they made positive dietary changes because of GDM and realised its ongoing importance on their health [Quote 210] and in future pregnancies.

*Quote 207*



“Now I don’t think gestational disease is so scary but in the start, I was worried” [P29\_One-to-One]

---

*Quote 208*

“I don’t think it really affected it much to be honest it is just one of those things. I didn’t feel particularly down about it or upset about the diagnosis I was more worried more than anything what it would mean postpartum to the baby” [P24\_One-to-One]

---

*Quote 209*

“ but I think if I did get it in the future again then I would be a lot more positive about the whole experience because I have had it before and I know how to handle it so if it did get pregnant again then I would be a lot more relaxed about it.” [P10\_One-to-One]

---

*Quote 210*

“ I think from my experience in a positive way because it did make me feel about what I was eating so overall it has had a positive effect on me.” [P31\_One-to-One]

---

## **6.5 Summary**

In chapter 6, I have presented and discussed the themes that emerged from the 4 interviews following thematic analysis. Detailed qualitative data from the transcripts which were transferred to the NVivo software, was analysed guided by the principles outlined by van Manen to reveal thematic themes which represented ‘units of meaning’. The emerging themes have provided insight into the ‘lived experiences of being newly diagnosed with GDM and attending an education session’ in the women in this study. The emerging themes which represent the ‘Lived Experience Descriptions’ were analysed through Van Manen’s phenomenology practice lens, aided by the 4 life existentials which provided a deeper understanding of how these women felt at various ‘lifeworlds’ or stages of their pregnancy. The women’s experiences from the perspective of lived space, time, body and relation evolved from their time of diagnosis to the post-partum period through an experiential learning curve.

The themes also provided insight into how the women's emotions, behaviour and actions changed to deal with a new diagnosis of GDM. Several themes that emerged were common to both the 'Group' and 'One-to-One' attenders. The findings highlight that some of the essential themes also represent certain aspects of care which women feel strongly about or would like to be done differently. These findings have implications for clinical practice in the shorter and longer term. In chapter 7, I will discuss and reflect on these essential themes in the context of current and future clinical practice.

## Chapter 7 Discussion

In chapter 7 the essential themes that have emerged will be discussed. Both the qualitative and quantitative research findings will be discussed in the context of (i) the literature review and how theoretical framework guided the research process in answering the research questions; (ii) the implications of the research findings from a participants' and a healthcare professional's point of view and (iii) possible future applications. I will also be reflecting on the findings and discussing the limitations of the study.

The purpose of this study was to investigate the lived experiences of women "being newly diagnosed with GDM and the effect of an education intervention". The theoretical framework used was that of Max van Manen's phenomenology of Practice which is also a context sensitive form of interpretive inquiry. Van Manen's four 'lifeworld themes' or 'life existentials' which consist of lived space, lived body, lived time, and lived relationality pervade the lifeworlds of all human beings and are a means through which all human beings experience the world (316). These 4 fundamental life existentials were used as heuristic guides to explore, reflect and analyse the phenomenon of "a new diagnosis of GDM and an education intervention" by studying the lifeworlds of women with GDM in a temporal way at various stages of their pregnancy (316).

The Health Care Professionals (HCPs) are now more cognizant of the fact that in addition to medical or pharmacological interventions, they need to be much more involved and have a deeper understanding of the way in which individuals experience and live with their health problems (387).

Individuals most commonly experience their body in a 'near self-forgetful' mode because very often they do not ordinarily notice their body whilst they indulge in normal daily activities such as eating, walking and talking (387, 396). The body is at the centre of an individual world's through which it connects with the outside world through physical and emotional relations. When the body experiences symptoms or is disturbed the individuals become acutely aware of their body (387). When people develop an illness or a condition such as GDM, it changes every aspect of their lives including their sense of time, their experience of space, their felt relations with others,

their sense of self and body as well as their priorities (387). The women with GDM experienced several experiential dimensions of these four existentials throughout their pregnancy journey (387).

There are several reasons why it is important to investigate the 'lived experiences of women with GDM and the influence of GDM related education session'. As previously discussed in chapter 1, the prevalence of GDM which is dependent on age, ethnicity and diagnostic criteria used has increased worldwide including in the UK. The estimated prevalence of GDM in UK & Ireland has varied between 8 to 24 % since 2010 (7, 56). Multiple antenatal and perinatal complications such as macrosomia, stillbirth, birth trauma, prematurity, neonatal hypoglycaemia and shoulder dystocia are associated with GDM which can be prevented with effective treatment of GDM (7). Women with a previous diagnosis of GDM have a seven-fold increased risk of developing T2DM in the future compared to women without GDM(12, 135).

Long term complications of GDM in the baby includes childhood obesity and the development of T2DM and cardiovascular problems in later life (13, 16, 136). Obesity, advanced maternal age, race/ethnicity, parity, family history of type 2 diabetes and previous macrosomia are the main risk factors for the development of GDM and used for screening prior to testing them (6, 129). Some of these risk factors can be modified whilst other cannot.

GDM is a risk factor for T2DM which has reached pandemic levels across the world with an estimated 422 million in 2014 as per WHO data (434). The management of GDM offers a unique opportunity not only to intervene during the current pregnancy but also influence future health of the women but their whole family. The education provided to women is fundamental in managing GDM. In addition to dietary information, lifestyle related behavioural changes if appropriately taught or coached can become the foundation of future healthy eating households which can reduce the risk of developing T2DM. The engagement of the women with their GDM management interventions and other processes is of utmost significance, especially if a longer lasting effect is desired.

A diagnosis of GDM can result in psychological effects such as anxiety, fear, and depression (231, 435) which can in turn contribute to adverse outcomes (198, 199)

(436) as described in the literature review. Unless a woman has a history of any mental illness, psychological aspects in pregnant women with or without GDM are not routinely explored in UK. Hence, it is important to consider all these factors in the background when managing women with GDM.

Through the semi structured interviews, this study has hopefully explored certain psychological effects of GDM in these women which will highlight positive aspects and point out areas of concerns for which potential solutions could be sought. The interviews provided a deeper understanding of the women's lived experiences and revealed issues that are important to them at various stages of pregnancy which might have often been overlooked by HCPs. These specifically identified issues could be targeted for practical and feasible solutions with the objectives of engaging these women in their self-management, improving their quality of care and outcomes as well as improving service delivery in the healthcare settings.

Several aspects pertaining to their emotions, behaviour, actions, attitude, and care in general that were important to these women in this study, emerged through the narratives of the semi structured interviews. Thematic analysis of the transcripts guided by van Manen's life existentials resulted in themes or 'meaning units' as discussed thoroughly in chapter 4.

Whilst each woman experienced the phenomenon of 'being diagnosed with GDM' in her own unique way, several essential themes emerged from cumulative experiences of all the participants which helped address the research questions.

## **7.1 Essential themes and subthemes**

The emerging themes which reveal the unique and yet varied 'lived experiences' of the women will answer the first study question: "the lived experience of women with a new diagnosis of GDM". The themes from the research findings will also inform regarding the second part of the question related to "the influence of attending a "Group" or "One-to-One" education session in women newly diagnosed with GDM".

The women's lived experience revealed the intricate and multiple connections between the pregnant women, gestational diabetes, educational influence as well as personal and professional interactions. Using van Manen's phenomenology of practice

and the 4 life existentials enabled the essential themes to emerge following the semi structured interviews (316).

The essential themes and subsidiary (sub) themes presented in this chapter were derived from the thematic analysis based on the ‘lived experience descriptions’ of the women following their interviews (317). These findings reflect the ways the women made meaning of their lived experience of the phenomena of ‘being diagnosed with GDM and attending a “Group” or a “One-to-One” education session.’ These themes have a temporal orientation with regards to these women’s pregnancy journey including their diagnosis of GDM and subsequent education intervention.

**Table 7** is a summary of the essential themes and subsidiary themes that emerged from the thematic analysis.

*Table 7: Emerging themes and subthemes*

<b>Themes</b>	<b>Subthemes</b>
<b>Lived experience of dealing with information (or lack of)</b>	Lack of information at the time of diagnosis
	Dealing with uncertainty of online and 3 <sup>rd</sup> party information
<b>Lived emotional experience post diagnosis of GDM</b>	Initial feelings of shock, worry and guilt
	Rationalisation of emotions
<b>Lived experience after attending Education Session’</b>	Educational and informative session
	Shift from negative to positive feelings about GDM
	Dietary experience post education session
<b>Lived experience of glucose management</b>	Glucose control, concerns, and challenges
	Relationship with HCP
<b>Lived Post-natal GDM Experience</b>	Shift from scare to stability
	Post gestational dietary changes - variable
	Awareness of risk of T2DM in post-natal period – partial

## **7.2 Theme: Lived experience of dealing with information (or lack of)**

This lack of information reported in this study invariably led to the need to acquire more information. Following their diagnosis, the women were ‘confronted’ with a diagnosis of GDM which was experienced by the women as a constant reminder which led to worry. In the absence of any action taken, they would remain in this prolonged state of ‘dis-ease’ or ‘un-easiness’ (387). Hence the women quickly sought information which directly or indirectly would influence their emotions.

One of the striking themes that emerged from the findings from the first interview was related to issues with information. As soon as the women were informed of their diagnosis over the telephone, they felt an urgent and instinctive need to obtain information and reassurance. They also described their discontentment upon the way the diagnosis had been given to them over the phone. Their first source of information was to turn to the internet and/or family or friends.

### **7.2.1 Lack of information at the time of diagnosis**

The study findings showed that ‘lack of information’ emerged as a subtheme during the first interview. Although the gap from the time of diagnosis to obtaining any reliable information was around a week, the subjective or ‘lived time’ experienced by the women was described as ‘long and stressful’. Without any guidance and a ‘partially understood’ diagnosis, the women felt ‘helpless’ and thought they had been ‘left in limbo.’ Some women were also concerned they had been left without treatment for a week. The lack of information described by the participants included interpretation of blood glucose results, fully stating their diagnosis, further guidance on hospital schedule and immediate steps or actions to be taken until reviewed in hospital. This finding is consistent with a Swedish qualitative study in which women with GDM being evaluated for their beliefs about their health, illness, and different health care settings, reported a gap in information about GDM and associated treatment from the time of diagnosis until they were reviewed in clinic (437). An earlier study from the same author reported few Swedish women with GDM complaining of lack of appropriate information about gestational diabetes provided by

health care staff which led to a reduced lack of confidence in HCPs and to their perceived inadequate competency (232).

Following the completion of my data collection, Dayyani (2019) reported findings relatively similar to my findings regarding lack of information at the time of diagnosis and increased anxiety. This study of non-Western ethnic minority pregnant women with GDM in Denmark described experiencing fear and uncertainty due to a lack of initial information. However, despite their later appreciation of GDM information provided in clinics, it was noted that the information gap throughout their pregnancy was due to their low literacy level, poor language skills and a lack of individual education session (438).

### **Inconsistent Information**

The study findings also revealed inconsistent information being provided to women. The results highlighted that in addition to the lack of relevant information provided following the diagnosis, it became apparent there were also inconsistencies in the way the women were individually informed of the diagnosis. Some of the women had been informed of a diagnosis of GDM with an explanation of the OGTT results over the phone. A few of the women were not able to understand the OGTT results discussed with them. Another cohort of women had been told that their ‘levels were high’ or they had ‘diabetes.’ Others were advised to cut down on sugars and carbohydrates. Most of them were informed to wait for an appointment from the diabetes team. There appeared to be a lack of a standard way to inform the women of their diagnosis and the provision of any immediate or intermediary action plan until they are reviewed.

Unlike the results of a previous study (331) where women were satisfied by being informed of their diagnosis by text message or via phone, most women in this study were not happy with receiving the diagnosis over the telephone whilst a few were satisfied and understood why it had to be so.

### **7.2.2 Dealing with uncertainty of online and 3<sup>rd</sup> party information**

Having been informed of a possible diagnosis of GDM creates a disturbance in the body and mind of the women leading to protracted state of un-easiness (or disease) (387) which heightens the anxiety levels. Very often a simple explanation or



reassuring comment is required to appease the individual and help restore an 'unbroken' relation with the body and thus the world. Knowing a diagnosis allows the person to know exactly what they are dealing with and it 'allows the person to give the disease a place in his life' (387). In the absence of adequate information, the women desperately felt the need to take some action on their own.

The quickest and easiest way to fill the "information gap" experienced by the women was to search the internet. This is consistent with other studies reporting women with GDM accessing the internet for information related to their pregnancy (331, 439, 440). Most of the women simultaneously reached out to their partners, relatives, and friends. In this digital age, information can be obtained within seconds. The type or quality of information obtained on the web is however questionable. The findings in this study showed many women's lived experience of technology was that of '**uncertainty**' about the information obtained online but more specifically the doubtful accuracy of the information.

This is in contrast to previous studies which reported women having a preference for the internet compared to other resources due to more privacy, potentially obtaining more information or in women whose first language is not English (440) (441) (442). The study findings reported the online experience of the majority of participants was impersonal, non- interactive and ultimately frustrating. This resulted in increased worry and anxiety. With advances in technology online contact or relationships are now a fact of life and have also been described in qualitative studies (404) (317).

My findings showed that whilst a small proportion of women were satisfied with the information obtained online, mostly from an NHS website, a lot of the women felt alarmed and scared, especially when reading about GDM complications. Other studies have reported women searching for specific information online. Women with GDM have been reported to typically look for dietary or pregnancy related information on the internet such as complications (221) (443). Another study showed women who were not satisfied with GDM related education from health care staff often searched for information on the internet or books (444).

However, obtaining information on the web has its own consequences. Accuracy and reliability of online information are two main caveats. The reliability of health-related information obtained from various websites has always been an area of concern. The

reliability of the information in terms of the accuracy, quality and credibility are the most important aspect which can impact on the web users (445-447). The creators of these websites have to follow certain guidelines or code of practice which are not always adhered to (448, 449). The governance around these codes of practice has not proved efficient (450, 451)

Once the diagnosis of GDM had been confirmed, the women contacted known friends who had a history of GDM in their previous pregnancies or friends who worked in the health care who provided variable advice. The women were advised by their friends 'not to worry', 'that they would have to check their blood sugars', 'they will be having scans to check for a big baby' and all 'information will be provided in hospital'.

Interestingly, the women described feeling slightly relieved and reassured after their discussion with their friends despite the fact that some of the alarming information provided were similar to those obtained online, for instance the risk of a big baby. It appears human contact is somehow experienced more positively compared to online information. This also demonstrates the relational experience of pregnancy where the women 'experience other people' with whom they share not only an interpersonal space but also their thoughts and experiences (387).

The women also reached out to members of their family. Most women spoke to their mothers and their partners or husbands and occasionally to another family member who already had diabetes. The women who were already in shock or worried described the various emotional or non-emotional reactions they experienced from the others. Most mothers were reassuring. Some of the women's partners were worried and helped in searching for online information whilst others remained neutral, calm, or reassured the women.

Irrespective of the response obtained, sharing of this important information about GDM is experienced as 'norm' or what is expected in relationships (317). The lived 'body', 'space' and 'relationality' experience of the women at this stage was that of anxiety and frustration due to lack of timely information which transitioned to that of discovery and sharing of information with their loved ones. This lived social interaction will probably remain memorable for all the people involved. The immediate members of family are equally affected by such news and are expected to

support the pregnant women with GDM which can be challenging in the absence of reliable information and guidance.

Appropriate and adequate information therefore has to be aimed not only at the pregnant women with GDM but also for other family members. In addition to the support of HCPs, a supportive environment provided by family and friends have been reported to help women with GDM improve their self-management (229, 452, 453).

### **7.3 Theme: Lived emotional experience post diagnosis of GDM**

Delving deep into the ‘lived emotional response’ of the women who had been newly diagnosed with GDM was an important part of the interviews. These women were dealing with and expressing the inner and outer emotions in their own ways.

Usually, the onset of an illness or the diagnosis of a new disease or appearance of symptoms makes people to be suddenly aware of their body (387). The body reacts to outside triggers, which in this case was GDM. This bodily reaction can manifest in physical or emotional form. With GDM being mostly asymptomatic, this new disease condition would have come as a surprise, shock, or worry as was revealed in this study’s findings.

These women’s bodily feelings which they shared with others such as joy, pleasure upon becoming pregnant were suddenly altered by this new disease state or GDM (316, 387). In this study the women shared or revealed their diagnosis to their family and friends through an emotional response (316) in view of seeking emotional and social support. In addition to these women’s ‘lived time, body and relationality’ experience of being quite emotional manifesting as a multitude of reactions, having a diagnosis of GDM also altered any wishes, plan or goals which they may have had pertaining to their pregnancy (317).

#### **7.3.1 Initial feelings of shock worry and guilt**

The study findings reported the women experiencing and describing a spectrum of emotions after learning about their diagnosis of GDM. Although each woman reacted in her unique way the study findings revealed certain emerging patterns. Consistent with other qualitative studies, the majority of the women in this study experienced a

range of negative feelings, particularly that of shock (228) (454), worry (455, 456), anxiety (217, 444), being upset (227) and feelings of guilt/self-blame (231, 444). The main underlying reasons for feeling 'shocked', 'in denial' & 'depressed' in these studies were mainly attributed to the women 'feeling well' in themselves and/or 'being of healthy weight' and 'not likely to happen to them' (217, 231, 454). The women in this study were similarly shocked by their diagnosis which they felt was 'completely unexpected' and the underlying reasons suggested were the fact that they 'did not have GDM in their previous pregnancy' and that their current pregnancy was non-problematic up to the point of their OGTT.

Although it is understandable that the women had initial negative reactions to being given a diagnosis of GDM, it was surprising that they were still shocked in view of the fact that the majority were aware of the various underlying reasons or risk factors for their OGTT. This relatively contradictory reaction has been previously described in literature (222).

### **7.3.2 Rationalisation of emotions**

A cohort of women 'rationalised their feelings' to bring about some positivity to the worrisome diagnosis of GDM. This rationalisation occurred due to three main reasons. Some of the women were more positive as they worked in the healthcare settings, had some prior knowledge of diabetes in general or had a family history of diabetes. The women's attitude in this cohort was to take 'things in their stride' or be 'easy going' which made them less anxious. Some of the women controlled their emotions as they did not want 'stress to impact negatively' on the baby. The findings in this study were similar to other studies where women with GDM have reported positive emotions but these were attributed to feeling more energetic from a better diet (227) or by "accepting GDM as an alarm bell" (232).

From a 'temporality' perspective this act of rationalisation brought about by reasoning or buffering of their feelings appeared to be a coping mechanism for the women to deal with the additional 'burden of negative emotions' arising from the diagnosis of GDM. This potentially kept the stress or anxiety levels down.

## **7.4 Theme: Lived experience after attending education session**

The education session was the long-awaited answer to the ‘lack of information’ experienced by the women in this study following the diagnosis of GDM which was experienced as a major life event. The women were keen for information about GDM and management. Attending the education session was a landmark experience in the ‘lifeworld of the pregnant women with GDM’ (316). The education session was quite unique as it was experienced from the perspective of lived body, lived space, lived relationality, and lived temporality. Whether they were randomised into the “Group” or “One-to-One” education session, they all described how eagerly they waited for the education session. The waiting time up to the session felt longer than a week during which time they experienced a spectrum of emotions, including anticipation.

### **7.4.1 Educational and informative education session**

Both the education sessions were well received by the women. The women’s ‘lived time and space’ experience during the education session was fairly similar. Except for a few women, the majority of the “Group” attenders found the length of the session adequate. A few of those who felt the session was long actually understood why it was so. The women attending the individual sessions were happy with the duration of the session. Women from both “Group” and “One-to-One” found the education session ‘very good and informative’ which emerged as a theme. All the women were satisfied with the content of the education sessions. A prospective observational study in Belgium looking into the impact of a multidisciplinary “Group” education which was published after completion of my data collection showed similar findings to the current study regarding women’s overall satisfaction with the content of the “Group” and individual education sessions (239).

The women in the “One-to-One” session felt more knowledgeable about GDM and diabetes in general. The women in the “Group” session were impressed with the well-illustrated PowerPoint presentation and described leaving the session feeling more knowledgeable about GDM and about what to do next. The majority of the “Group” attenders felt the session was interactive and they were able to ask questions and learn from the questions of the other women. The “Group” attenders described a ‘sense of

togetherness,' or being on 'the same boat' which initially helped them to cope with the anxiety and worry associated with GDM. This points to the fact that the women experienced a temporary connection with the other women in the "Group" session through 'lived relationality' and explains how individuals turned to one another when confronted with a problem such as in this case the phenomenon 'of being diagnosed with GDM'.

The pregnant women's prior plans, goals, wishes and hopes (lived time or telos) were altered by the diagnosis of GDM (316). During the time spent in the education session, they had to set themselves new goals. These included multiple short term and long-term goals based on the information they had received. Their immediate goals were to make the necessary dietary changes, to check their blood sugars before and after mealtimes and to keep their blood sugars within specific target values. Their longer-term goal was to ensure the bloods sugar remained within target levels to avoid the risk of having a large baby. This goal setting exercise was also important from the HCP's point of view as it laid the basic principles for the management of GDM, which the women were expected to adhere to. The women learnt new information which contributed to their pre-existing knowledge. The education sessions also represented the official first contact with HCPs following their diagnosis.

#### **7.4.2 Shift from negative to positive feelings about GDM**

The second interviews revealed the majority of the women attending the "Group" and the "One-to-One" sessions experienced a spectrum of emotions from the time of their diagnosis. Further analysis revealed the emergence of three types of emotional patterns describing the 'lived experience of GDM after the education session' in these women. These patterns demonstrated a shift from negative feelings to either more neutral feelings or very positive ones or they remained persistently negative. The findings showed that positivity was related to the women feeling 'in control and confident.' This sense of control and confidence was attributed to gaining knowledge about GDM from the education sessions, being able to monitor and bring their capillary blood glucose levels to target values and being able to control their diet. Similar findings have been reported in other studies which have highlighted women feeling more positive and confident regarding their GDM care as a result of better

understanding of how GDM was managed and after making changes in their lifestyle (224, 226, 457) (437).

Analysis from the 3rd interviews showed the women's level of control and confidence were either maintained or increased in the majority of the "Group" and "One-to-One" attendees. The "Group" attendees reported feeling more 'in control and confident' mainly by being able to monitor their blood sugars and controlling their diet. The women stated knowing their blood sugars provided them with reassurance and the ability to take appropriate actions accordingly. The "One-to-One" participants attributed their positivity, sense of 'control and confidence' to the significant changes they had made following the education session, regular blood glucose monitoring but maintaining their blood glucose levels within desired levels through dietary changes or diabetes medications. My study findings were similar to a previous study which reported women with GDM gaining more control and focus due to lifestyle changes as their pregnancy progressed (233). Another study described women feeling more positive about having control over their diet by making their own dietary choices (231).

Interestingly, when these women were asked about their feelings or emotions, they would automatically discuss their blood sugar levels. Their entire focus appeared to be related to the management of their blood sugar levels with the aim of having the best pregnancy outcomes. During the process of their GDM management the women learnt new knowledge, skills and developed new behavioural changes. Continuous self-monitoring of blood glucose (SMBG) and being able to take actions provided the women a sense of control of their GDM and in their lives. Better blood glucose levels correlated with more positive emotions and a sense of confidence towards the progression of their pregnancy.

Through individual daily experiences, focus and patience, they recognised how various food types influenced their blood sugars and learnt how to modify their diet accordingly. This eventually led to positive behavioural changes towards their diet and lifestyle as well as reducing anxiety and stress levels. Through experiential learning the women went through tedious lived body, lived time and lived relationality experiences of building on their knowledge of various food types and managing their bloods sugars through trial and error. In addition to control and confidence they felt a

sense of empowerment towards their GDM management. From a lived ‘spatiality and temporality’ perspective these women’s emotions had been transformed from anxiety, worry and fear to feeling more positive, knowledgeable and confident about managing GDM (374).

### **7.4.3 Dietary experience post education session**

The findings in this study revealed that information on food and diet related changes became the prime focus in all the women who had been newly diagnosed with GDM. As soon as the diagnosis was known they all instinctively started making changes in their diet, more specifically cutting back on sugary foods. In the absence of any concrete information from the healthcare providers, the women sought information about management of gestational diabetes from relatives and friends. This is consistent with previous studies (232) (443, 444) and studies published after the completion of my study (458, 459). These studies highlighted that woman with GDM searched the internet or discussed their food choices with friends despite having had advice from a dietician (443) or because they needed additional information or were unsatisfied with information provided by HCPs (459).

The majority of the women who attended the “Group” and “One-to-One” sessions were very satisfied with the information provided about food in relation to GDM. The women from the “Group” and “One-to-One” sessions reported feeling more knowledgeable and happier, particularly about learning specific information such as the types of carbohydrates, the important food types and proportions that should be consumed, the content of sugar in various foods, the effects of various types of food on blood sugar levels and types of healthy snacks.

Other than dietary changes, the women also learnt about the importance of exercise, general lifestyle advice such as smoking cessation, GDM complications and especially the risk of developing type 2 diabetes in the future. The interactive “Group” and “One-to-One” education session provided a platform for the women to build on and clarify their pre-existing knowledge of GDM and any associated myths. The women were also taught self-monitoring of blood glucose levels as part of the education sessions.

Despite being satisfied with the informative education sessions a cohort of women in the “Group” session felt the session was too long and the amount of information overwhelming and occasionally difficult to digest. These women suggested the use of



written material or leaflets that should have been sent to them immediately after their diagnosis which would have been more beneficial and perhaps enhanced the education session. The study findings also reported a few women being not entirely happy with food related information in both the “Group” and “One-to-One” participants. They would have liked to have been given examples of healthy meal plans and more examples of alternate low sugar content food or snacks. Request for individual diet including menu plans and culture specific dietary advice by women with GDM have been reported in other studies (227, 444, 460).

As the pregnancy progressed the study results showed that dietary changes made by the women from both “Group” and “One-to-One” had a positive impact on their GDM management but also had positive effects on their emotions, behaviour, and action. The women from the “Group” session reported feeling ‘good’, ‘healthier’, ‘energetic’ and ‘happy’ with their dietary changes. This is consistent with previous studies (222, 227). Those women in the “Group” session whose blood glucose levels were being controlled with diet only were less anxious and very motivated to stay diet controlled and avoid any future medications.

Those who were on medications also felt the same. Interestingly most of the women in the “One-to-One” session were diet controlled and the study findings showed they had reported healthy eating habits before their pregnancy and had been motivated to make ‘drastic’ and ‘strict’ changes to their diet for the benefit of the baby and to maintain their blood sugar levels within target levels. The “One-to-One” attenders reported feeling happy and confident with their dietary achievement. The health and safety of the baby being a primary motivating factor has been reported in previous studies (222, 457).

The results from this study showed the women in both “Group” and “One-to-One” sessions were very resilient towards maintain their diet optimal and even resisted sugary foods during festivities and holidays. The education sessions were the probably the first source of influence regarding any health beliefs that the women may have had previously. The knowledge provided laid the foundation for their GDM knowledge, management, and any future behavioural changes. The women underwent lived body, lived time and lived spatiality transformation in terms of their knowledge and emotions after the education session.

From a temporality perspective, they became more knowledgeable as they mastered their diet based on what they learnt from the education sessions and other sources. Through this experience they had the opportunity to reflect on their own previous dietary habits. They developed positive behavioural changes with regards to their diet which was driven by their good blood sugars. These dietary changes were invariably impacting positively on the whole family. Any positive behaviour changes experienced or mastered at this stage of their lifeworld has a temporal significance in that the effects can be longer lasting with overall positive effects.

The women's lived body experience, as they felt at their highest self-esteem, confidence and in control of their GDM provided an ideal time to reinforce discussions about the importance of long-term benefits of dietary changes in the women and the family to prevent the future development of T2DM.

## **7.5 Theme: Lived experience of glucose management**

After attending the education session, the women's lifeworld seemed to revolve around glucose management. The women's focus shifted to making dietary changes and self-blood glucose monitoring. It was very interesting to note that the women's blood sugar levels seemed to have a direct impact on their lived body, lived space, lived time and lived relationality experiences. Blood sugar levels influenced the women's emotions, behaviour, and any actions taken. They shared their emotions and feelings with people close to them who were in turn affected. Although checking blood sugar levels provided a degree of control and confidence to the women, it also led to concerns associated with blood sugars particularly when they initially started SMBG.

### **7.5.1 Glucose control, concerns, and challenges**

Quite a few women from the "Group" session and very few from the "One-to-One" session had experienced fluctuating or high blood sugar levels particularly when they had first started checking their blood glucose levels. This resulted in negative feelings described as upsetting, stressed, disappointment and 'feeling out of control'. This is consistent with findings from other studies (222, 231). The women were particularly frustrated with experiencing hyperglycaemia despite being on a strict diet and sticking to a regime. However, this did not deter them from continuously monitoring their blood sugars and discussing further management with the diabetes team.

The results of this study revealed that the women from the “Group” session who were experiencing varying blood sugar levels seemed to be dealing with the dynamic situation in a knowledgeable way as the pregnancy progressed. They were able to observe the trend in their blood sugar levels and make effective changes in their diet to bring the sugar levels down. The study findings also showed they were less resistant to and understood the reason to start on oral medications or insulin.

The women in both “Group” and “One-to-One” sessions had demonstrated excellent self-management skills whereby they had used the information and skills obtained from the education session and applied it in the optimal management of their blood sugar levels (268). All the women reiterated how SMBG conferred a sense of reassurance and control to them as well as reflected their degree of dietary control. They reported feeling happy and in control with good blood sugar levels which a finding consistent with other studies (222, 233).

The women were self-managing their emotions which were experienced as being on ‘a roller coaster’. They were initially anxious and worried because of the diagnosis of GDM then experienced a transitory relief and happiness with the knowledge about management and then had to cope with their fluctuating blood sugar levels which was experienced by some as ‘loss of control’ which has been documented previously (221) (461).

However, despite the labile situation the women demonstrated resilience and motivation. The education session had provided them with the tools and with their experiential learning the women had improved their self-efficacy and self-esteem leading to self-empowerment. This impacted positively on their behaviour and action towards sustaining their dietary and glucose management optimal. The women’s variable ‘lived body, lived time, space and relationality’ experiences of blood glucose management could potentially influence the women’s attitude towards future pregnancies

It was interesting to note that the women had not mentioned whether they would have liked additional help or psychological support from the HCPs when they ‘felt stressed or out of control’ whilst dealing with hyperglycaemia or any other issue. There was an underlying impression that their main objective was to bring the blood sugar levels down.

## **7.5.2 Relationship with Health Care Professionals**

The women's lived 'relationality and spatiality' experience evolved as the pregnancy progressed. My study findings demonstrated that after the initial disappointment due to the lack of information post diagnosis and the way they had been informed, all the women quickly developed a robust and interactive relationship with the healthcare professionals along their pregnancy journey. Unlike certain studies where women reported negative experiences with health care services (226, 231), the women in both "Group" and "One-to-One" sessions had a positive experience following their clinic consultations. From a lived body, space and relationality perspective the women experienced reassurance, comfort and safety during their clinic consultations.

The women from both cohorts were all very complimentary of the care that had been provided by the multidisciplinary team of HCPs especially the Diabetes Specialist Nurse (DSN). They found their discussions around their blood sugar levels and exploration of the underlying reasons for high readings and its management very productive and helpful. The development of this 'healthy lived relation' with the HCPs helped the women manage their glycaemic optimally.

The women reported feeling very reassured after talking to the DSNs. They found the DSNs and the midwives to be very resourceful and supportive as reported by other studies (238, 421). The women had developed excellent rapport as well as trust with the diabetes consultants and diabetes specialist nurses with whom they had mutual negotiations especially in the context of initiating medications, which was a crucial decision for them. They were overall very happy with the care provided by the HCPs. The support and encouragement from the MDT members helped empower the women towards managing their diabetes. The women's lived relationality experience with members of the MDT impacted on the phenomenon of 'being newly diagnosed with GDM' (387).

## **7.6 Theme: Lived post-natal GDM experience**

The 'lived post-natal lifeworld' had its own challenges as the women were embracing motherhood. Their lived body and space and time experiences included feelings of relief and safety after giving birth. The women had their individual 'lived experiences of GDM' at various stages of pregnancy that would influence their current and future

opinion and attitude towards various aspects of GDM care and management. They expressed different emotions about their recent pregnancy and GDM experiences and the new challenges they faced. Having ‘lived with GDM’ they shared their experiences at the time and in the post-partum period through retrospection.

### **7.6.1 Shift from Scare to Stability**

The women’s experiences and thoughts about their GDM experience can be very informative and help in planning care better. Consistent with previous reports, this study findings showed the women in the “Group” session still vividly remember their initial feelings of ‘scare’, ‘shock’, ‘worry’ and ‘guilt’ which they experienced immediately after their diagnosis (225, 232). The women from the “Group” and “One-to-One” sessions described their overall feelings about their ‘lived GDM experience’ as ‘mixed’, overall negative or positive. The women who described ‘mixed feelings’ reported how those initial negative feelings gradually improved once they acquired information on GDM, its management and especially knowing that it was treatable.

The study findings demonstrated these women felt relieved, safer and less worried after delivery. This change from shock to stability has been reported in previous studies (226, 229). Interestingly, despite being aware of their future risk of T2DM, some women in this cohort reported they would feel less worried in their future pregnancies given the fact that it is manageable.

The women who still had negative feelings about GDM attributed it to their challenging experiences with dietary change, glucose management and initial lack of information. Few of them “Group” attenders had a positive outlook about GDM retrospectively as they felt they learnt a lot about good diet and felt GDM could happen to anybody and is manageable.

Very few women in the “One-to-One” session reported negative feelings which was due to their poor experience around labour, difficulty with finger pricking, fear of macrosomia and the feeling of ‘something wrong’ with pregnancy. Overall, most of the “One-to-One” attenders reported a more positive ‘lived GDM experience’ as they felt they changed their diet and lifestyle to a healthy one and successfully managed their glucose levels with the information provided. Having some positive emotional response and outlook about GDM has been reported in previous studies (222, 227).

## **7.6.2 Post-gestational dietary changes - variable**

When questioned about their dietary experience during pregnancy, the findings from the study revealed that the “Group” attenders described the significant and drastic changes they had made to their usual diet. They reported they had to reduce their sugary food intake to a minimum and had switched to healthier food options. They reported challenges, anxiety, and loss of control as some found it hard to find the type of food that would not cause spikes in blood sugars which has been reported in other studies (222) (443). Based on their recent experience the “Group” attenders reported that following their delivery they are now very vigilant about the sugar content of the food they consume.

Consistent with the findings from a previous study (253), this study showed a lot of the women from the “Group” session were quite proactively trying to or maintaining their dietary changes and opting for a healthy diet for themselves and their family. They also described how they had developed certain behavioural changes that have stuck with them. One woman explained how she questions the need for sugar in her tea, coffee, or other drinks whilst or is always searching for sugar substitutes. A few of these women were making these changes with the underlying understanding that they remained at risk for developing type 2 diabetes in the future which has been reported in other studies (225, 231). Unfortunately, a few of the “Group” attenders had reverted back to their pre-pregnancy diet but were still buying healthy food.

The “One-to-One” attenders were all aware of the need to maintain a healthy diet and lifestyle. Many of these women were managing to maintain a healthy diet as they had developed certain dietary behavioural changes. Some of the “One-to-One” attenders had become accustomed to certain types of food which had been beneficial for them. Others had had experienced the positive impact of healthy diet on them and their family and were motivated to maintain certain behaviour such as inspecting the food labels whilst shopping

One woman reported how reading the food labels had become second nature not only to her but her whole family including the youngsters in the family. the study results showed that for various reasons not everyone was able to maintain a healthy diet after delivery. Amongst the “One-to-One” attenders, some of the women had relaxed their strict pregnancy diet but a few were still aware of the future risk of diabetes and what

needed to be done. A few of these women were aware they had to keep to a healthy diet but found it difficult with having young children in the house and maintaining good diet takes a lot of time for preparation and organisation. This is consistent with findings from other studies (459, 462) (463). Interestingly the “One-to-One” attenders who had eased off or stopped their pregnancy diet still maintained the aim to revert to a healthy diet at some point.

As previously discussed the various dietary experiences of the women in terms of ‘lived body and time’ will influence their current post-natal dietary and general lifestyle behaviour as well as that in the short and long- term. This has significant implications for their future pregnancies.

### **7.6.3 Awareness of T2DM risk in post-natal period - partial**

During the fourth interview the women had not been asked directly about their awareness of the risk of T2DM. They were asked about whether they had implemented the changes that had been recommended after delivery during the education session. The expectation was that they would mention the risk of T2DM whilst answering this question as many of the women already family of T2DM and most importantly this was highlighted in the education session.

The study results showed that only a minority of women who had attended the “Group” session seemed to have an awareness of the risk of T2DM in the future which has been reported in other studies (233, 464) but many more were aware of the risk of recurrence of GDM in future pregnancies. They reported that having had GDM would not prevent them from having another pregnancy, however they would be more prepared for it and would know how to manage it. These women felt a ‘lot more positive’, ‘relaxed’ and ‘not worried anymore’ about GDM and the fact that GDM is ‘manageable or treatable’ seemed to be the basis for their decision about future pregnancies which has been reported in a previous study (238). These women also stated they were now more conscious of the dietary and lifestyle changes that need to be made which most of them had made to variable degrees or were planning to do which is consistent with a previous study(223).

One of the women in the “Group” attenders was diagnosed with T2DM following their post-natal OGTT who stated she was going to maintain a healthy balance of diet and exercise. A slightly higher number of women who attended the “One-to-One” session

were aware of the risk of developing T2DM after having had GDM as previously reported in a study (465). Consistent with the findings from a previous study (465), the majority of the “One-to-One” attenders were also aware of the risk of developing GDM in future pregnancies. They felt they would be more prepared or will make dietary changes prior to the next pregnancy. If they did develop GDM in the future, they stated they would be more aware and would have a more positive experience.

Those women who acknowledged the risk of T2DM did not appear particularly worried or alarmed about this possibility. There appeared to be a low perceived risk for the development of diabetes as has been reported in other studies (464, 466-468).

Depending on the different types of experiences related to their ‘lived body, space, time and relationality’ that the women from the 2 cohorts have endured, they have developed different opinions and attitudes towards developing future GDM or T2DM. van Manen refers to the temporal dimensions of the past, present and future that constitute the horizons of a person’s temporal landscape. In this study the women’s current attitude or opinion is the result of the sum of all their lived experiences from the time they were diagnosed, how effective their education session was and their interaction with the HCPs. Their lived experiences will also leave an imprint in these women and influence their future behaviour. This emphasizes the importance of how women with GDM are managed, especially the education they receive and their ongoing care as this will be impactful for the future.

## **7.7 Limitations**

The limitation of the study was that most of the participants were Caucasian. Although the findings of this study would reflect the ‘lived experience of women with GDM’ of a Caucasian population, they would not represent the experiences of women from other ethnicities. This is essential because GDM is more prevalent in certain ethnic populations such as in the Middle-Eastern, South Indian and Pakistani regions. Another limitation in this study is that despite a randomisation process the intervention or ‘Group session’ consisted of Caucasian women only and the ‘control’ or ‘One-to-One session’ consisted of a mixture of Caucasian and women from other ethnicities. A true randomisation could not be achieved due to a small sample size. Since the geographical population was predominantly Caucasian a stratified random sampling method could have been applied to help represent the ethnic minority women in a more



proportionate way. Stratified sampling could have also have been used for cultural and educational background as these are important factors that are associated with or impact GDM.

Stating pre-determined outcomes would have been useful in this study as it would have contributed towards determination of the sample size of the study and clearer identification of outcomes.

On reflection the sampling frame was not convenience. Purposive sampling was in fact used. I have amended this in the method section under section 4.5 'Sample Size' and section 4.7 'Recruitment'. Although the women with GDM could conveniently be approached for the study due to the physical location of the maternal unit, not every woman with GDM was included in the study. Purposive sampling involves identifying members of the population who have certain characteristics or experience. Women who could be approached for my study had to have a diagnosis of GDM for the first time and fulfil the inclusion criteria.

The choice of sample size for the study was based on previous literature available from qualitative studies using phenomenology including van Manen's phenomenology of practice. As mentioned in section 4.5, previous qualitative studies using phenomenology to study aspects of GDM have used 6 to 12 participants. Saturation of data was not used as criteria to determine the sample size in this study but in hindsight should have been considered in the design of the study. However, with the inclusion of 16 participants in each cohort in this study I consider saturation would have been achieved.

It has to acknowledged that there were certain differences between the intervention (Group session) and the control (One-to-One session). The main differences were the content/topic of the sessions, the length of the sessions and that different healthcare professionals delivered the sessions. Although the topics discussed in the 'Group' and 'One-to-One' sessions were the same, the content in the Power-point presentation was richer with illustrations. Consequently, the length of the 'Group' and 'One-to-One' sessions were different. The average duration for the 'Group session was an hour whereas the 'One-to-One' session varied from 30 to 40 minutes. Women from education session were provided the similar Patient Information Leaflets. The Group session was always led by a dietician. The 'One-to-One' session was occasionally led

by a Diabetes Specialist nurse. The delivery of information during these education sessions was not assessed but could have been done through observation.

The quantitative data from the questionnaires completed from the two cohorts were compared but unfortunately the sample size was not powered enough to show any statistically significant differences. The pregnancy outcomes in the women attending the structured group education and the one-to-one session are very important aspects, however these were outside the purview of this study and therefore not investigated. Studying the pregnancy outcomes in women attending a structured group education should be considered in future studies.

Participants lost to follow-up was another limitation of this study. 8 women did not attend for their 4<sup>th</sup> interview post- delivery which resulted in loss of information from them. Due to the design of this study, I was unable to share or go back to discuss the transcripts following each interview with the participants. The women's interviews were scheduled on the days they attended for their consultations and therefore there was just enough time for the interviews to be completed. Many women were on tight schedules due to their work or activities related to other children. Due to time limitations and the gravity of the situation, despite many follow up questions during the interview, the participants may have just wanted to discuss the medical aspects of care rather than anything non-medical that may have been on their minds.

There are certain areas such as social relations and weight related issues which I felt could have been explored further. The researcher carried the analysis of the transcripts primarily and the nodes created in NVivo were shared and discussed with one of the supervisors. The emerging themes were also discussed with the supervisor. The fourth interview felt slightly rushed as the women were in a hurry to leave the hospital after their post-natal OGTT.

## **7.8 Recommendations for clinical Practice**

Lack of information was described as one of the emerging themes. Along with lack of medical or factual information many women highlighted the need to be reassured during that first phone call when they were at a vulnerable time, having been informed of a new diagnosis. There was inconsistency in the dissemination of information with

some of the women being informed of their abnormal blood results whilst others being told they had GDM.

Very often a simple reassurance or explanation provided in these circumstances can be enough to alleviate these worries or to “resume or rebuild an unbroken relation with the body and thus with the world” (387). The findings in this study showed how the women were eager for some reassurance at the time they were being informed of their diagnosis. The handful of women who managed to speak to a diabetes nurse or midwife after their initial phone call and were provided with some more information and reassurance felt relieved and in a better mental state to deal with the situation whilst waiting for the education session. An explanation had a ‘healing’ effect and prompted these women to a less anxious state (387).

The request for information at this crucial stage of diagnosis seems entirely reasonable and clearly very important to the women with GDM in this study. From the women’s narratives including multiple suggestions, it was clear that this ‘information gap’ needed to be bridged and the telephone call message had to be standardized. The responsibility to do so lies with the service provider.

Provision of comprehensive and timely information is key in the management of gestational diabetes both from the perspective of the women and the HCPs. People’s beliefs are largely based on their inherent knowledge (469) but can also be influenced by organisational or institutional factors such the type of educational programmes delivered in a particular health care setting (470). This can be very impactful as people’s health care seeking behaviour is guided by their own beliefs (471, 472).

One way of solving this issue would require a better coordination in terms of the timing of clinical contact with the HCPs as well the provision of appropriate GDM related information in a sequential way by the various members of the diabetes and obstetric teams’ members.

In an ideal health care set up the antenatal or diabetes team could provide information as soon as possible which be provided in 2 ways. Some readily available information about GDM could be provided to the women at the time of diagnosis including some reassurance. Many women in this study echoed the need to have some reassurance over that first phone call. The second way would be to schedule a telephone call or face to face meeting with the women on the following day to address any immediate

questions. These would certainly be in keeping with good medical practice of providing an individualised care to these women. There are however several obstacles in the latter option including practical feasibility especially in terms of the availability of qualified health care staff, clinical space, or other appropriate staff to deal with any complications which may arise from this visit.

Another way of making appropriate and immediate information available would be to point the women newly diagnosed with GDM to an existing and valid website for further information on GDM. There are several websites that are available on the internet that provide different types of information. Some of these have been created by individuals whereas some by government institutions such as the NHS. Unfortunately, the information from certain websites might not be entirely reliable and could be taken out of context. Similarly, information from trusted websites could be misconstrued.

Trust specific websites would probably require individualised registration. Creating a website is an option that can be made feasible by the Information Technology department of a Trust working in collaboration with the diabetes/obstetric team.

In the absence of any of these options an appropriately and carefully designed leaflet containing 'general information about GDM and immediate management or precautions' could be made available to all women who attend for an OGTT. This could arguably alarm the undiagnosed women unnecessarily, however, these women already have one or more risk factors for GDM and therefore this information would prove to be educational for them, especially if they were planning any further pregnancies. This could be useful in health promotion and advise them about future risk of T2DM and the steps that could be taken to prevent GDM in future pregnancies.

Those women whose previous pregnancies were unaffected by GDM were understandably shocked or surprised. Their current experience including the medical management of their GDM and dealing with their emotional aspects will have an impact on their future life whether they are pregnant or not.

Based on the findings of the second and third interviews, it appeared that the women were always facing some challenges whether in the form of dealing with hyperglycaemia, the need to start medications, results of growth scans on a regular basis during their clinic consultations. All these challenges were associated with

variable levels of worry, anxiety, or stress but surprisingly, these emotional aspects were never actively discussed, inquired about or dealt with during consultations.

As previously discussed in the literature review, anxiety states, stress and depression can occur pre-pregnancy, during pregnancy and after pregnancy (196, 217, 219, 473). 'Pregnancy anxiety' which is pregnancy specific anxiety has also been reported (203) (473). Given these relatively high emotional states of these pregnant women with GDM with possible underlying anxiety states or depression it would seem that questions about 'psychological well-being' would be a natural component of the consultations, but this was unfortunately not the case. This could be because traditionally there has been more focus on the medical management of GDM to prevent or manage complications of GDM. Previous studies in pregnant women with type 1 and type 2 diabetes have highlighted the over - medicalisation of pregnancy (474). The planned care of these women with GDM by the multidisciplinary team needs to have a holistic approach which would incorporate medical, psychosocial, or even pastoral care.

Although the current research findings have demonstrated the usefulness of the education session in helping these women manage their current pregnancy, it probably is not completely adequate for longer term behavioural changes. In this study, the women probably managed their GDM through experiential learning and the medical input from the HCPs. There were no behaviour modification techniques used as adjuncts in the management of their GDM. Self- monitoring which is a valuable and effective behaviour modification technique (475) (476) was used in this study in the context of blood glucose levels monitoring by the women which provided reassurance and a degree of control to the women. However, there was no mention of any food diaries, calorie monitoring or weight chart monitoring on a regular basis which have been used in previous studies using behaviour modification techniques and have shown less weight gain during pregnancy (477-479).

Using the COM-B model in the context of the current group education session to influence certain specific behaviours of these women who have been newly diagnosed with GDM could prove to be quite effective. In fact, the GDM education session itself is an excellent opportunity for these women where they will:

- obtain accurate and appropriate knowledge about GDM and its management in a friendly environment
- have a physical platform to discuss their questions, opinions and other issues with the HCP
- be able to share their experiences, doubts, fears or successes with other women in a similar position as part of a social platform.

The knowledge obtained from the education session provides empowerment to the women. The more empowered they feel the more confident and capable they feel. The findings from my study showed the women from both education sessions became more confident after their education sessions. They also felt less anxious and worried. The GDM education confers a psychological capability to these women who develop a better understanding of the management of GDM and emotionally stronger to deal with this condition.

By providing opportunity and conferring capability, the GDM education session equips the women for certain positive behavioural changes, more specifically dietary changes but also healthy lifestyle changes. The current GDM education content is probably adequate at impacting on behaviour changes during the course of the pregnancy but will require further changes in terms of content and application of models of behaviour change to be able to bring about post-partum and longer-term behavioural changes.

The education session certainly provides the initial mental processes to motivate the women towards certain behavioural changes. However, motivation being a cumulative mental process (297) takes time and therefore a single GDM education session is probably not enough for short and long-term changes. The education session by providing information and an overview of how the pregnancy would be managed, provides the women a more defined pathway of care including scheduled plans. Knowledge about regular clinical visits, timings of growth scans and other scheduled events provides reflective motivation (297) to the women who feel more involved with their pregnancy and GDM.

Automatic motivation in these women would be experienced when they start attending their clinic consultations regularly with the multidisciplinary diabetes and obstetric

team. The members of the MDT should seize the opportunity during consultations to motivate them and should also take responsibility to sustain the motivation in these women for longer lasting behavioural changes.

Application of the principles of the COM-B behaviour change model within certain aspects of the current content of the education session would be a good start. HCPs involved in the care of women with GDM should be made aware of models of behaviour change such as the COM-B (297), which would equip them to use the appropriate language and behaviour to influence these women positively.

Previous studies have reported women experiencing a feeling of abandonment by the healthcare providers after their delivery (228, 459). Given the fact that 25 % of the women in the current study did not attend for their post-natal OGTT is indicative that the women for various reasons had stopped engaging with the health care services. These women are probably lost in the system and will only re-appear when they next become pregnant.

The uptake for testing for T2DM has been low in UK and other parts of the world due multiple barriers experienced by women as reported in previous studies (480) (481, 482). Although postnatal OGTT has been replaced by a 12-week post-partum HbA1C check or fasting plasma glucose at 6 to 8 weeks post-partum (42), the onus still remains in the women to attend for a blood test which may or may not happen. My study findings showed the women had lost some interest and the enthusiasm they had about their diet and other GDM related knowledge. The analysis of the GDM knowledge questionnaires also showed a reduction in number of correct answers in the 4<sup>th</sup> interview compared to the answers following the education session (2<sup>nd</sup> interview).

Given their risk of developing T2DM, the organisation of some form of individual or “Group” follow up would be an effective way to ensure:

- Firstly, that they had their first post-natal Fasting Plasma Glucose test or HbA1C checked.
- Secondly, they would feel supported in view of the new stress related to motherhood.
- Thirdly to ensure they were encouraged to maintain their dietary behavioural changes. Having an individual follow up with healthcare professionals

whether in the primary or secondary care would probably encourage attendance for a post-natal diabetes check and provide an opportunity for further pre-pregnancy counselling.

A previous study reported post-partum Swedish women with GDM having very positive experiences attending regular “Group” meetings for up to 1 year. These meetings with women with similar experiences provided the opportunity for the women to share experiences, to maintain their knowledge and to motivate them to maintain healthy lifestyle changes (223). Another important factor is the need to involve the women’s partners or people forming part of their immediate social support in the educational approaches used from the very outset of their diagnosis. Previous studies have demonstrated that social support can be a good facilitator in the women’s adjustment to self-care (452) (229) (422)

The results from the analysis of the GDM knowledge questionnaires did not show any superiority of the “Group” education attenders over the “One-to-One” attenders in terms of GDM knowledge, risk factors for GDM (except macrosomia), GDM affecting both the mother and the baby or the risk of T2DM development. The result of the analysis showed that despite the proportions of women answering certain questions were low at baseline, a global improvement in knowledge was noted after the education sessions as well as retention of knowledge in the post-partum period with proportions of women with correct answers varying from 83 to 100% in both “Group” and “One-to-One” attenders.

The research findings hence indicate that both the “One-to-One” and the “Group” education were relatively comparable in their objective of improving knowledge in the areas of general information about GDM, risk factors for GDM, GDM affecting mother and baby and the increased risk of developing T2DM following GDM. My study findings are similar with the study by Murphy et al who reported significant improvement in knowledge about GDM in all the participants who received nutritional counselling in individual and small group sessions (2 to 4 individuals per group) (252). Murphy et al also concluded that small “Group” teaching was equally effective to individual nutritional counselling in achieving the learning needs of women with GDM (252). It should however be pointed out that the session provided in the study by Murphy et al was only about nutrition whereas the group education session in my



study consisted of nutrition related information but also included information about risk factors, complications of GDM and post-partum advice.

Whilst women's knowledge in certain areas improved in the post-partum period, there were other aspects where they remained poor, despite the education session in my study. Fewer women from both the **"Group"** and **"One-to-One"** session had knowledge about 'macrosomia' as a risk factor for GDM. This knowledge improved for **"Group"** attenders after the education session but remained suboptimal for the **"One-to-One"** attenders. Similar patterns were noted for knowledge regarding the effects of certain foods on blood sugar levels as previously discussed. This indicates that certain aspects from the education session have not been retained in a short term and the women are likely to forget what they learnt during their education sessions in the long term.

A previous study reported women with previous GDM had not scored higher than women newly diagnosed with GDM whilst answering a GDM related questionnaire which points to the fact that women do not always retain knowledge from previous pregnancies and highlights the need for refresher or ongoing education interventions (252) in the post-partum period.

After the completion of my data collection a few studies looking into the effectiveness of the **"Group"** education in women with GDM have reported findings similar to my study. An Irish study reported improvement in the knowledge and understanding of GDM in women newly diagnosed with GDM following a multidisciplinary **"Group"** education intervention (483). This study also reported low proportions (7.5%) of women who identified previous macrosomia as a risk factor (483) which was similar to my study findings.

A prospective study which investigated the impact of a multidisciplinary **"Group"** education in women with GDM compared to individual sessions, showed significant improvement in the women's knowledge about GDM and their emotional status in both settings. Both the **"Group"** and individual session attenders were equally satisfied with the content and duration of the education. This study did not show any superiority of **"Group"** education over individual education session, which was consistent with my study findings. However, it demonstrated the fact that irrespective of the settings

there was improvement in GDM knowledge and that “Group” education sessions could be an excellent alternative to help manage GDM (239).

More recently studies have reported educational interventions aimed to be delivered in groups or bigger numbers in women with GDM through various means including web based education (331), educational DVDs (484) and multidisciplinary “Group” education sessions (239). Using a “Group” session would be ideal in view of the increasing challenge in increased workload in the health care settings across the world with the added benefits that a “Group” session provides (239). “Group” education offers motivation and peer support to the learners who share similar goals (256, 485, 486). “Group” education has successfully been used and shown to be effective in patients with type 1 and type 2 diabetes instead of individual sessions in healthcare settings (275, 487) (235).

“Group” educational interventions that have an underlying health-based model have reported improvement in knowledge in areas of knowledge, perceived susceptibility, benefits, and barriers and overall improved the quality of life of women with GDM compared to routine care (279, 488). The application of health behaviour models or other models would be a very effective and useful addition to an education session related to GDM.

## **7.9 Proposed model of care for GDM**

Based on the findings from my study, more specifically the challenging aspects of the ‘lived experiences’ of the women as analysed from a ‘lived body, space, time and relationality’ perspective, I propose a model of care for the short- and long-term management of women with GDM which could help tackle some of these issues. The ‘follow-up’ proposed in this model might be questioned or challenged as this would require more input from health care staff, especially during current times when the healthcare systems are facing staffing issues. However, in view of increased prevalence of GDM (42, 56, 489), T2DM and obesity reaching pandemic levels (490) and their cost burden on the healthcare system, it would be beneficial for health care providers in the longer term to invest in the continued education of women with a history of GDM. **Figure 16** shows the proposed model of care.

### Pre Conception Planning

- Women with previous GDM discharged from antenatal services
- Relevant counselling
- Written information on preventative measures provided
- Information on OGTT

### Diagnosis of GDM

- Standardised way of providing diagnosis via phone, email or text
- Additional information provided simultaneously e.g. specific websites or email relevant information
- Contact details provided for women to ring back or if any other support or information required

### Education Session

- Structured education
- Culturally sensitive
- Theories embedded: Adult learning theory, Health Behaviour Model
- Psychological input
- Partners or other family members to attend
- Possibility of splitting into 2 education sessions OR Follow up education sessions

### Post-partum 8-12 weeks

- Face to face/Online meeting with Practice nurse or GP to discuss post natal HbA1C
- Opportunity to discuss issues & emotional support
- Reiterate risk of GDM, T2DM.
- Provide goals and Arrange follow up meeting

### Follow Up Primary/Secondary Care

- At least annual GP follow up- as part of annual HbA1C check OR
- Follow Up as part of antenatal or diabetes services for women with previous GDM

*Figure 16: Proposed model of care for GDM:*

## 7.10 Conclusion

Studies from the 1990s and most recent ones have reported that women still blame themselves or feel shocked after being diagnosed with GDM despite the abundance of information and high-tech medical care available nowadays. Many valuable recommendations have been made in the last 20 years and some have been implemented. Analysis from my study has shown that a diagnosis GDM has far more implications in terms of ‘lived body, space, time and relationality’ perspectives in the lives of these women. Understanding how these women live with this condition or their ‘lived experiences’ could contribute to a more holistic approach to their care. This study has shown that women with GDM are initially worried and but adapt eventually and often show sustained motivation to make the required lifestyle changes. However, during their journey, they experienced variable degree of psychological effects which are not actively dealt with both by the women and the HCPs. The psychological aspects of care during pregnancy should become an integral part of the clinical care for women with GDM. Structured “Group” education enhanced with behaviour models such as the COM-B model and other models of health promotion to empower the women during their pregnancy and for life should prove effective as shown in other studies (279, 488).

Remote or online consultations were introduced during the COVID pandemic which have worked quite well. In the case of pregnant women with diabetes a hybrid system with a combination of online and “One-to-One” reviews have proven to work satisfactorily in many Trusts. “Group” online teaching on education and even teaching the use of glucometers or other glucose monitoring technologies were fairly well received by women. This only reinforces the use of structured “Group” education in healthcare settings.

Future research should investigate the effects of implementing psychological interventions in addition to medical intervention in women with GDM looking at long term behavioural changes, the development of T2DM and pregnancy outcomes. The benefits of longer term follow up in women with GDM, as proposed in my model, could also be investigated prospectively to look at longer term outcomes such as recurrence of GDM, weight changes and development of T2DM.

## References

1. Lundgren I, Wahlberg V. The experience of pregnancy: a hermeneutical/phenomenological study. *J Perinat Educ.* 1999;8(3):12-20 DOI: <https://doi.org/10.1624/105812499X87196>.
2. Trad PV. Adaptation to developmental transformations during the various phases of motherhood. *J Am Acad Psychoanal.* 1991;19(3):403-21 DOI: <https://doi.org/10.1521/jaap.1.1991.19.3.403>.
3. Mishra S, Rao CR, Shetty A. Trends in the Diagnosis of Gestational Diabetes Mellitus. *Scientifica* (Cairo). 2016;2016:5489015 DOI: <https://doi.org/10.1155/2016/5489015>.
4. O'Sullivan JB, Mahan CM. Criteria for the Oral Glucose Tolerance Test in Pregnancy. *Diabetes.* 1964;13:278-85.
5. Di Cianni G, Miccoli R, Volpe L, Lencioni C, Del Prato S. Intermediate metabolism in normal pregnancy and in gestational diabetes. *Diabetes Metab Res Rev.* 2003;19(4):259-70 DOI: <https://doi.org/10.1002/dmrr.390>.
6. Pu J, Zhao B, Wang EJ, Nimbai V, Osmundson S, Kunz L, et al. Racial/ethnic differences in gestational diabetes prevalence and contribution of common risk factors. *Paediatric and perinatal epidemiology.* 2015;29(5):436-43 DOI: <https://doi.org/10.1111/ppe.12209>.
7. Crowther CA, Hiller JE, Moss JR, McPhee AJ, Jeffries WS, Robinson JS, et al. Effect of treatment of gestational diabetes mellitus on pregnancy outcomes. *N Engl J Med.* 2005;352(24):2477-86 DOI: <https://doi.org/10.1056/NEJMoa042973>.
8. Hummel S, Much D, Rossbauer M, Ziegler A-G, Beyerlein A. Postpartum outcomes in women with gestational diabetes and their offspring: POGO study design and first-year results. *The review of diabetic studies: RDS.* 2013;10(1):49.
9. Rottenkolber M, Ferrari U, Holland L, Aertsen S, Kammer NN, Hetterich H, et al. The diabetes risk phenotype of young women with recent gestational diabetes. *The Journal of Clinical Endocrinology & Metabolism.* 2015;100(6):E910-E8.
10. Jarvela IY, Juutinen J, Koskela P, Hartikainen A-L, Kulmala P, Knip M, et al. Gestational diabetes identifies women at risk for permanent type 1 and type 2 diabetes in fertile age: predictive role of autoantibodies. *Diabetes care.* 2006;29(3):607-12.
11. Krishnaveni GV, Hill JC, Veena SR, Geetha S, Jayakumar MN, Karat CL, et al. Gestational diabetes and the incidence of diabetes in the 5 years following the index pregnancy in South Indian women. *Diabetes research and clinical practice.* 2007;78(3):398-404.
12. Bellamy L, Casas J-P, Hingorani AD, Williams D. Type 2 diabetes mellitus after gestational diabetes: a systematic review and meta-analysis. *Lancet.* 2009;373(9677):1773-9 DOI: [https://doi.org/10.1016/s0140-6736\(09\)60731-5](https://doi.org/10.1016/s0140-6736(09)60731-5).
13. Abokaf H, Shoham-Vardi I, Sergienko R, Landau D, Sheiner E. In utero exposure to gestational diabetes mellitus and long term endocrine morbidity of the offspring. *Diabetes Research and Clinical Practice.* 2018;144:231-5.
14. Carolan-Olah M, Sayakhot P. A randomized controlled trial of a web-based education intervention for women with gestational diabetes mellitus. *Midwifery.* 2019;68:39-47 DOI: <https://doi.org/10.1016/j.midw.2018.08.019>.
15. Cremona A, O'Gorman C, Cotter A, Saunders J, Donnelly A. Effect of exercise modality on markers of insulin sensitivity and blood glucose control in pregnancies complicated with gestational diabetes mellitus: a systematic review. *Obesity science & practice.* 2018;4(5):455-67.

16. Simeoni U, Barker DJ, editors. Offspring of diabetic pregnancy: long-term outcomes. *Seminars in Fetal and Neonatal Medicine*; 2009: Elsevier.
17. Dabelea D, Snell-Bergeon JK, Hartsfield CL, Bischoff KJ, Hamman RF, McDuffie RS. Increasing prevalence of gestational diabetes mellitus (GDM) over time and by birth cohort: Kaiser Permanente of Colorado GDM Screening Program. *Diabetes care*. 2005;28(3):579-84.
18. Chu SY, Callaghan WM, Kim SY, Schmid CH, Lau J, England LJ, et al. Maternal obesity and risk of gestational diabetes mellitus. *Diabetes care*. 2007;30(8):2070-6.
19. Organization WH. Definition, Diagnosis and Classification of Diabetes Mellitus and its Complications. Part 1: Diagnosis and Classification of Diabetes Mellitus. Report of a WHO Consultation, Geneva: World Health Organization. 1999.
20. IADPSG. International Association Of Diabetes And Pregnancy Study Groups Consensus Panel. International association of diabetes and pregnancy study groups recommendations on the diagnosis and classification of hyperglycemia in pregnancy. *Diabetes Care*. 2010;33(3):676-82.
21. Group HSCR, Metzger BE, Lowe LP, Dyer AR, Trimble ER, Chaovarindr U, et al. Hyperglycemia and adverse pregnancy outcomes. *N Engl J Med*. 2008;358(19):1991-2002 DOI: 10.1056/NEJMoa0707943.
22. Wendland EM, Torloni MR, Falavigna M, Trujillo J, Dode MA, Campos MA, et al. Gestational diabetes and pregnancy outcomes--a systematic review of the World Health Organization (WHO) and the International Association of Diabetes in Pregnancy Study Groups (IADPSG) diagnostic criteria. *BMC Pregnancy Childbirth*. 2012;12:23 DOI: 10.1186/1471-2393-12-23.
23. WHO. Diagnostic criteria and classification of hyperglycaemia first detected in pregnancy. Geneva: World Health Organization. 2013.
24. WHO. World Health Organization & International Diabetes Federation. Definition and diagnosis of diabetes mellitus and intermediate hyperglycaemia : report of a WHO/IDF consultation. Geneva : World Health Organization. 2006.
25. O'Sullivan JB, Charles D, Mahan CM, Dandrow RV. Gestational diabetes and perinatal mortality rate. *Am J Obstet Gynecol*. 1973;116(7):901-4.
26. O'Sullivan JB, Gellis SS, Dandrow RV, Tenney BO. The potential diabetic and her treatment in pregnancy. *Obstet Gynecol* 1966;27:683-9. *Obstet Gynecol*. 2003;102(1):7.
27. NDDG. Classification and diagnosis of diabetes mellitus and other categories of glucose intolerance. National Diabetes Data Group. *Diabetes*. 1979;28(12):1039-57.
28. Carpenter MW, Coustan DR. Criteria for screening tests for gestational diabetes. *Am J Obstet Gynecol*. 1982;144(7):768-73.
29. WHO. WHO Expert Committee on Diabetes Mellitus: second report. *World Health Organ Tech Rep Ser*. 1980;646:1-80.
30. Lind T, Phillips PR. Influence of pregnancy on the 75-g OGTT. A prospective multicenter study. The Diabetic Pregnancy Study Group of the European Association for the Study of Diabetes. *Diabetes*. 1991;40 Suppl 2:8-13.
31. Sacks DB. Diagnosis of gestational diabetes mellitus: it is time for international consensus. *Clin Chem*. 2014;60(1):141-3 DOI: <https://doi.org/10.1373/clinchem.2013.206920>.
32. Cutchie WA, Cheung NW, Simmons D. Comparison of international and New Zealand guidelines for the care of pregnant women with diabetes. *Diabet Med*. 2006;23(5):460-8 DOI: <https://doi.org/10.1111/j.1464-5491.2006.01850.x>.

33. Scott DA, Loveman E, McIntyre L, Waugh N. Screening for gestational diabetes: a systematic review and economic evaluation. *Health Technol Assess.* 2002;6(11):1-161.
34. Diabetes in Pregnancy: Management of Diabetes and Its Complications from Preconception to the Postnatal Period. National Institute for Health and Clinical Excellence: Guidance [Internet]. 2008 [cited 23/09/2017]. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/21370515>.
35. Group HSCR. Hyperglycemia and Adverse Pregnancy Outcome (HAPO) Study: associations with neonatal anthropometrics. *Diabetes.* 2009;58(2):453-9 DOI: <https://doi.org/10.2337/db08-1112>.
36. Gestational diabetes mellitus. *Diabetes Care.* 2004;27 Suppl 1:S88-90 DOI: <https://doi.org/10.2337/diacare.27.2007.s88>.
37. Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. *Diabetes Care.* 1998(21):S5-S19.
38. Mellitus GD. American Diabetes Association. *Diabetes care.* 2004;27:S88-S90.
39. RCOG. RCOG Scientific Impact Paper Diagnosis and Treatment of Gestational Diabetes produced by the Scientific Advisory Committee. 2011.
40. Organization WH. Diabetes Mellitus: Report of a WHO Study Group [meeting held in Geneva from 11 to 16 February 1985]: World Health Organization; 1985.
41. Group HSCR. The hyperglycemia and adverse pregnancy outcome (HAPO) study. *International Journal of Gynecology & Obstetrics.* 2002;78(1):69-77.
42. National Institute for Health and Clinical Excellence. Putting NICE guidance into practice. [Internet]. 2015 [cited 05/02/2019]. Available from: <http://www.nice.org.uk/guidance/ng3/resources/costing-statement-3782989>.
43. SIGN. Scottish Intercollegiate Guidelines Network. National clinical guideline 116: Management of diabetes. Edinburgh: SIGN; 2010.
44. Landon MB, Spong CY, Thom E, Carpenter MW, Ramin SM, Casey B, et al. A multicenter, randomized trial of treatment for mild gestational diabetes. *New England Journal of Medicine.* 2009;361(14):1339-48.
45. Catalano PM, Tyzbir ED, Roman NM, Amini SB, Sims EA. Longitudinal changes in insulin release and insulin resistance in nonobese pregnant women. *Am J Obstet Gynecol.* 1991;165(6 Pt 1):1667-72.
46. Phelps RL, Metzger BE, Freinkel N. Carbohydrate metabolism in pregnancy. XVII. Diurnal profiles of plasma glucose, insulin, free fatty acids, triglycerides, cholesterol, and individual amino acids in late normal pregnancy. *Am J Obstet Gynecol.* 1981;140(7):730-6.
47. Catalano PM. Trying to understand gestational diabetes. *Diabet Med.* 2014;31(3):273-81 DOI: <https://doi.org/10.1111/dme.12381>.
48. Damm P, Vestergaard H, Kuhl C, Pedersen O. Impaired insulin-stimulated nonoxidative glucose metabolism in glucose-tolerant women with previous gestational diabetes. *Am J Obstet Gynecol.* 1996;174(2):722-9.
49. Kautzky-Willer A, Prager R, Waldhausl W, Pacini G, Thomaseth K, Wagner OF, et al. Pronounced insulin resistance and inadequate beta-cell secretion characterize lean gestational diabetes during and after pregnancy. *Diabetes Care.* 1997;20(11):1717-23.
50. Homko C, Sivan E, Chen X, Reece EA, Boden G. Insulin secretion during and after pregnancy in patients with gestational diabetes mellitus. *J Clin Endocrinol Metab.* 2001;86(2):568-73 DOI: <https://doi.org/10.1210/jcem.86.2.7137>.

51. Weir GC, Laybutt DR, Kaneto H, Bonner-Weir S, Sharma A. Beta-cell adaptation and decompensation during the progression of diabetes. *Diabetes*. 2001;50 Suppl 1:S154-9.
52. DeFronzo RA. Banting Lecture. From the triumvirate to the ominous octet: a new paradigm for the treatment of type 2 diabetes mellitus. *Diabetes*. 2009;58(4):773-95 DOI: <https://doi.org/10.2337/db09-9028>.
53. Zraika S, Hull RL, Verchere CB, Clark A, Potter KJ, Fraser PE, et al. Toxic oligomers and islet beta cell death: guilty by association or convicted by circumstantial evidence? *Diabetologia*. 2010;53(6):1046-56 DOI: <https://doi.org/10.1007/s00125-010-1671-6>.
54. Barbour LA, McCurdy CE, Hernandez TL, Kirwan JP, Catalano PM, Friedman JE. Cellular mechanisms for insulin resistance in normal pregnancy and gestational diabetes. *Diabetes Care*. 2007;30 Suppl 2:S112-9 DOI: <https://doi.org/10.2337/dc07-s202>.
55. Ashcroft FM, Rohm M, Clark A, Brereton MF. Is Type 2 Diabetes a Glycogen Storage Disease of Pancreatic beta Cells? *Cell Metab*. 2017;26(1):17-23 DOI: <https://doi.org/10.1016/j.cmet.2017.05.014>.
56. Ferrara A. Increasing prevalence of gestational diabetes mellitus: a public health perspective. *Diabetes care*. 2007;30(Supplement\_2):S141-S6.
57. Anna V, Van Der Ploeg HP, Cheung NW, Huxley RR, Bauman AE. Sociodemographic correlates of the increasing trend in prevalence of gestational diabetes mellitus in a large population of women between 1995 and 2005. *Diabetes care*. 2008;31(12):2288-93.
58. Guariguata L, Linnenkamp U, Beagley J, Whiting D, Cho N. Global estimates of the prevalence of hyperglycaemia in pregnancy. *Diabetes research and clinical practice*. 2014;103(2):176-85.
59. Association AD. Gestational diabetes mellitus. *Diabetes care*. 2004;27(suppl 1):s88-s90 DOI: <https://doi.org/10.2337/diacare.27.2007.S88>.
60. Zhu Y, Zhang C. Prevalence of Gestational Diabetes and Risk of Progression to Type 2 Diabetes: a Global Perspective. *Curr Diab Rep*. 2016;16(1):7- DOI: <https://doi.org/10.1007/s11892-015-0699-x>.
61. Bimson BE, Rosenn BM, Morris SA, Sasso EB, Schwartz RA, Brustman LE. Current trends in the diagnosis and management of gestational diabetes mellitus in the United States. *J Matern Fetal Neonatal Med*. 2017;30(21):2607-12 DOI: 10.1080/14767058.2016.1257603.
62. Ignell C, Claesson R, Anderberg E, Berntorp K. Trends in the prevalence of gestational diabetes mellitus in southern Sweden, 2003–2012. *Acta obstetrica et gynecologica Scandinavica*. 2014;93(4):420-4.
63. Anderberg E, Källén K, Berntorp K, Frid A, Åberg A. A simplified oral glucose tolerance test in pregnancy: compliance and results. *Acta obstetrica et gynecologica Scandinavica*. 2007;86(12):1432-6.
64. Association AD. Standards of medical care in diabetes: 2012. *Diabetes care*. 2012;35 Suppl 1(1):S11-S63 DOI: <https://doi.org/10.2337/dc12-s011>.
65. Association AD. Standards of Medical Care in Diabetes—2014. *Diabetes Care* 2014; 37 (Suppl. 1): S14–S80 Diagnosis and Classification of Diabetes Mellitus. *Diabetes Care* 2014; 37 (Suppl. 1): S81–S90. *Diabetes care*. 2014;37(3):887- DOI: <https://doi.org/10.2337/dc14-S014>.
66. Kuti MA, Abbiyesuku FM, Akinlade KS, Akinosun OM, Adedapo KS, Adeleye JO, et al. Oral glucose tolerance testing outcomes among women at high risk for gestational diabetes mellitus. *Journal of clinical pathology*. 2011;64(8):718-21.



67. Anzaku AS, Musa J. Prevalence and associated risk factors for gestational diabetes in Jos, North-central, Nigeria. *Archives of gynecology and obstetrics*. 2013;287(5):859-63.
68. Olagbuji BN, Atiba AS, Olofinbiyi BA, Akintayo AA, Awoleke JO, Ade-Ojo IP, et al. Prevalence of and risk factors for gestational diabetes using 1999, 2013 WHO and IADPSG criteria upon implementation of a universal one-step screening and diagnostic strategy in a sub-Saharan African population. *European Journal of Obstetrics & Gynecology and Reproductive Biology*. 2015;189:27-32.
69. Olarinoye J, Ohwovoriole A, Ajayi G. Diagnosis of gestational diabetes mellitus in Nigerian pregnant women-comparison between 75G and 100G oral glucose tolerance tests. *West African journal of medicine*. 2004;23(3):198-201.
70. Hedderston M, Ehrlich S, Sridhar S, Darbinian J, Moore S, Ferrara A. Racial/ethnic disparities in the prevalence of gestational diabetes mellitus by BMI. *Diabetes care*. 2012;35(7):1492-8.
71. Gastrich MD, Peck S, Janevic T, Bachmann G, Lotwala N, Siyam A. Gestational diabetes mellitus: An educational opportunity. *J Diabetes Nurs*. 2013;17(6):220-4.
72. Östlund I, Hanson U. Occurrence of gestational diabetes mellitus and the value of different screening indicators for the oral glucose tolerance test. *Acta obstetrica et gynecologica Scandinavica*. 2003;82(2):103-8.
73. Young BC, Ecker JL. Fetal macrosomia and shoulder dystocia in women with gestational diabetes: risks amenable to treatment? *Curr Diab Rep*. 2013;13(1):12-8.
74. Lambrinoudaki I, Vlachou SA, Creatsas G. Genetics in gestational diabetes mellitus: association with incidence, severity, pregnancy outcome and response to treatment. *Curr Diabetes Rev*. 2010;6(6):393-9 DOI: 10.2174/157339910793499155.
75. Konig M, Shuldiner AR. The genetic interface between gestational diabetes and type 2 diabetes. *J Matern Fetal Neonatal Med*. 2012;25(1):36-40 DOI: 10.3109/14767058.2012.626926.
76. Kim C, Newton KM, Knopp RH. Gestational diabetes and the incidence of type 2 diabetes: a systematic review. *Diabetes Care*. 2002;25(10):1862-8 DOI: 10.2337/diacare.25.10.1862.
77. Atlas D. International diabetes federation. *IDF Diabetes Atlas, 7th edn* Brussels, Belgium: International Diabetes Federation. 2015;33:2.
78. Emerging Risk Factors C. Diabetes mellitus, fasting blood glucose concentration, and risk of vascular disease: a collaborative meta-analysis of 102 prospective studies. *The lancet*. 2010;375(9733):2215-22.
79. Einarson TR, Acs A, Ludwig C, Panton UH. Prevalence of cardiovascular disease in type 2 diabetes: a systematic literature review of scientific evidence from across the world in 2007–2017. *Cardiovascular diabetology*. 2018;17(1):1-19.
80. Simmons RK, Griffin SJ, Lauritzen T, Sandbæk A. Effect of screening for type 2 diabetes on risk of cardiovascular disease and mortality: a controlled trial among 139,075 individuals diagnosed with diabetes in Denmark between 2001 and 2009. *Diabetologia*. 2017;60(11):2192-9.
81. Verma A, Boney CM, Tucker R, Vohr BR. Insulin resistance syndrome in women with prior history of gestational diabetes mellitus. *The Journal of Clinical Endocrinology & Metabolism*. 2002;87(7):3227-35.
82. Carr DB, Utzschneider KM, Hull RL, Tong J, Wallace TM, Kodama K, et al. Gestational diabetes mellitus increases the risk of cardiovascular disease in women with a family history of type 2 diabetes. *Diabetes care*. 2006;29(9):2078-83.

83. Lauenborg J, Mathiesen E, Hansen T, Glumer C, Jørgensen T, Borch-Johnsen K, et al. The prevalence of the metabolic syndrome in a Danish population of women with previous gestational diabetes mellitus is three-fold higher than in the general population. *The Journal of Clinical Endocrinology & Metabolism*. 2005;90(7):4004-10.
84. Shah BR, Retnakaran R, Booth GL. Increased risk of cardiovascular disease in young women following gestational diabetes mellitus. *Diabetes care*. 2008;31(8):1668-9.
85. McKenzie-Sampson S, Paradis G, Healy-Profitos J, St-Pierre F, Auger N. Gestational diabetes and risk of cardiovascular disease up to 25 years after pregnancy: a retrospective cohort study. *Acta Diabetol*. 2018;55(4):315-22 DOI: 10.1007/s00592-017-1099-2.
86. Grundy SM. Metabolic syndrome scientific statement by the american heart association and the national heart, lung, and blood institute. *Am Heart Assoc*; 2005. p. 2243-4.
87. Clark Jr CM, Qiu C, Amerman B, Porter B, Fineberg N, Aldasouqi S, et al. Gestational diabetes: should it be added to the syndrome of insulin resistance? *Diabetes care*. 1997;20(5):867-71.
88. Ward WK, Johnston CLW, Beard JC, Benedetti TJ, Halter JB, Porte Jr D. Insulin resistance and impaired insulin secretion in subjects with histories of gestational diabetes mellitus. *Diabetes*. 1985;34(9):861-9.
89. Davis CL, Gutt M, Llabre MM, Marks JB, O'Sullivan MJ, Potter JE, et al. History of gestational diabetes, insulin resistance and coronary risk. *Journal of diabetes and its complications*. 1999;13(4):216-23.
90. Walker JJ. Pre-eclampsia. *Lancet*. 2000;356(9237):1260-5 DOI: 10.1016/S0140-6736(00)02800-2.
91. Solomon CG, Seely EW. Brief review: hypertension in pregnancy : a manifestation of the insulin resistance syndrome? *Hypertension*. 2001;37(2):232-9 DOI: 10.1161/01.hyp.37.2.232.
92. Jensen DM, Sorensen B, Feilberg-Jorgensen N, Westergaard JG, Beck-Nielsen H. Maternal and perinatal outcomes in 143 Danish women with gestational diabetes mellitus and 143 controls with a similar risk profile. *Diabet Med*. 2000;17(4):281-6 DOI: 10.1046/j.1464-5491.2000.00268.x.
93. Ovesen PG, Jensen DM, Damm P, Rasmussen S, Kesmodel US. Maternal and neonatal outcomes in pregnancies complicated by gestational diabetes. A nation-wide study. *The Journal of Maternal-Fetal & Neonatal Medicine*. 2015;28(14):1720-4.
94. Ros HS, Cnattingius S, Lipworth L. Comparison of risk factors for preeclampsia and gestational hypertension in a population-based cohort study. *Am J Epidemiol*. 1998;147(11):1062-70 DOI: 10.1093/oxfordjournals.aje.a009400.
95. Feig DS, Shah BR, Lipscombe LL, Wu CF, Ray JG, Lowe J, et al. Preeclampsia as a risk factor for diabetes: a population-based cohort study. *PLoS medicine*. 2013;10(4):e1001425.
96. Pace R, Brazeau A-S, Meltzer S, Rahme E, Dasgupta K. Conjoint associations of gestational diabetes and hypertension with diabetes, hypertension, and cardiovascular disease in parents: a retrospective cohort study. *American journal of epidemiology*. 2017;186(10):1115-24.
97. Noctor E, Crowe C, Carmody LA, Kirwan B, O'Dea A, Glynn LG, et al. ATLANTIC-DIP: prevalence of metabolic syndrome and insulin resistance in women with previous gestational diabetes mellitus by International Association of Diabetes in

- Pregnancy Study Groups criteria. *Acta Diabetol.* 2015;52(1):153-60 DOI: 10.1007/s00592-014-0621-z.
98. Benhalima K, Lens K, Bosteels J, Chantal M. The Risk for Glucose Intolerance after Gestational Diabetes Mellitus since the Introduction of the IADPSG Criteria: A Systematic Review and Meta-Analysis. *J Clin Med.* 2019;8(9) DOI: 10.3390/jcm8091431.
99. Li LJ, Aris IM, Su LL, Chong YS, Wong TY, Tan KH, et al. Effect of gestational diabetes and hypertensive disorders of pregnancy on postpartum cardiometabolic risk. *Endocr Connect.* 2018;7(3):433-42 DOI: 10.1530/EC-17-0359.
100. Chen L, Magliano DJ, Zimmet PZ. The worldwide epidemiology of type 2 diabetes mellitus—present and future perspectives. *Nature reviews endocrinology.* 2012;8(4):228-36.
101. 2021 [cited 07/06/2022]. Available from: [https://www.who.int/health-topics/diabetes#tab=tab\\_1](https://www.who.int/health-topics/diabetes#tab=tab_1).
102. NICE. Diabetes in pregnancy. Gestational diabetes: risk assessment, testing, diagnosis and management. . 2021.
103. Gillman MW, Rifas-Shiman S, Berkey CS, Field AE, Colditz GA. Maternal gestational diabetes, birth weight, and adolescent obesity. *Pediatrics.* 2003;111(3):e221-6 DOI: 10.1542/peds.111.3.e221.
104. Silverman BL, Rizzo TA, Cho NH, Metzger BE. Long-term effects of the intrauterine environment. The Northwestern University Diabetes in Pregnancy Center. *Diabetes Care.* 1998;21 Suppl 2:B142-9.
105. Kim SY, Sharma AJ, Callaghan WM. Gestational diabetes and childhood obesity: what is the link? *Curr Opin Obstet Gynecol.* 2012;24(6):376-81 DOI: 10.1097/GCO.0b013e328359f0f4.
106. Metzger BE, Silverman BL, Freinkel N, Dooley SL, Ogata ES, Green OC. Amniotic fluid insulin concentration as a predictor of obesity. *Arch Dis Child.* 1990;65(10 Spec No):1050-2 DOI: 10.1136/adc.65.10\_spec\_no.1050.
107. Silverman BL, Metzger BE, Cho NH, Loeb CA. Impaired glucose tolerance in adolescent offspring of diabetic mothers. Relationship to fetal hyperinsulinism. *Diabetes Care.* 1995;18(5):611-7 DOI: 10.2337/diacare.18.5.611.
108. Tam WH, Ma RC, Yang X, Ko GT, Tong PC, Cockram CS, et al. Glucose intolerance and cardiometabolic risk in children exposed to maternal gestational diabetes mellitus in utero. *Pediatrics.* 2008;122(6):1229-34 DOI: 10.1542/peds.2008-0158.
109. Tam WH, Ma RC, Yang X, Li AM, Ko GT, Kong AP, et al. Glucose intolerance and cardiometabolic risk in adolescents exposed to maternal gestational diabetes: a 15-year follow-up study. *Diabetes Care.* 2010;33(6):1382-4 DOI: 10.2337/dc09-2343.
110. Silverman BL, Rizzo T, Green OC, Cho NH, Winter RJ, Ogata ES, et al. Long-term prospective evaluation of offspring of diabetic mothers. *Diabetes.* 1991;40 Suppl 2:121-5.
111. Catalano PM, Farrell K, Thomas A, Huston-Presley L, Mencin P, de Mouzon SH, et al. Perinatal risk factors for childhood obesity and metabolic dysregulation. *Am J Clin Nutr.* 2009;90(5):1303-13 DOI: 10.3945/ajcn.2008.27416.
112. Oyen N, Diaz LJ, Leirgul E, Boyd HA, Priest J, Mathiesen ER, et al. Prepregnancy Diabetes and Offspring Risk of Congenital Heart Disease: A Nationwide Cohort Study. *Circulation.* 2016;133(23):2243-53 DOI: 10.1161/CIRCULATIONAHA.115.017465.

113. McCance D MM, Sacks DA. A practical manual of diabetes in pregnancy. John Wiley & Sons. 2017 DOI: 10.1002/978119043805.
114. Wicklow BA, Sellers EAC, Sharma AK, Kroeker K, Nickel NC, Philips-Beck W, et al. Association of Gestational Diabetes and Type 2 Diabetes Exposure In Utero With the Development of Type 2 Diabetes in First Nations and Non-First Nations Offspring. *JAMA Pediatr.* 2018;172(8):724-31 DOI: 10.1001/jamapediatrics.2018.1201.
115. Yu Y, Arah OA, Liew Z, Cnattingius S, Olsen J, Sorensen HT, et al. Maternal diabetes during pregnancy and early onset of cardiovascular disease in offspring: population based cohort study with 40 years of follow-up. *BMJ (Clinical research ed).* 2019;367:l6398 DOI: 10.1136/bmj.l6398.
116. Parikh NI, Gonzalez JM, Anderson CAM, Judd SE, Rexrode KM, Hlatky MA, et al. Adverse pregnancy outcomes and cardiovascular disease risk: unique opportunities for cardiovascular disease prevention in women: a scientific statement from the American Heart Association. *Circulation.* 2021;143(18):e902-e16.
117. Mosca L, Benjamin EJ, Berra K, Bezanson JL, Dolor RJ, Lloyd-Jones DM, et al. Effectiveness-based guidelines for the prevention of cardiovascular disease in women--2011 update: a guideline from the American Heart Association. *J Am Coll Cardiol.* 2011;57(12):1404-23 DOI: 10.1016/j.jacc.2011.02.005.
118. 2021 [cited 08/06/2022]. Available from: [https://www.diabetes.org.uk/about\\_us/news\\_landing\\_page/nhs-spending-on-diabetes-to-reach-169-billion-by-2035](https://www.diabetes.org.uk/about_us/news_landing_page/nhs-spending-on-diabetes-to-reach-169-billion-by-2035).
119. Dall TM, Yang W, Gillespie K, Mocarski M, Byrne E, Cintina I, et al. The economic burden of elevated blood glucose levels in 2017: diagnosed and undiagnosed diabetes, gestational diabetes mellitus, and prediabetes. *Diabetes care.* 2019;42(9):1661-8.
120. Mereaglia M, Dainelli L, Banks H, Benedetto C, Detzel P, Fattore G. The short-term economic burden of gestational diabetes mellitus in Italy. *BMC pregnancy and childbirth.* 2018;18(1):1-9.
121. Moses RG, Calvert D. Pregnancy outcomes in women without gestational diabetes mellitus related to the maternal glucose level. Is there a continuum of risk? *Diabetes Care.* 1995;18(12):1527-33 DOI: 10.2337/diacare.18.12.1527.
122. Falavigna M, Schmidt MI, Trujillo J, Alves LF, Wendland ER, Torloni MR, et al. Effectiveness of gestational diabetes treatment: a systematic review with quality of evidence assessment. *Diabetes Res Clin Pract.* 2012;98(3):396-405 DOI: 10.1016/j.diabres.2012.09.002.
123. Kamysheva E, Skouteris H, Wertheim EH, Paxton SJ, Milgrom J. Examination of a multi-factorial model of body-related experiences during pregnancy: the relationships among physical symptoms, sleep quality, depression, self-esteem, and negative body attitudes. *Body Image.* 2008;5(2):152-63 DOI: 10.1016/j.bodyim.2007.12.005.
124. Conceptions in England and Wales: 2017. Annual statistics on conceptions to residents of England and Wales; numbers and rates, by age group including women aged under 18 years [Internet]. 2017 [cited 20/05/2019]. Available from: <https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/conceptionandfertilityrates/bulletins/conceptionstatistics/2017>.
125. Narayan B, Nelson-Piercy C. Medical problems in pregnancy. *Clinical Medicine.* 2017;17(3):251 DOI: <https://doi.org/10.7861/clinmedicine.17-3-251>.
126. Kenyon S, Knight M, Tuffnell D, Shakespeare J, Grey R, Kurinczuk J. Saving Lives, Improving Mothers' Care: Surveillance of maternal deaths in the UK 2011-13

and lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2009-13. 2015.

127. Wilmot EG, Mansell P. Diabetes and pregnancy. *Clin Med (Lond)*. 2014;14(6):677-80 DOI: <https://doi.org/10.7861/clinmedicine.14-6-677>.

128. McIntyre HD. Discovery, Knowledge, and Action-Diabetes in Pregnancy Across the Translational Spectrum: The 2016 Norbert Freinkel Award Lecture. *Diabetes Care*. 2018;41(2):227-32 DOI: <https://doi.org/10.2337/dci17-0056>.

129. Diabetes in pregnancy. Gestational diabetes: risk assessment, testing, diagnosis and management [Internet]. 2021 [cited 07/09/2021]. Available from: <https://pathways.nice.org.uk/pathways/diabetes-in-pregnancy>.

130. Schaefer UM, Songster G, Xiang A, Berkowitz K, Buchanan TA, Kjos SL. Congenital malformations in offspring of women with hyperglycemia first detected during pregnancy. *American journal of obstetrics and gynecology*. 1997;177(5):1165-71.

131. Yang J, Cummings EA, O'connell C, Jangaard K. Fetal and neonatal outcomes of diabetic pregnancies. *Obstetrics & Gynecology*. 2006;108(3):644-50.

132. Association AD. Standards of Medical Care in Diabetes—2011. *Diabetes Care*. 2011;34(Supplement\_1):S11-S61 DOI: <https://doi.org/10.2337/dc11-S011>.

133. Mathiesen ER, Vaz JA. Insulin treatment in diabetic pregnancy. *Diabetes/metabolism research and reviews*. 2008;24:S3-20.

134. de Valk HW, Visser GH. Insulin during pregnancy, labour and delivery. Best practice & research *Clinical obstetrics & gynaecology*. 2011;25(1):65-76 DOI: <https://doi.org/10.1016/j.bpobgyn.2010.10.002>.

135. Kampmann U, Madsen LR, Skajaa GO, Iversen DS, Moeller N, Ovesen P. Gestational diabetes: a clinical update. *World journal of diabetes*. 2015;6(8):1065.

136. Carolan-Olah M, Duarte-Gardea M, Lechuga J. A critical review: early life nutrition and prenatal programming for adult disease. *Journal of clinical nursing*. 2015;24(23-24):3716-29.

137. Staneva A, Bogossian F, Pritchard M, Wittkowski A. The effects of maternal depression, anxiety, and perceived stress during pregnancy on preterm birth: A systematic review. *Women and Birth*. 2015;28(3):179-93.

138. Dunkel Schetter C. Psychological science on pregnancy: stress processes, biopsychosocial models, and emerging research issues. *Annual review of psychology*. 2011;62:531-58.

139. Walder DJ, Laplante DP, Sousa-Pires A, Veru F, Brunet A, King S. Prenatal maternal stress predicts autism traits in 6½ year-old children: Project Ice Storm. *Psychiatry research*. 2014;219(2):353-60.

140. Steinig J, Nagl M, Linde K, Zietlow G, Kersting A. Antenatal and postnatal depression in women with obesity: a systematic review. *Archives of women's mental health*. 2017;20(4):569-85.

141. Ross LE, McLean LM, Psych C. Anxiety disorders during pregnancy and the postpartum period: a systematic review. *Depression*. 2006;6(9):1-14.

142. Sheeba B, Nath A, Metgud CS, Krishna M, Venkatesh S, Vindhya J, et al. Prenatal depression and its associated risk factors among pregnant women in Bangalore: a hospital based prevalence study. *Frontiers in public health*. 2019;7:108.

143. Rich-Edwards JW, James-Todd T, Mohllajee A, Kleinman K, Burke A, Gillman MW, et al. Lifetime maternal experiences of abuse and risk of pre-natal depression in two demographically distinct populations in Boston. *International Journal of Epidemiology*. 2011;40(2):375-84.

144. Leight KL, Fitelson EM, Weston CA, Wisner KL. Childbirth and mental disorders. *International Review of Psychiatry*. 2010;22(5):453-71.
145. Parker GB, Hegarty B, Paterson A, Hadzi-Pavlovic D, Granville-Smith I, Gokiert A. Predictors of post-natal depression are shaped distinctly by the measure of 'depression'. *Journal of affective disorders*. 2015;173:239-44.
146. Dunkel Schetter C, Tanner L. Anxiety, depression and stress in pregnancy: implications for mothers, children, research, and practice. *Curr Opin Psychiatry*. 2012;25(2):141-8 DOI: <https://doi.org/10.1097/YCO.0b013e3283503680>.
147. Lewinsohn PM, Seeley JR, Roberts RE, Allen NB. Center for Epidemiologic Studies Depression Scale (CES-D) as a screening instrument for depression among community-residing older adults. *Psychology and aging*. 1997;12(2):277.
148. Radloff LS. The CES-D scale: A self-report depression scale for research in the general population. *Applied psychological measurement*. 1977;1(3):385-401.
149. Cox JL, Holden JM, Sagovsky R. Detection of postnatal depression: development of the 10-item Edinburgh Postnatal Depression Scale. *The British journal of psychiatry*. 1987;150(6):782-6.
150. Beck AT, Steer RA, Carbin MG. Psychometric properties of the Beck Depression Inventory: Twenty-five years of evaluation. *Clinical psychology review*. 1988;8(1):77-100.
151. Woods SM, Melville JL, Guo Y, Fan M-Y, Gavin A. Psychosocial stress during pregnancy. *American journal of obstetrics and gynecology*. 2010;202(1):61.e1-. e7.
152. Yali AM, Lobel M. Coping and distress in pregnancy: an investigation of medically high risk women. *Journal of Psychosomatic Obstetrics & Gynecology*. 1999;20(1):39-52.
153. Dickerson SS, Kemeny ME. Acute stressors and cortisol responses: a theoretical integration and synthesis of laboratory research. *Psychological bulletin*. 2004;130(3):355 DOI: <https://doi.org/10.1037/0033-2909.130.3.355>.
154. Pruessner JC, Dedovic K, Pruessner M, Lord C, Buss C, Collins L, et al. Stress regulation in the central nervous system: evidence from structural and functional neuroimaging studies in human populations-2008 Curt Richter Award Winner. *Psychoneuroendocrinology*. 2010;35(1):179-91.
155. Ruiz R, Fullerton J. The measurement of stress in pregnancy. *Nursing & health sciences*. 1999;1(1):19-25.
156. Jesse DE, Walcott-McQuigg J, Mariella A, Swanson MS. Risks and protective factors associated with symptoms of depression in low-income African American and Caucasian women during pregnancy. *Journal of midwifery & women's health*. 2005;50(5):405-10.
157. Zuckerman B, Amaro H, Bauchner H, Cabral H. Depressive symptoms during pregnancy: relationship to poor health behaviors. *American journal of obstetrics and gynecology*. 1989;160(5):1107-11.
158. Orr ST, James SA, Miller CA, Barakat B, Daikoku N, Pupkin M, et al. Psychosocial stressors and low birthweight in an urban population. *American journal of preventive medicine*. 1996;12(6):459-66.
159. Bullock L, Bloom T, Davis J, Kilburn E, Curry MA. Abuse disclosure in privately and Medicaid-funded pregnant women. *Journal of midwifery & women's health*. 2006;51(5):361-9.
160. Dunn LL, Oths KS. Prenatal predictors of intimate partner abuse. *Journal of Obstetric, Gynecologic & Neonatal Nursing*. 2004;33(1):54-63.

161. Heaman MI. Relationships between physical abuse during pregnancy and risk factors for preterm birth among women in Manitoba. *Journal of Obstetric, Gynecologic, & Neonatal Nursing*. 2005;34(6):721-31.
162. Martin SL, Griffin JM, Kupper LL, Petersen R, Beck-Warden M, Buescher PA. Stressful life events and physical abuse among pregnant women in North Carolina. *Maternal and Child Health Journal*. 2001;5(3):145-52.
163. Curry MA. The interrelationships between abuse, substance use, and psychosocial stress during pregnancy. *Journal of Obstetric, Gynecologic, & Neonatal Nursing*. 1998;27(6):692-9.
164. Spitzer RL, Williams JB, Kroenke K, Hornyak R, McMurray J, Group PHQO-GS. Validity and utility of the PRIME-MD patient health questionnaire in assessment of 3000 obstetric-gynecologic patients: the PRIME-MD Patient Health Questionnaire Obstetrics-Gynecology Study. *American journal of obstetrics and gynecology*. 2000;183(3):759-69.
165. Jesse DE, Seaver W, Wallace DC. Maternal psychosocial risks predict preterm birth in a group of women from Appalachia. *Midwifery*. 2003;19(3):191-202.
166. Alder J, Fink N, Bitzer J, Hösli I, Holzgreve W. Depression and anxiety during pregnancy: a risk factor for obstetric, fetal and neonatal outcome? A critical review of the literature. *The Journal of Maternal-Fetal & Neonatal Medicine*. 2007;20(3):189-209.
167. Kelly RH, Russo J, Holt VL, Danielsen BH, Zatzick DF, Walker E, et al. Psychiatric and substance use disorders as risk factors for low birth weight and preterm delivery. *Obstetrics & Gynecology*. 2002;100(2):297-304.
168. Rodrigues T, Rocha L, Barros H. Physical abuse during pregnancy and preterm delivery. *American journal of obstetrics and gynecology*. 2008;198(2):171. e1-. e6.
169. McFarlane J, Parker B, Soeken K. Abuse during pregnancy: associations with maternal health and infant birth weight. *Nursing research*. 1996;45(1):37-42.
170. Obstetricians ACo, Gynecologists. Psychosocial risk factors: perinatal screening and intervention. ACOG Committee Opinion No. 343. *Obstet Gynecol*. 2006;108(2):469-77.
171. Vahia VN. Diagnostic and statistical manual of mental disorders 5: A quick glance. *Indian journal of psychiatry*. 2013;55(3):220.
172. Marcus SM, Heringhausen JE. Depression in childbearing women: when depression complicates pregnancy. *Primary Care: Clinics in Office Practice*. 2009;36(1):151-65.
173. Vigod SN, Wilson CA, Howard LM. Depression in pregnancy. *BMJ (Clinical research ed)*. 2016;352.
174. Goodman SH. Depression in mothers. *Annu Rev Clin Psychol*. 2007;3:107-35.
175. Dadi AF, Miller ER, Bisetegn TA, Mwanri L. Global burden of antenatal depression and its association with adverse birth outcomes: an umbrella review. *BMC Public Health*. 2020;20(1):1-16.
176. Halim N, Beard J, Mesic A, Patel A, Henderson D, Hibberd P. Intimate partner violence during pregnancy and perinatal mental disorders in low and lower middle income countries: A systematic review of literature, 1990–2017. *Clinical psychology review*. 2018;66:117-35.
177. Heron J, O'Connor TG, Evans J, Golding J, Glover V, Team AS. The course of anxiety and depression through pregnancy and the postpartum in a community sample. *Journal of affective disorders*. 2004;80(1):65-73.
178. Kingston D, Kehler H, Austin M-P, Mughal MK, Wajid A, Vermeyden L, et al. Trajectories of maternal depressive symptoms during pregnancy and the first 12

months postpartum and child externalizing and internalizing behavior at three years. *PloS one*. 2018;13(4):e0195365.

179. Ferrari AJ, Charlson FJ, Norman RE, Patten SB, Freedman G, Murray CJ, et al. Burden of depressive disorders by country, sex, age, and year: findings from the global burden of disease study 2010. *PLoS Med*. 2013;10(11):e1001547 DOI: <https://doi.org/10.1371/journal.pmed.1001547>.

180. Bauer A, Parsonage M, Knapp M, Iemmi V, Adelaja B, Hogg S. The costs of perinatal mental health problems. London: Centre for Mental Health and London School of Economics. 2014:44.

181. Shen H, Magnusson C, Rai D, Lundberg M, Le-Scherban F, Dalman C, et al. Associations of parental depression with child school performance at age 16 years in Sweden. *JAMA psychiatry*. 2016;73(3):239-46.

182. Biaggi A, Conroy S, Pawlby S, Pariante CM. Identifying the women at risk of antenatal anxiety and depression: a systematic review. *Journal of affective disorders*. 2016;191:62-77.

183. Howard LM, Oram S, Galley H, Trevillion K, Feder G. Domestic violence and perinatal mental disorders: a systematic review and meta-analysis. *PLoS medicine*. 2013;10(5):e1001452.

184. Lancaster CA, Gold KJ, Flynn HA, Yoo H, Marcus SM, Davis MM. Risk factors for depressive symptoms during pregnancy: a systematic review. *American journal of obstetrics and gynecology*. 2010;202(1):5-14.

185. Underwood L, Waldie K, D'Souza S, Peterson ER, Morton S. A review of longitudinal studies on antenatal and postnatal depression. *Archives of Women's Mental Health*. 2016;19(5):711-20.

186. Gelaye B, Rondon MB, Araya R, Williams MA. Epidemiology of maternal depression, risk factors, and child outcomes in low-income and middle-income countries. *The Lancet Psychiatry*. 2016;3(10):973-82.

187. Mitchell-Jones N, Gallos I, Farren J, Tobias A, Bottomley C, Bourne T. Psychological morbidity associated with hyperemesis gravidarum: a systematic review and meta-analysis. *BJOG: An International Journal of Obstetrics & Gynaecology*. 2017;124(1):20-30.

188. Roomruangwong C, Epperson CN. Perinatal depression in Asian women: prevalence, associated factors, and cultural aspects. *Asian Biomedicine*. 2011;5(2):179-93.

189. Bayrampour H, Salmon C, Vinturache A, Tough S. Effect of depressive and anxiety symptoms during pregnancy on risk of obstetric interventions. *Journal of Obstetrics and Gynaecology Research*. 2015;41(7):1040-8 DOI: <https://doi.org/10.1111/jog.12683>.

190. Grigoriadis S, VonderPorten EH, Mamisashvili L, Tomlinson G, Dennis C-L, Koren G, et al. The impact of maternal depression during pregnancy on perinatal outcomes: a systematic review and meta-analysis. *The Journal of clinical psychiatry*. 2013;74(4):8615.

191. Grote NK, Bridge JA, Gavin AR, Melville JL, Iyengar S, Katon WJ. A meta-analysis of depression during pregnancy and the risk of preterm birth, low birth weight, and intrauterine growth restriction. *Archives of general psychiatry*. 2010;67(10):1012-24.

192. Jarde A, Morais M, Kingston D, Giallo R, MacQueen GM, Giglia L, et al. Neonatal outcomes in women with untreated antenatal depression compared with women without depression: a systematic review and meta-analysis. *JAMA psychiatry*. 2016;73(8):826-37.



193. Accortt EE, Cheadle AC, Dunkel Schetter C. Prenatal depression and adverse birth outcomes: an updated systematic review. *Maternal and child health journal*. 2015;19(6):1306-37.
194. Araujo DMR, Vilarim MM, Sabroza AR, Nardi AE. Depression during pregnancy and low birth weight: a systematic literature review. *Cadernos de Saúde Pública*. 2010;26:219-27.
195. Ghimire U, Papabathini SS, Kawuki J, Obore N, Musa TH. Depression during pregnancy and the risk of low birth weight, preterm birth and intrauterine growth restriction-an updated meta-analysis. *Early Human Development*. 2021;152:105243.
196. Bennett HA, Einarson A, Taddio A, Koren G, Einarson TR. Prevalence of depression during pregnancy: systematic review. *Obstetrics & Gynecology*. 2004;103(4):698-709 DOI: <https://doi.org/10.1097/01.AOG.0000116689.75396.5f>.
197. Yu Y, Zhu X, Xu H, Hu Z, Zhou W, Zheng B, et al. Prevalence of depression symptoms and its influencing factors among pregnant women in late pregnancy in urban areas of Hengyang City, Hunan Province, China: a cross-sectional study. *BMJ open*. 2020;10(9):e038511.
198. Behrman RE, Butler AS. Preterm birth: causes, consequences, and prevention. 2007.
199. Beydoun H, Saftlas AF. Physical and mental health outcomes of prenatal maternal stress in human and animal studies: a review of recent evidence. *Paediatric and perinatal epidemiology*. 2008;22(5):438-66.
200. Dunkel Schetter C, Lobel M. . Pregnancy and Birth: a multilevel analysis of stress and birth weight. In: Revenson T, Baum A, Singer J, editors. *Handbook of Health psychology 2*. Lawrence Erlbaum; Mahwah, . NJ. 2011:427-53.
201. Borders AEB, Grobman WA, Amsden LB, Holl JL. Chronic stress and low birth weight neonates in a low-income population of women. *Obstetrics & Gynecology*. 2007;109(2 Part 1):331-8.
202. Giscombé CL, Lobel M. Explaining disproportionately high rates of adverse birth outcomes among African Americans: the impact of stress, racism, and related factors in pregnancy. *Psychological bulletin*. 2005;131(5):662.
203. Schetter CD. Stress processes in pregnancy and preterm birth. *Current Directions in Psychological Science*. 2009;18(4):205-9.
204. Roesch SC, Schetter CD, Woo G, Hobel CJ. Modeling the types and timing of stress in pregnancy. *Anxiety, Stress & Coping*. 2004;17(1):87-102.
205. Rini CK, Dunkel-Schetter C, Wadhwa PD, Sandman CA. Psychological adaptation and birth outcomes: the role of personal resources, stress, and sociocultural context in pregnancy. *Health Psychology*. 1999;18(4):333.
206. Pan A, Lucas M, Sun Q, van Dam RM, Franco OH, Manson JE, et al. Bidirectional association between depression and type 2 diabetes mellitus in women. *Archives of internal medicine*. 2010;170(21):1884-91.
207. Moulton CD, Pickup JC, Ismail K. The link between depression and diabetes: the search for shared mechanisms. *The lancet Diabetes & endocrinology*. 2015;3(6):461-71.
208. Rustad JK, Musselman DL, Nemeroff CB. The relationship of depression and diabetes: pathophysiological and treatment implications. *Psychoneuroendocrinology*. 2011;36(9):1276-86.
209. Lustman PJ, Clouse RE. Depression in diabetic patients: the relationship between mood and glycemic control. *Journal of Diabetes and its Complications*. 2005;19(2):113-22.

210. Robinson DJ, Coons M, Haensel H, Vallis M, Yale J-F. Diabetes and mental health. *Canadian journal of diabetes*. 2018;42:S130-S41.
211. Morrison C, McCook JG, Bailey BA. First trimester depression scores predict development of gestational diabetes mellitus in pregnant rural Appalachian women. *J Psychosom Obstet Gynaecol*. 2016;37(1):21-5 DOI: 10.3109/0167482X.2015.1106473.
212. Arafa A, Dong J-Y. Depression and risk of gestational diabetes: A meta-analysis of cohort studies. *Diabetes research and clinical practice*. 2019;156:107826.
213. Hinkle SN, Buck Louis GM, Rawal S, Zhu Y, Albert PS, Zhang C. A longitudinal study of depression and gestational diabetes in pregnancy and the postpartum period. *Diabetologia*. 2016;59(12):2594-602 DOI: <https://doi.org/10.1007/s00125-016-4086-1>.
214. Luppino FS, de Wit LM, Bouvy PF, Stijnen T, Cuijpers P, Penninx BW, et al. Overweight, obesity, and depression: a systematic review and meta-analysis of longitudinal studies. *Arch Gen Psychiatry*. 2010;67(3):220-9 DOI: 10.1001/archgenpsychiatry.2010.2.
215. Lasserre AM, Glaus J, Vandeleur CL, Marques-Vidal P, Vaucher J, Bastardot F, et al. Depression with atypical features and increase in obesity, body mass index, waist circumference, and fat mass: a prospective, population-based study. *JAMA Psychiatry*. 2014;71(8):880-8 DOI: 10.1001/jamapsychiatry.2014.411.
216. American College of O, Gynecologists. Committee opinion no. 630: Screening for perinatal depression. *Obstet Gynecol*. 2015;125(5):1268-71.
217. Daniells S, Grenyer BF, Davis WS, Coleman KJ, Burgess JA, Moses RG. Gestational diabetes mellitus: is a diagnosis associated with an increase in maternal anxiety and stress in the short and intermediate term? *Diabetes Care*. 2003;26(2):385-9 DOI: <https://doi.org/10.2337/diacare.26.2.385>.
218. Wilson CA, Newham J, Rankin J, Ismail K, Simonoff E, Reynolds RM, et al. Is there an increased risk of perinatal mental disorder in women with gestational diabetes? A systematic review and meta-analysis. *Diabet Med*. 2020;37(4):602-22 DOI: 10.1111/dme.14170.
219. Azami M, Badfar G, Soleymani A, Rahmati S. The association between gestational diabetes and postpartum depression: A systematic review and meta-analysis. *diabetes research and clinical practice*. 2019;149:147-55.
220. Martini J, Knappe S, Beesdo-Baum K, Lieb R, Wittchen H-U. Anxiety disorders before birth and self-perceived distress during pregnancy: associations with maternal depression and obstetric, neonatal and early childhood outcomes. *Early human development*. 2010;86(5):305-10 DOI: <https://doi.org/10.1016/j.earlhumdev.2010.04.004>.
221. Devsam BU, Bogossian FE, Peacock AS. An interpretive review of women's experiences of gestational diabetes mellitus: Proposing a framework to enhance midwifery assessment. *Women and Birth*. 2013;26(2):e69-e76 DOI: <https://doi.org/10.1016/j.wombi.2012.12.003>.
222. Evans MK, O'Brien B. Gestational diabetes: the meaning of an at-risk pregnancy. *Qual Health Res*. 2005;15(1):66-81 DOI: <https://doi.org/10.1177/1049732304270825>.
223. Hjelm K, Bard K, Berntorp K, Apelqvist J. Beliefs about health and illness postpartum in women born in Sweden and the Middle East. *Midwifery*. 2009;25(5):564-75.

224. Lindmark A, Smide B, Leksell J. Perception of healthy lifestyle information in women with gestational diabetes: A pilot study before and after delivery. *European Diabetes Nursing*. 2010;7(1):16-20 DOI: <https://doi.org/10.1002/edn.150>.
225. Neufeld HT. Food perceptions and concerns of aboriginal women coping with gestational diabetes in Winnipeg, Manitoba. *Journal of nutrition education and behavior*. 2011;43(6):482-91.
226. Persson M, Winkvist A, Mogren I. 'From stunned to gradual balance'—women's experiences of living with gestational diabetes mellitus. *Scandinavian journal of caring sciences*. 2010;24(3):454-62.
227. Bandyopadhyay M, Small R, Davey MA, Oats JJ, Forster DA, Aylward A. Lived experience of gestational diabetes mellitus among immigrant South Asian women in Australia. *Aust N Z J Obstet Gynaecol*. 2011;51(4):360-4 DOI: <https://doi.org/10.1111/j.1479-828X.2011.01322.x>.
228. Morrison MK, Lowe JM, Collins CE. Australian women's experiences of living with gestational diabetes. *Women and birth : journal of the Australian College of Midwives*. 2014;27(1):52-7 DOI: <https://doi.org/10.1016/j.wombi.2013.10.001>.
229. Carolan M. Women's experiences of gestational diabetes self-management: a qualitative study. *Midwifery*. 2013;29(6):637-45 DOI: <https://doi.org/10.1016/j.midw.2012.05.013>.
230. Parsons J, Ismail K, Amiel S, Forbes A. Perceptions among women with gestational diabetes. *Qualitative health research*. 2014;24(4):575-85.
231. Lawson EJ, Rajaram S. A transformed pregnancy: the psychosocial consequences of gestational diabetes. *Sociology of Health & Illness*. 1994;16(4):536-62 DOI: <https://doi.org/10.1111/1467-9566.ep11347644>.
232. Hjelm K, Bard K, Nyberg P, Apelqvist J. Management of gestational diabetes from the patient's perspective—a comparison of Swedish and Middle-Eastern born women. *Journal of Clinical Nursing*. 2007;16(1):168-78.
233. Collier SA, Mulholland C, Williams J, Mersereau P, Turay K, Prue C. A qualitative study of perceived barriers to management of diabetes among women with a history of diabetes during pregnancy. *Journal of Women's Health*. 2011;20(9):1333-9 DOI: <https://doi.org/10.1089/jwh.2010.2676>.
234. McIntyre HD, Catalano P, Zhang C, Desoye G, Mathiesen ER, Damm P. Gestational diabetes mellitus. *Nature reviews Disease primers*. 2019;5(1):1-19.
235. Group DS. Training in flexible, intensive insulin management to enable dietary freedom in people with type 1 diabetes: dose adjustment for normal eating (DAFNE) randomised controlled trial. *BMJ (Clinical research ed)*. 2002;325(7367):746.
236. Skinner TC, Carey ME, Cradock S, Daly H, Davies MJ, Doherty Y, et al. Diabetes education and self-management for ongoing and newly diagnosed (DESMOND): process modelling of pilot study. *Patient education and counseling*. 2006;64(1-3):369-77.
237. Deakin T, Cade J, Williams R, Greenwood D. Structured patient education: the Diabetes X-PERT Programme makes a difference. *Diabetic medicine*. 2006;23(9):944-54.
238. Carolan M, Steele C, Margetts H. Knowledge of gestational diabetes among a multi-ethnic cohort in Australia. *Midwifery*. 2010;26(6):579-88.
239. Minschart C, Amuli K, Delameillieure A, Calewaert P, Mathieu C, Benhalima K. Multidisciplinary Group Education for Gestational Diabetes Mellitus: A Prospective Observational Cohort Study. 2020;9(2):509.

240. Blumer I, Hadar E, Hadden DR, Jovanovic L, Mestman JH, Murad MH, et al. Diabetes and pregnancy: an endocrine society clinical practice guideline. *J Clin Endocrinol Metab.* 2013;98(11):4227-49 DOI: 10.1210/jc.2013-2465.
241. Jovanovic L. American Diabetes Association's fourth international workshop-conference on gestational diabetes mellitus: summary and discussion: therapeutic interventions. *Diabetes care.* 1998;21:B131.
242. Association. AD. 13. Management of Diabetes in Pregnancy: Standards of Medical Care in Diabetes-2018. *Diabetes Care.* 2018;41.
243. Metzger BE, Coustan DR. Summary and recommendations of the Fourth International Workshop-Conference on Gestational Diabetes Mellitus. The Organizing Committee. *Diabetes Care.* 1998;21 Suppl 2:B161-7.
244. Force IDFCGT. Global guideline on pregnancy and diabetes. Brussels: International Diabetes Federation. 2009.
245. Feig DS, Berger H, Donovan L, Godbout A, Kader T, Keely E. Diabetes Canada 2018 clinical practice guidelines for the prevention and management of diabetes in Canada: diabetes and pregnancy. *Can J Diabetes.* 2018;42(18):S255-S82.
246. Hernandez TL, Mande A, Barbour LA. Nutrition therapy within and beyond gestational diabetes. *Diabetes Res Clin Pract.* 2018;145:39-50 DOI: 10.1016/j.diabres.2018.04.004.
247. Clapp III JF. Maternal carbohydrate intake and pregnancy outcome. *Proceedings of the Nutrition Society.* 2002;61(1):45-50.
248. Moses RG, Luebcke M, Davis WS, Coleman KJ, Tapsell LC, Petocz P, et al. Effect of a low-glycemic-index diet during pregnancy on obstetric outcomes. *The American Journal of Clinical Nutrition.* 2006;84(4):807-12.
249. Reader D, Splett P, Gunderson EP, Care D, Group EDP. Impact of gestational diabetes mellitus nutrition practice guidelines implemented by registered dietitians on pregnancy outcomes. *Journal of the American Dietetic Association.* 2006;106(9):1426-33.
250. Evert AB, Hei KV. Gestational diabetes education and diabetes prevention strategies. *Diabetes Spectrum.* 2006;19(3):135-9.
251. Mirfeizi M, Mehdizadeh Tourzani Z, Asghari Jafarabadi M, Moghimi Hanjani S, Hasanzad M. Health education in gestational diabetes mellitus and quality of life. *Journal of Midwifery and Reproductive Health.* 2017;5(4):1066-74.
252. BAA AMR, BASc AGR. Nutrition education for women with newly diagnosed gestational diabetes mellitus: small-group vs. individual counselling. *Canadian Journal of diabetes.* 2004;28(2):00-.
253. Mendelson SG, McNeese-Smith D, Koniak-Griffin D, Nyamathi A, Lu MC. A community-based parish nurse intervention program for Mexican American women with gestational diabetes. *Journal of Obstetric, Gynecologic & Neonatal Nursing.* 2008;37(4):415-25.
254. Organization WH. Health Promotion Glossary. Division of Health Promotion, Education and Communications. Health Education and Health Promotion Unit, World Health Organization WHO/HPR/HEP/981 Distr: Limited. 1998 DOI: [https://apps.who.int/adolescent/second-decade/section/section\\_9/level9\\_15.php](https://apps.who.int/adolescent/second-decade/section/section_9/level9_15.php).
255. Tones K, Tilford S. Health Education: Effectiveness, Efficiency and Equity. 2nd ed: Chapman & Hall; 1994.
256. Hubley J, Copeman J, Woodall J. Practical health promotion. 2nd ed.. ed. Copeman J, Woodall J, editors. Cambridge: Cambridge : Polity; 2013.

257. Organization WH. Ottawa Charter for Health Promotion, An International Conference on Health Promotion. WHO Regional Office for Europe, Copenhagen. 1986 Nov 17-21.
258. Midha A, Sullivan M. The need to redefine the practice of health promotion in the United Kingdom. *Health Policy*. 1998;44(1):19-30 DOI: 10.1016/s0168-8510(98)00004-9.
259. Tilford S, Green J, Tones K. Values, health promotion and public health. 2003.
260. Bandura A. Self-efficacy: toward a unifying theory of behavioral change. *Psychological Review*. 1977;64(2):191-215 DOI: <https://psycnet.apa.org/doi/10.1037/0033-295X.84.2.191>.
261. NICE. Supporting investment in public health: review of methods for assessing cost-effectiveness, cost impact and return on investment. Proof of concept report: National Institute for Health and Care Excellence. 2011 DOI: <https://www.nice.org.uk/media/default/About/what-we-do/NICE-guidance/NICE-guidelines/Public-health-guidelines/Additional-publications/Cost-impact-proof-of-concept.pdf>.
262. Gillies CL, Abrams KR, Lambert PC, Cooper NJ, Sutton AJ, Hsu RT, et al. Pharmacological and lifestyle interventions to prevent or delay type 2 diabetes in people with impaired glucose tolerance: systematic review and meta-analysis. *BMJ (Clinical research ed)*. 2007;334(7588):299.
263. Tuomilehto J, Lindström J, Eriksson JG, Valle TT, Hämäläinen H, Ilanne-Parikka P, et al. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *New England Journal of Medicine*. 2001;344(18):1343-50.
264. Janz NK, Becker MH. The health belief model: A decade later. *Health education quarterly*. 1984;11(1):1-47.
265. Nutbeam D, Harris E, Wise W. *Theory in a nutshell: a practical guide to health promotion theories*: McGraw-Hill; 2010.
266. Chen M-F, Wang R-H, Schneider JK, Tsai C-T, Jiang DD-S, Hung M-N, et al. Using the health belief model to understand caregiver factors influencing childhood influenza vaccinations. *Journal of Community Health Nursing*. 2011;28(1):29-40.
267. Hubley J. *Communicating health : an action guide to health education and health promotion*. 2nd ed.. ed. Oxford: Oxford : Macmillan; 2004.
268. Barlow J, Sturt J, Hearnshaw H. Self-management interventions for people with chronic conditions in primary care: examples from arthritis, asthma and diabetes. *Health Education Journal*. 2002;61(4):365-78 DOI: <https://doi.org/10.1177%2F001789690206100408>.
269. Griffiths C, Motlib J, Azad A, Ramsay J, Eldridge S, Feder G, et al. Randomised controlled trial of a lay-led self-management programme for Bangladeshi patients with chronic disease. *British Journal of General Practice*. 2005;55(520):831-7.
270. MC. C-O. Educational and intervention programmes for gestational diabetes mellitus (GDM) management: An integrative review. *Collegian* 2016 1;23(1):103-14.
271. Kim C. Maternal outcomes and follow-up after gestational diabetes mellitus. *Diabet Med*. 2014;31(3):292-301 DOI: 10.1111/dme.12382.
272. Bandura A. *Model of causality in social learning theory*. *Cognition and psychotherapy*: Springer; 1985. p. 81-99.
273. Faro B, Ingersoll G, Fiore H, Ippolito KS. Improving students' diabetes management through school-based diabetes care. *Journal of Pediatric Health Care*. 2005;19(5):301-8.

274. Smith CT, Chen AM, Plake KS, Nash CL. Evaluation of the impact of a diabetes education curriculum for school personnel on disease knowledge and confidence in caring for students. *Journal of School Health*. 2012;82(10):449-56.
275. Steinsbekk A, Rygg L, Lisulo M, Rise MB, Fretheim A. Group based diabetes self-management education compared to routine treatment for people with type 2 diabetes mellitus. A systematic review with meta-analysis. *BMC Health Services Research*. 2012;12(1):213 DOI: 10.1186/1472-6963-12-213.
276. McKibbin CL, Patterson TL, Norman G, Patrick K, Jin H, Roesch S, et al. A lifestyle intervention for older schizophrenia patients with diabetes mellitus: a randomized controlled trial. *Schizophrenia research*. 2006;86(1-3):36-44.
277. Adolfsson ET, Walker-Engström M-L, Smide B, Wikblad K. Patient education in type 2 diabetes—a randomized controlled 1-year follow-up study. *Diabetes research and clinical practice*. 2007;76(3):341-50.
278. Mohebbi B, Tol A, Sadeghi R, Mohtarami SF, Shamshiri A. Self-management Intervention Program Based on the Health Belief Model (HBM) among Women with Gestational Diabetes Mellitus: A Quazi-Experimental Study. *Arch Iran Med*. 2019;22(4):168-73.
279. Khiyali Z, Manoochri M, Babaei Heydarabadi A, Mobasheri F. Educational intervention on preventive behaviors on gestational diabetes in pregnant women: application of health belief model. *International Journal of Pediatrics*. 2017;5(5):4821-31.
280. Karimy S, Mansouri A, Shahdadi H, Pakizeh-Del P. The effect of health belief model-based education on adherence to the dietary regimen in pregnant women with gestational diabetes. *Journal of Diabetes Nursing*. 2016;4(4):1-9.
281. Hoppichler F, Lechleitner M. Counseling programs and the outcome of gestational diabetes in Austrian and Mediterranean Turkish women. *Patient Educ Couns*. 2001;45(4):271-4 DOI: 10.1016/s0738-3991(01)00129-x.
282. Gray-Donald K, Robinson E, Collier A, David K, Renaud L, Rodrigues S. Intervening to reduce weight gain in pregnancy and gestational diabetes mellitus in Cree communities: an evaluation. *CMAJ*. 2000;163(10):1247-51.
283. Ruggiero L, Spirito A, Bond A, Coustan D, McGarvey S. Impact of social support and stress on compliance in women with gestational diabetes. *Diabetes Care*. 1990;13(4):441-3 DOI: 10.2337/diacare.13.4.441.
284. Witkop CT, Neale D, Wilson LM, Bass EB, Nicholson WK. Active compared with expectant delivery management in women with gestational diabetes: a systematic review. *Obstet Gynecol*. 2009;113(1):206-17 DOI: 10.1097/AOG.0b013e31818db36f.
285. Cane J, O'Connor D, Michie S. Validation of the theoretical domains framework for use in behaviour change and implementation research. *Implementation science*. 2012;7:1-17.
286. Eccles MP, Armstrong D, Baker R, Cleary K, Davies H, Davies S, et al. An implementation research agenda. *BioMed Central*; 2009. p. 1-7.
287. Potvin L, Jones CM. Twenty-five years after the Ottawa Charter: the critical role of health promotion for public health. *Canadian Journal of Public Health*. 2011;102:244-8.
288. Grol R, Grimshaw J. From best evidence to best practice: effective implementation of change in patients' care. *The lancet*. 2003;362(9391):1225-30.
289. Albarracín D, Gillette JC, Earl AN, Glasman LR, Durantini MR, Ho M-H. A test of major assumptions about behavior change: a comprehensive look at the effects

- of passive and active HIV-prevention interventions since the beginning of the epidemic. *Psychological bulletin*. 2005;131(6):856.
290. Noar SM, Zimmerman RS. Health Behavior Theory and cumulative knowledge regarding health behaviors: are we moving in the right direction? *Health education research*. 2005;20(3):275-90.
291. Nigg CR, Allegrante JP, Ory M. Theory-comparison and multiple-behavior research: common themes advancing health behavior research. *Health Education Research*. 2002;17(5):670-9.
292. Weinstein ND. Testing four competing theories of health-protective behavior. *Health psychology*. 1993;12(4):324.
293. Michie S, Johnston M, Abraham C, Lawton R, Parker D, Walker A. Making psychological theory useful for implementing evidence based practice: a consensus approach. *BMJ quality & safety*. 2005;14(1):26-33.
294. Michie S, van Stralen MM, West R. The behaviour change wheel: a new method for characterising and designing behaviour change interventions. *Implement Sci*. 2011;6:42 DOI: 10.1186/1748-5908-6-42.
295. Michie S, Richardson M, Johnston M, Abraham C, Francis J, Hardeman W, et al. The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: building an international consensus for the reporting of behavior change interventions. *Annals of behavioral medicine*. 2013;46(1):81-95.
296. West R, Brown J. *Theory of addiction*. 2013.
297. West R, Michie S. A brief introduction to the COM-B Model of behaviour and the PRIME Theory of motivation [v1]. *Qeios*. 2020.
298. Rockliffe L, Peters S, Smith DM, Heal C, Heazell AEP. Investigating the utility of the COM-B and TM model to explain changes in eating behaviour during pregnancy: A longitudinal cohort study. *British Journal of Health Psychology*. 2022;27(3):1077-99.
299. Christiansen PK, Skjoth MM, Lorenzen LE, Draborg E, Vinter CA, Kjaer T, et al. Barriers to a healthy postpartum lifestyle and the possibilities of an information technology-based intervention: A qualitative study. *Midwifery*. 2021;98:102994 DOI: 10.1016/j.midw.2021.102994.
300. Lake AJ, Neven ACH, Williams A, O'Reilly SL, Hendrieckx C, Morrison M, et al. Barriers to and enablers of type 2 diabetes screening among women with prior gestational diabetes: A systematic review update and qualitative synthesis applying the Theoretical Domains Framework. *Diabetic Medicine*. 2022;39(4):e14772.
301. Neven ACH, Lake AJ, Williams A, O'Reilly SL, Hendrieckx C, Morrison M, et al. Barriers to and enablers of postpartum health behaviours among women from diverse cultural backgrounds with prior gestational diabetes: A systematic review and qualitative synthesis applying the theoretical domains framework. *Diabetic Medicine*. 2022;39(11):e14945.
302. Smith R, Michalopoulou M, Reid H, Riches SP, Wango YN, Kenworthy Y, et al. Applying the behaviour change wheel to develop a smartphone application 'stay-active' to increase physical activity in women with gestational diabetes. *BMC Pregnancy and Childbirth*. 2022;22(1):1-16.
303. Boyd J, McMillan B, Easton K, Delaney B, Mitchell C. Utility of the COM-B model in identifying facilitators and barriers to maintaining a healthy postnatal lifestyle following a diagnosis of gestational diabetes: a qualitative study. *BMJ Open*. 2020;10(8):e037318 DOI: 10.1136/bmjopen-2020-037318.

304. Rosal MC, Olendzki B, Reed GW, Ockene I, Gumieniak O, Scavron J. Diabetes self-management among low-income Spanish-speaking patients: a pilot study. *Annals of Behavioral Medicine*. 2005;29(3):225-35.
305. Lujan J, Ostwald SK, Ortiz M. Promotora diabetes intervention for Mexican Americans. *The Diabetes Educator*. 2007;33(4):660-70.
306. Toobert DJ, Glasgow RE, Strycker LA, Barrera M, Ritzwoller DP, Weidner G. Long-term effects of the Mediterranean lifestyle program: a randomized clinical trial for postmenopausal women with type 2 diabetes. *International Journal of Behavioral Nutrition and Physical Activity*. 2007;4(1):1-12.
307. Cooper H, Booth K, Gill G. Patients' perspectives on diabetes health care education. *Health education research*. 2003;18(2):191-206.
308. Gestational Diabetes [Internet]. [cited 06/04/2020]. Available from: <https://www.acog.org/topics/gestational-diabetes>.
309. Nankervis A, McIntyre H, Moses R, Ross G, Callaway L, Porter C, et al. ADIPS consensus guidelines for the testing and diagnosis of gestational diabetes mellitus in Australia. Modified June. 2014 DOI: <http://www.adips.org/downloads/ADIPSConsensusGuidelinesGDM-03.05.13VersionACCEPTEDFINAL.pdf>.
310. Poolsup N, Suksomboon N, Amin M. Effect of treatment of gestational diabetes mellitus: a systematic review and meta-analysis. *PloS one*. 2014;9(3):e92485.
311. Barakat R, Pelaez M, Lopez C, Lucia A, Ruiz JR. Exercise during pregnancy and gestational diabetes-related adverse effects: a randomised controlled trial. *British Journal of Sports Medicine*. 2013;47(10):630 DOI: <https://doi.org/10.1136/bjsports-2012-091788>.
312. Nobles C, Marcus BH, Stanek III EJ, Braun B, Whitcomb BW, Solomon CG, et al. Effect of an exercise intervention on gestational diabetes mellitus: a randomized controlled trial. *Obstetrics and gynecology*. 2015;125(5):1195.
313. Smith-Morris CM. Diagnostic controversy: gestational diabetes and the meaning of risk for Pima Indian women. *Medical anthropology*. 2005;24(2):145-77.
314. Husserl E, Carr D, University N. *The Crisis of European Sciences and Transcendental Phenomenology: An Introduction to Phenomenological Philosophy*. Evanston: Northwestern University Press; 1970.
315. Van Manen M. *RESEARCHING LIVED EXPERIENCE, HUMAN SCIENCE FOR AN AC: STHTE UNI OF NY PRESS*; 1990.
316. van Manen M. *Researching Lived Experience: Human science for an Action Sensitive Pedagogy*. 2nd ed. New York: Roulledge; 1997.
317. van Manen M. *Phenomenology of Practice: meaning-giving methods in phenomenological research and writing*. New York: Routledge; 2014.
318. Holloway I W, S. *Qualitative Research in Nursing and Healthcare*. 2010;3rd Edition:10.
319. Stolberg HO, Norman G, Trop I. Randomized controlled trials. *AJR Am J Roentgenol*. 2004;183(6):1539-44 DOI: <https://doi.org/10.2214/ajr.183.6.01831539>.
320. Atlas ID. Brussels, Belgium: international diabetes federation; 2013. International Diabetes Federation (IDF). 2017;147.
321. Dornhorst A, Paterson C, Nicholls J, Wadsworth J, Chiu D, Elkeles R, et al. High prevalence of gestational diabetes in women from ethnic minority groups. *Diabetic Medicine*. 1992;9(9):820-5 DOI: <https://doi.org/10.1111/j.1464-5491.1992.tb01900.x>.
322. Retnakaran R, Hanley AJ, Connelly PW, Sermer M, Zinman B. Ethnicity modifies the effect of obesity on insulin resistance in pregnancy: a comparison of



- Asian, South Asian, and Caucasian women. *The Journal of Clinical Endocrinology & Metabolism*. 2006;91(1):93-7 DOI: <https://doi.org/10.1210/jc.2005-1253>.
323. Cundy T. Proposed new diagnostic criteria for gestational diabetes—a pause for thought? *Diabetic Medicine*. 2012;29(2):176-80 DOI: <https://doi.org/10.1111/j.1464-5491.2011.03407.x>.
324. Strong M, Oakley JE, Brennan A. Estimating multiparameter partial expected value of perfect information from a probabilistic sensitivity analysis sample: a nonparametric regression approach. *Medical Decision Making*. 2014;34(3):311-26 DOI: <https://doi.org/10.1177%2F0272989X13505910>.
325. Liu X, Zou L, Chen Y, Ruan Y, Liu Y, Zhang W. Effects of maternal age on pregnancy: a retrospective cohort study. *Zhonghua yi xue za zhi*. 2014;94(25):1984-8.
326. Schummers L, Hutcheon JA, Hacker MR, VanderWeele TJ, Williams PL, McElrath TA, et al. Absolute risks of obstetric outcomes risks by maternal age at first birth: a population-based cohort. *Epidemiology (Cambridge, Mass)*. 2018;29(3):379.
327. Hernandez TL, Anderson MA, Chartier-Logan C, Friedman JE, Barbour LA. Strategies in the nutritional management of gestational diabetes. *Clinical obstetrics and gynecology*. 2013;56(4):803.
328. Louie JCY, Markovic TP, Perera N, Foote D, Petocz P, Ross GP, et al. A randomized controlled trial investigating the effects of a low-glycemic index diet on pregnancy outcomes in gestational diabetes mellitus. *Diabetes care*. 2011;34(11):2341-6.
329. Moses RG, Barker M, Winter M, Petocz P, Brand-Miller JC. Can a low-glycemic index diet reduce the need for insulin in gestational diabetes mellitus? A randomized trial. *Diabetes care*. 2009;32(6):996-1000.
330. Alayoub H, Curran S, Coffey M, Hatunic M, Higgins M. Assessment of the effectiveness of group education on knowledge for women with newly diagnosed gestational diabetes. *Irish Journal of Medical Science (1971-)*. 2018;187(1):65-8.
331. Sayakhot P, Carolan-Olah M, Steele C. Use of a web-based educational intervention to improve knowledge of healthy diet and lifestyle in women with gestational diabetes mellitus compared to standard clinic-based education. *BMC pregnancy and childbirth*. 2016;16(1):1-12 DOI: <https://doi.org/10.1186/s12884-016-0996-7>.
332. Harris M. History and significance of the emic/etic distinction. *Annual review of anthropology*. 1976;5(1):329-50.
333. Streubert Speziale HJ, Carpenter DR. *Qualitative Research in Nursing: Advancing the Humanistic Imperative*. 4th ed. Philadelphia: Lippincott Williams & Wilkins; 2007.
334. Boulton M, Parker M. Informed consent in a changing environment. *Social science and medicine (1982)*. 2007;65(11):2187-98.
335. Mays N, Pope C. Qualitative research in health care. Assessing quality in qualitative research. *BMJ (Clinical research ed)*. 2000;320(7226):50-2 DOI: <https://doi.org/10.1136/bmj.320.7226.50>.
336. Feldman M. *Strategies for Interpreting Qualitative Data*. Thousand Oaks, California: SAGE Publications; 1995. Available from: <https://methods.sagepub.com/book/strategies-for-interpreting-qualitative-data>.
337. Marshall C, Rossman, G.B. *Designing Qualitative Research*. 1989.
338. Malinowski B. *Argonauts of the Western Pacific: An Account of Native Enterprise and Adventure in the Archipelagoes of Melanesian New Guinea [1922/1994]*. London: Routledge & Sons; 1922.
339. Boas F. *Anthropology and modern life*. New York: Norton; 1928.

340. Mead M. Sex and temperament in three primitive societies. New York: Morrow; 1935.
341. Spradley JP. Participant Observation. New York: Holt, Rinehart and Winston; 1980.
342. Morse JM, Field PA. Qualitative Research Methods for Health Professionals. Thousand Oaks, CA.: SAGE Publications; 1995.
343. Muecke MA. On the evaluation of ethnographies. In Morse, JM (Ed), Critical issues in qualitative research methods. 1994:187-209.
344. Manias E, Street A. Rethinking ethnography: reconstructing nursing relationships. J Adv Nurs. 2001;33(2):234-42 DOI: 10.1046/j.1365-2648.2001.01660.x.
345. Glaser B. Theoretical Sensitivity: Advances in the methodology of grounded theory. 1978.
346. Alvesson M, Skoldberg K. Reflexive Methodology: New Vistas for Qualitative Research. London: SAGE Publications; 2000.
347. Cutcliffe JR. Methodological issues in grounded theory. J Adv Nurs. 2000;31(6):1476-84 DOI: 10.1046/j.1365-2648.2000.01430.x.
348. Glaser BG, Strauss AL. The Discovery of Grounded Theory: Strategies for Qualitative Research. New York: Aldine de Gruyter; 1967.
349. Hutchinson SA. Qualitative approaches in nursing research. Grounded theory: the method. In Nursing Research: A qualitative Perspective (eds PL Munhall & C Oiler Boyd). 1993(19-2535):180-212.
350. Strauss A, Strauss ALS, Corbin JM, Corbin J. Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory. 2nd Edition ed. Thousand Oaks, CA.: SAGE Publications; 1998.
351. Krippendorff K. Content analysis: An introduction to its methodology: Sage publications; 1980.
352. Richardson JT. Handbook of qualitative research methods for psychology and the social sciences: BPS books; 1996.
353. Ge L, Wikby K, Rask M. 'Is gestational diabetes a severe illness?' exploring beliefs and self-care behaviour among women with gestational diabetes living in a rural area of the south east of China. Australian journal of rural health. 2016;24(6):378-84.
354. Kaptein S, Evans M, McTavish S, Banerjee AT, Feig DS, Lowe J, et al. The subjective impact of a diagnosis of gestational diabetes among ethnically diverse pregnant women: a qualitative study. Canadian Journal of Diabetes. 2015;39(2):117-22.
355. Salomon I, Soares S. Understanding the impact of gestational diabetes diagnosis. Revista Mineira de Enfermagem. 2004;8(3):349-57.
356. Tierney M, O'Dea A, Danyliv A, Noctor E, McGuire B, Glynn L, et al. Factors influencing lifestyle behaviours during and after a gestational diabetes mellitus pregnancy. Health Psychology and Behavioral Medicine. 2015;3(1):204-16.
357. Finlay L. Debating Phenomenological Research Methods. Phenomenology & Practice. 2009;3:6-25 DOI: 10.29173/pandpr19818.
358. Langdrige D. Phenomenological Psychology: Theory, Research and Method. 2007.
359. Grbich C. Qualitative Data Analysis: An Introduction. 2007.
360. Berrios GE. What is phenomenology? A review. J R Soc Med. 1989;82(7):425-8.

361. Cohen MZ, Kahn DL, Steeves RH. *Hermeneutic Phenomenological Research: A Practical Guide for Nurse Researchers*. Thousand Oaks, CA.: SAGE Publications; 2000.
362. Barnacle R. *Phenomenology and Wonder*. In: Barnacle, R (ed) *Phenomenology*. 2001.
363. E. H. Ideas Pertaining to a Pure Phenomenology and to a Phenomological Philosophy; book 1: general introduction to a pure phenomenology. 1982.
364. Merleau-Ponty M. *Phenomenology of Perception*. London: Routledge & Kegan Paul; 1962.
365. Spiegelberg H. *The phenomenological movement: A historical introduction* (3rd ed.). 1982 DOI: <https://doi.org/10.1007/978-94-009-7491-3>.
366. Creswell JW. *Research Design: Qualitative and Quantitative Approaches*. Thousand Oaks: SAGE Publications; 1994.
367. Karin D, Nyström M, Dahlberg H. *Reflective lifeworld research*. 2nd ed: Studentlitteratur, Lund; 2007.
368. Spinelli E. *The Interpreted World: An Introduction to Phenomenological Psychology*. 2nd Edition ed: SAGE Publications; 2005.
369. Valle RS, King M, Halling S. An introduction to existential-phenomenological thought in psychology. *Existential-phenomenological perspectives in psychology*: Springer; 1989. p. 3-16.
370. Polkinghorne D. *Phenomenological research methods*. In RS Valle & S. Halling (Eds.), *Existential-phenomenological perspectives in psychology*. New York: Plenum Press; 1989.
371. Giorgi A. The theory, practice and evaluation of the phenomenological method as a qualitative research procedure. *Journal of Phenomenological Psychology*. 1997;28(2):235-60 DOI: <https://doi.org/10.1163/156916297X00103>.
372. Smith J, Flowers P, Larkin M. *Interpretative Phenomenological Analysis: Theory, Method and Research*: SAGE Publications; 2009.
373. Merleau-Ponty M. *The primacy of perception*. Evanston: Northwestern University Press. 1964a.
374. van Manen M. *Researching Lived Experience: Human Science for an Action Sensitive Pedagogy*. 2nd Edition ed. Canada: The Althouse Press.; 2016.
375. Edie JM. *Studies in phenomenology and existential philosophy*. Edmund Husserl's phenomenology: A critical commentary. 1987.
376. Jones WT. *The Twentieth Century to Wittgenstein and Sartre*. 1975;2nd Edition.
377. Klein P, & Westcott, M. R. The changing character of phenomenological psychology. *Canadian Psychology/Psychologie canadienne*. 1994;35(2):133-58 DOI: <https://doi.org/10.1037/0708-5591.35.2.133>.
378. Osborne JW. Some similarities and differences among phenomenological and other methods of psychological qualitative research. *Canadian Psychology/Psychologie canadienne*. 1994;35(2):167-89 DOI: <https://doi.org/10.1037/0708-5591.35.2.167>.
379. Polkinghorne D. *Methodology for the human sciences: Systems of Inquiry*. 1983.
380. Ahern KJ. Ten tips for reflexive bracketing. *Qualitative health research*. 1999;9(3):407-11.
381. Taminiaux J. *Heidegger and the Project of Fundamental Ontology*: State University of New York Press; 1991.

382. Evans MK, O'Brien B. Gestational diabetes: the meaning of an at-risk pregnancy. *Qualitative health research*. 2005;15(1):66-81.
383. Carolan-Olah M, Duarte-Gardea M, Lechuga J, Salinas-Lopez S. The experience of gestational diabetes mellitus (GDM) among Hispanic women in a US border region. *Sexual & Reproductive Healthcare*. 2017;12:16-23.
384. Dilthey W, Makkreel RA, Rodi F. *Poetry and Experience*. Princeton, NJ.: Princeton University Press; 1985.
385. Fiorenza F. *Philosophical Hermeneutics*. Berkeley, University of California Press; 1976.
386. Heidegger M, Hofstadter A. *Poetry, Language, Thought*. New York: Harper & Row; 1971.
387. Van Manen M. Modalities of body experience in illness and health. *Qualitative Health Research*. 1998;8(1):7-24.
388. Gadamer H-G. *Philosophical hermeneutics* (DE Linge, Trans.). Berkeley, CA. 1976.
389. Heidegger M. *Being and Time* New York Harper & Row. Publishers; 1962.
390. Schutz A, Luckmann T. *The structures of the life-world: northwestern university press*; 1973.
391. Bollnow OF. Lived-space. *Philosophy Today*. 1961;5(1):31-9 DOI: <https://doi.org/10.5840/philtoday1961513>.
392. Tembo AC, Parker V, Higgins I. Being in limbo: The experience of critical illness in intensive care and beyond. 2012.
393. van Manen M. Care-as-Worry, or "don't worry, be happy". *Qual Health Res*. 2002;12(2):262-78 DOI: 10.1177/104973202129119784.
394. Benner PE, Wrubel J. *The primacy of caring: Stress and coping in health and illness: Addison-Wesley/Addison Wesley Longman*; 1989.
395. Fredriksen S-TD, Ringsberg KC. Living the situation stress-experiences among intensive care patients. *Intensive and Critical Care Nursing*. 2007;23(3):124-31.
396. Sartre J-P, Richmond S. *Being and nothingness: An essay in phenomenological ontology: Routledge*; 1956.
397. van Manen M. The pathic nature of inquiry and nursing. In: Madjar, Irena and Walton, Jo (editors). *Nursing and the Experience of Illness: Phenomenology in Practice*. London: Routledge; 1999. 17-35 p.
398. van Manen M. *Method and Meaning in the Human Sciences*. a conference at Newcastle University, England. 1996.
399. Tembo AC, Parker V. Factors that impact on sleep in intensive care patients. *Intensive and critical care nursing*. 2009;25(6):314-22.
400. Parker V. *Confronting life and death: living through critical illness and intensive care hospitalisation: University of Newcastle*; 1997.
401. Zeilani R, Seymour JE. Muslim women's experiences of suffering in Jordanian intensive care units: a narrative study. *Intensive and Critical Care Nursing*. 2010;26(3):175-84 DOI: <https://doi.org/10.1016/j.iccn.2010.02.002>.
402. Linschoten J. On falling asleep. In J. J. Kockelmans (Ed.), *Phenomenological psychology: The Dutch School* (pp. 79–117). Martinus Nijhoff Publishing. (Reprinted from "Tijdschrift voor Philosophie," 14(1952), pp. 207-264. Translated by Joseph J. Kockelmans). 1987.
403. Leder D. *The Absent Body* University of Chicago Press. Chicago, II. 1990.
404. Pettman D. *Love and Other Technologies: Retrofitting eros for the information age: Fordham Univ Press*; 2006.

405. Nancy J-L. *The inoperative community*: U of Minnesota Press; 1991.
406. Ihde D. *Technology and the lifeworld: From garden to earth*. 1990.
407. Heidegger M. *The question concerning technology*. New York. 1977;214.
408. Heidegger M. *The Basic Problems of Phenomenology*, trans. Albert Hofstadter. 1982.
409. Thomson I, Thomson IDT. *Heidegger on ontotheology: Technology and the politics of education*: Cambridge University Press; 2005.
410. Stiegler B. *Technics and time: Disorientation*: Stanford University Press; 1998.
411. Perniola M. *The sex appeal of the inorganic: philosophies of desire in the modern world*: A&C Black; 2004.
412. Adams C. PowerPoint, habits of mind, and classroom culture. *Journal of Curriculum studies*. 2006;38(4):389-411.
413. van Manen M. *Technics of touch in the neonatal intensive care*. *Med Humanit*. 2012;38(2):91-6 DOI: 10.1136/medhum-2012-010204.
414. Carolan M. Reflexivity: a personal journey during data collection. *Nurse Researcher (through 2013)*. 2003;10(3):7.
415. Finlay L. "Outing" the researcher: the provenance, process, and practice of reflexivity. *Qual Health Res*. 2002;12(4):531-45 DOI: 10.1177/104973202129120052.
416. Primeau LA. Reflections on self in qualitative research: stories of family. *Am J Occup Ther*. 2003;57(1):9-16 DOI: 10.5014/ajot.57.1.9.
417. Etherington K. *Becoming a Reflexive Researcher: Using Our Selves in Research*. 2004.
418. Guillemin M, Gillam L. Ethics, Reflexivity, and "Ethically Important Moments" in Research. *Qualitative Inquiry*. 2004;10:261-80 DOI: 10.1177/1077800403262360.
419. Poustie SJ, Taylor D, Forbes A, Skiba M, Nelson MR, McNeil JJ. Implementing a research governance framework for clinical and public health research. *Medical journal of Australia*. 2006;185(11/12):623-6.
420. Starks H, Brown Trinidad S. Choose your method: A comparison of phenomenology, discourse analysis, and grounded theory. *Qualitative health research*. 2007;17(10):1372-80.
421. Carolan M. Diabetes nurse educators' experiences of providing care for women, with gestational diabetes mellitus, from disadvantaged backgrounds. *Journal of clinical nursing*. 2014;23(9-10):1374-84.
422. Carolan M, Gill GK, Steele C. Women's experiences of factors that facilitate or inhibit gestational diabetes self-management. *BMC Pregnancy Childbirth*. 2012;12:99 DOI: 10.1186/1471-2393-12-99.
423. Speight J, Bradley C. The ADKnowl: identifying knowledge deficits in diabetes care. *Diabet Med*. 2001;18(8):626-33 DOI: 10.1046/j.1464-5491.2001.00537.x.
424. Giorgi A, Giorgi, B. Phenomenology. In J A Smith (Ed), *Qualitative psychology: A practical guide to research methods*. 2003:25-50.
425. Act DP. *Data protection act*. London Station Off. 1998;5.
426. Committee TC. *Report on the Review of Patient-Identifiable Information*. DEPARTMENT OF HEALTH. 1997.
427. Confidentiality: NHS Code of Practice [Internet]. 2003. Available from: <https://www.gov.uk/government/publications/confidentiality-nhs-code-of-practice>.
428. Creswell JW, Poth CN. *Qualitative inquiry and research design: Choosing among five approaches*: Sage publications; 2016.

429. Corp. I. IBM SPSS Statistics for Windows, Version 27.0 Armonk, NY: IBM Corp. Released 2020.
430. Ltd. QIP. NVivo (Version 12). 2018.
431. Centre for Maternal and Child Enquiries (CMACE). Maternal obesity in the UK: Findings from a national project. London: CMACE, 2010.
432. Catalano PM. Increasing maternal obesity and weight gain during pregnancy: the obstetric problems of plentitude. *Obstet Gynecol.* 2007;110(4):743-4 DOI: 10.1097/01.AOG.0000284990.84982.ba.
433. Speziale HS, Streubert HJ, Carpenter DR. Qualitative research in nursing: Advancing the humanistic imperative: Lippincott Williams & Wilkins; 2011.
434. 2022 [cited 05/06/2022]. Available from: [https://www.who.int/health-topics/diabetes#tab=tab\\_1](https://www.who.int/health-topics/diabetes#tab=tab_1).
435. Langer N, Langer O. Emotional adjustment to diagnosis and intensified treatment of gestational diabetes. *Obstetrics and gynecology.* 1994;84(3):329-34.
436. Dunkel Schetter C, Lobel M. Pregnancy and birth outcomes: A multilevel analysis of prenatal maternal stress and birth weight. 2012.
437. Hjelm K, Berntorp K, Apelqvist J. Beliefs about health and illness in Swedish and African-born women with gestational diabetes living in Sweden. *J Clin Nurs.* 2012;21(9-10):1374-86 DOI: 10.1111/j.1365-2702.2011.03834.x.
438. Dayyani I, Terkildsen Maindal H, Rowlands G, Lou S. A qualitative study about the experiences of ethnic minority pregnant women with gestational diabetes. *Scand J Caring Sci.* 2019;33(3):621-31 DOI: 10.1111/scs.12655.
439. Bert F, Gualano MR, Brusaferrò S, De Vito E, De Waure C, La Torre G, et al. Pregnancy e-health: a multicenter Italian cross-sectional study on Internet use and decision-making among pregnant women. *J Epidemiol Community Health.* 2013;67(12):1013-8.
440. Lagan BM, Sinclair M, George Kernohan W. Internet use in pregnancy informs women's decision making: a web-based survey. *Birth.* 2010;37(2):106-15.
441. Lowe P, Powell J, Griffiths F, Thorogood M, Locock L. Making it all normal: the role of the internet in problematic pregnancy. *Qual Health Res.* 2009;19(10):1476-84 DOI: 10.1177/1049732309348368.
442. Ek S, Eriksson-Backa K, Niemela R. Use of and trust in health information on the Internet: a nationwide eight-year follow-up survey. *Inform Health Soc Care.* 2013;38(3):236-45 DOI: 10.3109/17538157.2013.764305.
443. Hui AL, Sevenhuysen G, Harvey D, Salamon E. Food choice decision-making by women with gestational diabetes. *Can J Diabetes.* 2014;38(1):26-31 DOI: 10.1016/j.cjcd.2013.08.263.
444. Hirst JE, Tran TS, Do MAT, Rowena F, Morris JM, Jeffery HE. Women with gestational diabetes in Vietnam: a qualitative study to determine attitudes and health behaviours. *BMC Pregnancy and Childbirth.* 2012;12(1):81 DOI: 10.1186/1471-2393-12-81.
445. Gottlieb S. Health information on internet is often unreliable. *BMJ (Clinical research ed).* 2000;321(7254):136.
446. Eysenbach G, Gray JM, Bonati M, Arunachalam S, Diepgen TL, Impicciatore P, et al. Towards quality management of medical information on the internet: evaluation, labelling, and filtering of information Hallmarks for quality of information Quality on the internet Assuring quality and relevance of internet information in the real world. *BMJ (Clinical research ed).* 1998;317(7171):1496-502.

447. Impicciatore P, Pandolfini C, Casella N, Bonati M. Reliability of health information for the public on the World Wide Web: systematic survey of advice on managing fever in children at home. *BMJ (Clinical research ed)*. 1997;314(7098):1875 DOI: <https://doi.org/doi:10.1136/bmj.314.7098.1875>.
448. Hsu W-C, Bath PA. Development of a patient-oriented tool for evaluating the quality of breast cancer information on the internet. *Studies in health technology and informatics*. 2008;136:297-302.
449. Bernstam EV, Shelton DM, Walji M, Meric-Bernstam F. Instruments to assess the quality of health information on the World Wide Web: what can our patients actually use? *International journal of medical informatics*. 2005;74(1):13-9.
450. Adams S. Under construction: Reviewing and producing information reliability on the web. 2006.
451. Hofmann J, Katzenbach C, Gollatz K. Between coordination and regulation: Finding the governance in Internet governance. *New Media & Society*. 2017;19(9):1406-23.
452. Symons Downs D, Ulbrecht JS. Understanding exercise beliefs and behaviors in women with gestational diabetes mellitus. *Diabetes Care*. 2006;29(2):236-40 DOI: 10.2337/diacare.29.02.06.dc05-1262.
453. Levy-Shiff R, Lerman M, Har-Even D, Hod M. Maternal adjustment and infant outcome in medically defined high-risk pregnancy. *Dev Psychol*. 2002;38(1):93-103.
454. Carolan M. Gestational diabetes mellitus among women born in South East Asia: A review of the evidence. *Midwifery*. 2013;29(9):1019-26.
455. Sjögren B, Robeus N, Hansson U. Gestational diabetes: a case-control study of women's experience of pregnancy, health and the child. *Journal of psychosomatic research*. 1994;38(8):815-22.
456. Han S, Middleton PF, Bubner TK, Crowther CA. Women's views on their diagnosis and management for borderline gestational diabetes mellitus. *J Diabetes Res*. 2015;2015:209215 DOI: 10.1155/2015/209215.
457. Trutnovsky G, Panzitt T, Magnet E, Stern C, Lang U, Dorfer M. Gestational diabetes: women's concerns, mood state, quality of life and treatment satisfaction. *J Matern Fetal Neonatal Med*. 2012;25(11):2464-6 DOI: 10.3109/14767058.2012.683900.
458. Eades CE, Clarke KM, Cameron DM, Coulson N, Evans JMM. Analysis of spontaneous, user-generated data about gestational diabetes on online forums: implications for diabetes prevention. *Diabet Med*. 2020;37(12):2058-66 DOI: 10.1111/dme.14348.
459. McMillan B, Easton K, Goyder E, Delaney B, Madhuvrata P, Abdelgalil R, et al. Reducing risk of type 2 diabetes after gestational diabetes: a qualitative study to explore the potential of technology in primary care. *British Journal of General Practice*. 2018;68(669):e260-e7.
460. Razee H, van der Ploeg HP, Blignault I, Smith BJ, Bauman AE, McLean M, et al. Beliefs, barriers, social support, and environmental influences related to diabetes risk behaviours among women with a history of gestational diabetes. *Health Promot J Austr*. 2010;21(2):130-7 DOI: 10.1071/he10130.
461. Hui AL, Sevenhuysen G, Harvey D, Salamon E. Stress and anxiety in women with gestational diabetes during dietary management. *The Diabetes Educator*. 2014;40(5):668-77 DOI: <https://doi.org/10.1177/0145721714535991>.
462. Van Ryswyk E, Middleton P, Hague W, Crowther C. Women's views on postpartum testing for type 2 diabetes after gestational diabetes: Six month follow-up

- to the DIAMIND randomised controlled trial. Primary care diabetes. 2016;10(2):91-102.
463. Nielsen JH, Olesen CR, Kristiansen TM, Bak CK, Overgaard C. Reasons for women's non-participation in follow-up screening after gestational diabetes. *Women and birth : journal of the Australian College of Midwives*. 2015;28(4):e157-63 DOI: 10.1016/j.wombi.2015.04.006.
464. Jones EJ, Roche CC, Appel SJ. A review of the health beliefs and lifestyle behaviors of women with previous gestational diabetes. *J Obstet Gynecol Neonatal Nurs*. 2009;38(5):516-26 DOI: <https://doi.org/10.1111/j.1552-6909.2009.01051.x>.
465. Goldstein RF, Gibson-Helm ME, Boyle JA, Teede HJ. Satisfaction with diagnosis process for gestational diabetes mellitus and risk perception among Australian women. *Int J Gynaecol Obstet*. 2015;129(1):46-9 DOI: 10.1016/j.ijgo.2014.10.033.
466. Swan W, Liaw S-T. Diabetes risk reduction behaviours of rural postpartum women with a recent history of gestational diabetes. *Rural and remote health*. 2010;10(4):32-40.
467. Zera CA, Nicklas JM, Levkoff SE, Seely EW. Diabetes risk perception in women with recent gestational diabetes: delivery to the postpartum visit. *The Journal of Maternal-Fetal & Neonatal Medicine*. 2013;26(7):691-6.
468. Sharma M, Purewal TS, Fallows S, Kennedy L. The low-risk perception of developing type 2 diabetes among women with a previous history of gestational diabetes: a qualitative study. *Practical Diabetes*. 2019;36(1):15-9b.
469. Berger PL, Luckmann T. *The Social Construction of Reality: a treatise in the Sociology of Knowledge*. London: Penguin Books; 1991.
470. Perla RJ, Bradbury E, Gunther-Murphy C. Large-scale improvement initiatives in healthcare: a scan of the literature. *J Healthc Qual*. 2013;35(1):30-40 DOI: 10.1111/j.1945-1474.2011.00164.x.
471. Hjelm K, Nyberg P, Isacson Å, Apelqvist J. Beliefs about health and illness essential for self-care practice: a comparison of migrant Yugoslavian and Swedish diabetic females. *Journal of Advanced Nursing*. 1999;30(5):1147-59.
472. Hjelm K, Bard K, Nyberg P, Apelqvist J. Religious and cultural distance in beliefs about health and illness in women with diabetes mellitus of different origin living in Sweden. *International journal of nursing studies*. 2003;40(6):627-43.
473. Dunkel Schetter C, Glynn LM. *Stress in pregnancy: Empirical evidence and theoretical issues to guide interdisciplinary research*. 2011.
474. Woolley M, Jones C, Davies J, Rao U, Ewins D, Nair S, et al. Type 1 diabetes and pregnancy: a phenomenological study of women's first experiences. *Practical Diabetes*. 2015;32(1):13-8.
475. Skouteris H, Morris H, Nagle C, Nankervis A. Behavior modification techniques used to prevent gestational diabetes: a systematic review of the literature. *Curr Diab Rep*. 2014;14(4):480 DOI: 10.1007/s11892-014-0480-6.
476. Burke LE, Wang J, Sevick MA. Self-monitoring in weight loss: a systematic review of the literature. *J Am Diet Assoc*. 2011;111(1):92-102 DOI: 10.1016/j.jada.2010.10.008.
477. Asbee SM, Jenkins TR, Butler JR, White J, Elliot M, Rutledge A. Preventing excessive weight gain during pregnancy through dietary and lifestyle counseling: a randomized controlled trial. *Obstetrics & Gynecology*. 2009;113(2):305-12.
478. Thornton YS, Smarkola C, Kopacz SM, Ishaof SB. Perinatal outcomes in nutritionally monitored obese pregnant women: a randomized clinical trial. *Journal of the National Medical Association*. 2009;101(6):569-77.



479. Hui A, Back L, Ludwig S, Gardiner P, Sevenhuysen G, Dean H, et al. Lifestyle intervention on diet and exercise reduced excessive gestational weight gain in pregnant women under a randomised controlled trial. *BJOG: An International Journal of Obstetrics & Gynaecology*. 2012;119(1):70-7.
480. McGovern A, Butler L, Jones S, van Vlymen J, Sadek K, Munro N, et al. Diabetes screening after gestational diabetes in England: a quantitative retrospective cohort study. *British Journal of General Practice*. 2014;64(618):e17-e23.
481. Keely E. An opportunity not to be missed--how do we improve postpartum screening rates for women with gestational diabetes? *Diabetes Metab Res Rev*. 2012;28(4):312-6 DOI: 10.1002/dmrr.2274.
482. Morrison MK, Collins CE, Lowe JM. Postnatal testing for diabetes in Australian women following gestational diabetes mellitus. *Aust N Z J Obstet Gynaecol*. 2009;49(5):494-8 DOI: 10.1111/j.1479-828X.2009.01056.x.
483. Alayoub H, Curran S, Coffey M, Hatunic M, Higgins M. Assessment of the effectiveness of group education on knowledge for women with newly diagnosed gestational diabetes. *Ir J Med Sci*. 2018;187(1):65-8 DOI: 10.1007/s11845-017-1609-9.
484. Draffin CR, Alderdice FA, McCance DR, Maresh M, Harper R, Patterson CC, et al. Impact of an educational DVD on anxiety and glycaemic control in women diagnosed with gestational diabetes mellitus (GDM): A randomised controlled trial. *Diabetes Res Clin Pract*. 2017;126:164-71 DOI: 10.1016/j.diabres.2017.02.016.
485. Mensing CR, Norris SL. Group Education in Diabetes: Effectiveness and Implementation. *Diabetes Spectrum*. 2003;16(2):96-103 DOI: 10.2337/diaspect.16.2.96 %J Diabetes Spectrum.
486. Ridge T. Shared medical appointments in diabetes care: A literature review. *Diabetes spectrum*. 2012;25(2):72-5.
487. Merakou K, Knithaki A, Karageorgos G, Theodoridis D, Barbouni A. Group patient education: effectiveness of a brief intervention in people with type 2 diabetes mellitus in primary health care in Greece: a clinically controlled trial. *Health Educ Res*. 2015;30(2):223-32 DOI: 10.1093/her/cyv001.
488. Tavakkoli R, Mahmoodi M, Attarian S. Study the effect of educational intervention based on the health belief model (HBM) on quality of life among women with gestational diabetes. *Journal of Research in Medical and Dental Science*. 2018;6(2):245-52.
489. Feldman RK, Tieu RS, Yasumura L. Gestational Diabetes Screening: The International Association of the Diabetes and Pregnancy Study Groups Compared With Carpenter-Coustan Screening. *Obstet Gynecol*. 2016;127(1):10-7 DOI: 10.1097/AOG.0000000000001132.
490. Nolan CJ. Controversies in gestational diabetes. *Best practice & research clinical obstetrics & gynaecology*. 2011;25(1):37-49.

# Appendix A - Gestational Diabetes (GDM) Knowledge and Self- Management Questionnaire

## Gestational Diabetes (GDM) Knowledge and Self- Management Questionnaire

Please tick the box next to the answer you think is correct.

1. Which of the following applies to gestational diabetes?

- It is a life long condition?  
Yes  No  Don't know
- It only occurs during pregnancy and goes away after giving birth.  
Yes  No  Don't know
- It is due to an imbalance between insulin and glucose levels in the body.  
Yes  No  Don't know
- It may require medication as part of its treatment.  
Yes  No  Don't know

2. The following can increase the risk of developing gestational diabetes:

- Women who are overweight/obese or have a body mass index(BMI) above 30 kg/m<sup>2</sup>  
Yes  No  Don't know
- Women who have previously given birth to a baby weighing 9 pounds (4.5 kg ) or more  
Yes  No  Don't know
- Women who have previously been diagnosed with gestational diabetes  
Yes  No  Don't know
- Women who have a family history of diabetes (blood relative with diabetes)  
Yes  No  Don't know

- Women who come from an area where the prevalence of diabetes is high (such as Pakistan, India, South Asia, Bangladesh, Caribbean and the Middle East)

Yes       No       Don't know

3. Gestational diabetes can have risks to the pregnant women as well as the developing baby?

Yes       No       Don't know

**4. Are the following interventions important in managing gestational diabetes?**

- Restricting calorie intake and taking moderate exercise (of at least 30 minutes daily).

Yes       No       Don't know

- The need to start on anti-diabetic tablets to control blood sugar levels?

Yes       No       Don't know

- The need to add insulin if blood glucose levels are not well controlled?

Yes       No       Don't know

**5. Did you know that women who have GDM have an increased risk of developing type 2 diabetes in the next 5 to 10 years time?**

Yes       No       Don't know

**6. Please respond to each of the following statements about the effects of food on blood glucose levels:**

- Sugary foods raise blood glucose levels.

True           False           Don't know

- Starchy foods (e.g potato, bread, etc) raise blood sugar levels.

True           False           Don't know

- Protein foods (e.g meat, cheese, etc) raise blood glucose levels.

True           False           Don't know

- Alcohol-free wines and lagers have no effect on blood glucose levels.

True           False           Don't know

- Full fat foods affect blood glucose levels more than low fat foods.

True           False           Don't know

- Any amount of fresh fruit can be eaten with little effect on blood glucose levels.

True           False           Don't know

- Fresh, unsweetened fruit juice can be drunk freely with little effect on blood glucose levels.

True           False           Don't know

# Appendix B - Impact of the diagnosis of Gestational Diabetes (GDM) Questionnaire

## Impact of the diagnosis of Gestational Diabetes (GDM).

Thank you for taking time to read and complete this questionnaire.

1. Based on a scale of 0 to 100 [0 means “Not worried at all” and 100 means “As worried as I have ever felt” could you state a number to answer questions 1a and 1b.

1a. How did you feel when you were first told you had gestational diabetes? Answer: .....

1b. How do you feel now? Answer: .....

2. Are you glad you had a test for gestational diabetes?

Yes  No  Don't know

3. Do you wish you had never had a test for gestational diabetes?

Yes  No  Don't know

4. Do you want to be tested for gestational diabetes if you become pregnant again?

Yes  No  Don't know

5. Do you think having gestational diabetes in this pregnancy might influence your decision whether or not to have more children?

Yes  No  Don't know

6. Are you surprised you were diagnosed with gestational diabetes?

Yes  No  Don't know

7. Had you heard about gestational diabetes before?

Yes  No  Don't know

8. Do you think you will enjoy your pregnancy less now that you have been diagnosed with gestational diabetes?

Yes  No  Don't know

9. Do you think gestational diabetes is going to or has affected the following aspects of your life?

Diet: Yes  No  Don't know

Exercise routine: Yes  No  Don't know

Sex life? Yes  No  Don't know

Alcohol intake: Yes  No  Don't know

Social life: Yes  No  Don't know

10. If you were smoking before would consider stopping now?

Yes  No  Don't know

11. Do you feel you have been labelled with a disease?

Yes  No  Don't know

12. Do you think people would judge you if they knew you have gestational diabetes?

Yes  No  Don't know

13. Are you concerned about any health problems as a result of gestational diabetes occurring:

To You? Yes  No  Don't know

To the growing baby? Yes  No  Don't know

14. Are you worried you might need an injection as part of treatment?

Yes  No  Don't know

15. Will this diagnosis have financial implications for you?

Yes  No  Don't know

16. If you have answered yes to question 15, are you worried about it?

Yes  No  Don't know

# Appendix C - Study Ethics Approval document



**Health Research Authority**

**Research Ethics Service**

**London - South East Research Ethics Committee**

Barlow House  
3rd Floor  
4 Minshull Street  
Manchester  
M1 3DZ

Telephone: 0207 104 8002

16 November 2015

**Professor Franklin Joseph**  
**Countess of Chester NHS Foundation Trust**  
**Liverpool Road**  
**Chester, Cheshire**  
**CH2 1UL**

Dear Professor Joseph

**Study title:** The psychological impact of the diagnosis of Gestational Diabetes(GDM)and the influence of a grouped Structured Education Programme following the diagnosis of GDM: A phenomenological Approach.

**REC reference:** 15/LO/1754

**IRAS project ID:** 167063

Thank you for your letter of 09 October 2015, responding to the Proportionate Review Sub-Committee's request for changes to the documentation for the above study.

The revised documentation has been reviewed and approved by the Chair and Mr John Eastwood.

We plan to publish your research summary wording for the above study on the HRA website, together with your contact details. Publication will be no earlier than three months from the date of this favourable opinion letter. The expectation is that this information will be published for all studies that receive an ethical opinion but should you wish to provide a substitute contact point, wish to make a request to defer, or require further information, please contact the REC Manager Mrs Margaret Hutchinson, [nrescommittee.london-southeast@nhs.net](mailto:nrescommittee.london-southeast@nhs.net). Under very limited circumstances (e.g. for student research which has received an unfavourable opinion), it may be possible to grant an exemption to the publication of the study.

## **Confirmation of ethical opinion**

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised.

## **Conditions of the favourable opinion**

The favourable opinion is subject to the following conditions being met prior to the start of the study.

A Research Ethics Committee established by the Health Research Authority



Management permission or approval must be obtained from each host organisation prior to the start of the study at the site concerned.

Management permission ("R&D approval") should be sought from all NHS organisations involved in the study in accordance with NHS research governance arrangements.

Guidance on applying for NHS permission for research is available in the Integrated Research Application System or at <http://www.rdforum.nhs.uk>.

Where a NHS organisation's role in the study is limited to identifying and referring potential participants to research sites ("participant identification centre"), guidance should be sought from the R&D office on the information it requires to give permission for this activity.

For non-NHS sites, site management permission should be obtained in accordance with the procedures of the relevant host organisation.

Sponsors are not required to notify the Committee of approvals from host organisations.

#### Registration of Clinical Trials

All clinical trials (defined as the first four categories on the IRAS filter page) must be registered on a publically accessible database. This should be before the first participant is recruited but no later than 6 weeks after recruitment of the first participant.

There is no requirement to separately notify the REC but you should do so at the earliest opportunity e.g. when submitting an amendment. We will audit the registration details as part of the annual progress reporting process.

To ensure transparency in research, we strongly recommend that all research is registered but for non-clinical trials this is not currently mandatory.

If a sponsor wishes to request a deferral for study registration within the required timeframe, they should contact [hra\\_studyregistration@nhs.net](mailto:hra_studyregistration@nhs.net). The expectation is that all clinical trials will be registered, however, in exceptional circumstances non registration may be permissible with prior agreement from the HRA. Guidance on where to register is provided on the HRA website.

**It is the responsibility of the sponsor to ensure that all the conditions are complied with before the start of the study or its initiation at a particular site (as applicable).**

#### **Ethical review of research sites**

The favourable opinion applies to all NHS sites taking part in the study, subject to management permission being obtained from the NHS/HSC R&D office prior to the start of the study (see "Conditions of the favourable opinion" above).

#### **Approved documents**

The documents reviewed and approved by the Committee are:

<i>Document</i>	<i>Version</i>	<i>Date</i>
GP/consultant information sheets or letters [GP Letter]	1	23 September 2015
Interview schedules or topic guides for participants [Interview]	1	05 September

A Research Ethics Committee established by the Health Research Authority

Schedule Flowchart]		2015
IRAS Checklist XML [Checklist_24092015]		24 September 2015
IRAS Checklist XML [Checklist_09102015]		09 October 2015
Non-validated questionnaire [GDM Knowledge Questionnaire]	1	18 September 2015
Non-validated questionnaire [GDM Psychological Impact Questionnaire]	1	18 September 2015
Other [Research Team CV/GCP]	1	18 September 2015
Other [Student GCP]	1	23 September 2015
Other [REC Response Document]	1	09 October 2015
Other [Protocol Version 2]	2	09 October 2015
Participant consent form [ConsentFormVersion2]	2	09 October 2015
Participant information sheet (PIS) [Patient Information SheetVersion2]	2	09 October 2015
REC Application Form [REC_Form_24092015]		24 September 2015
Summary CV for Chief Investigator (CI) [Chief Investigator CV/GCP]	1	15 September 2015
Summary CV for student [Student CV]	1	01 September 2015
Summary CV for supervisor (student research) [Supervisor CV]	1	15 September 2015
Summary, synopsis or diagram (flowchart) of protocol in non technical language [Flow Chart/Interview Schedule]	1	05 September 2015

#### **Statement of compliance**

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

#### **After ethical review**

##### Reporting requirements

The attached document "After ethical review – guidance for researchers" gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Adding new sites and investigators
- Notification of serious breaches of the protocol
- Progress and safety reports
- Notifying the end of the study

The HRA website also provides guidance on these topics, which is updated in the light of changes in reporting requirements or procedures.

Feedback

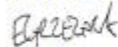
You are invited to give your view of the service that you have received from the National Research Ethics Service and the application procedure. If you wish to make your views known please use the feedback form available on the HRA website:  
<http://www.hra.nhs.uk/about-the-hra/governance/quality-assurance>

We are pleased to welcome researchers and R & D staff at our NRES committee members' training days – see details at <http://www.hra.nhs.uk/hra-training/>

<b>15/LO/1754</b>	<b>Please quote this number on all correspondence</b>
-------------------	---

With the Committee's best wishes for the success of this project.

Yours sincerely



**On behalf of  
Professor David Caplin  
Chair**

**Email:** [nrescommittee.london-southeast@nhs.net](mailto:nrescommittee.london-southeast@nhs.net)

**Enclosures:** "After ethical review – guidance for researchers"

**Copy to:** Mr Dale Vimalachandran,  
Countess of Chester NHS Foundation Trust

# Appendix D - Patient Information Leaflet

Countess of Chester Hospital   
NHS Foundation Trust

The Countess of Chester Health Park  
Liverpool Road  
Chester  
CH2 1UL

Tel 01244 365000 (switchboard)

## Participant Information Sheet

### **The psychological impact of the diagnosis of Gestational Diabetes (GDM) and the influence of a grouped Structured Education Programme following the diagnosis of GDM: A Phenomenological Approach.**

You are invited to take part in a research study related to "diabetes during pregnancy" which is also known as gestational diabetes (GDM). Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and ask us if there is anything that is not clear or if you would like more information.

#### **What is the purpose of the study?**

Pregnancy is usually a positive experience for most women however a new diagnosis of GDM can have additional negative effects on these women and influence pregnancy outcomes. Education is required to manage GDM. This can be provided in a group session or on a one to one basis. The purpose of this study is to describe the psychological effects in women who have been diagnosed with GDM for the first time. This study also investigates the impact of a group structured education programme on women newly diagnosed with GDM compared to those who attend a one to one education session.

#### **Why have I been invited to participate in this study?**

Women who have been diagnosed with gestational diabetes for the first time following a positive blood test (bloods taken before and two hours after a sugary drink) are eligible to take part in the study.

#### **What will happen if I decide to take part?**

If you decide to participate in this study:

1. We will ask you to sign a consent form confirming you wish to participate in the study after reading the patient information sheet. You will receive a copy of the signed consent form.
2. You will be allocated to receive education in either a group session or on a one to one basis.
3. You will be required to participate in a recorded interview conducted by the researcher. This will last between 20 to 30 minutes. The recording can be paused or stopped if you feel uncomfortable or upset at any time during the interview. You will be requested to talk about your initial thoughts and reactions towards being diagnosed with GDM.
4. You will be requested to complete two questionnaires which will enquire about your understanding of the diagnosis, treatment and risk factors for GDM and your attitude towards being tested for GDM.
5. You will be required to fill in the questionnaires on four separate occasions: firstly within a week following the diagnosis of GDM, secondly within a week of attending the education session, thirdly 4 to 6 weeks after the education session and lastly at 6 to 8 weeks after delivery.
6. You can fill in the questionnaires on the day or send the completed questionnaire by pre-paid envelopes that will be provided.
7. It will take approximately 5 to 15 minutes to complete the questionnaires.

#### **What will happen to the information I provide?**

- The information you provide will be treated in the strictest confidence, in accordance with the Data Protection Act 1998.
- Only authorised researchers will have access to the information you provide. Your details will never be disclosed to any third party.
- The results of the study will be available in a summary sheet and disseminated to participants on request.
- Parts of your conversation may be used "word for word" in future publications or presentations but such quotes will be anonymised.
- The audio recordings will be destroyed at the end of the study.

#### **What are the benefits of the study?**

The information obtained will provide valuable insight into women's knowledge, attitude, behaviour and perception towards a diagnosis of GDM. The findings will contribute to better understanding of the diagnosis from the pregnant women's perspective and will enable health care professionals to adapt or modify services accordingly.

**What are the potential disadvantages of taking part in this study?**

Although less likely, some women may become emotional or upset after the interview. Support is available in the form of a debriefing session by one of the midwives, a member of the diabetes research team or referral to counselling sessions with the diabetes psychology team. If further support needed the Diabetes Research team can be contacted on the telephone number provided at the end of this information sheet.

**Who is organising and funding the research?**

This study is funded by the Diabetes Research Department at the Countess of Chester Hospital.

**Who has reviewed the study?**

All research in the NHS is looked at by an independent group of people, called a Research Ethics Committee, to protect your interests. This study has been reviewed and given favourable opinion by the London-South East Research Ethics Committee.

**Do I have to take part?**

No. It is up to you to decide whether to take part or not. Participation in the study is voluntary. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to change your mind or withdraw at any time and without giving a reason. This will not affect the standard of treatment or care you receive.

**Will I be contacted again?**

We may wish to re-contact you to discuss any further information that may be required or if any clarification is required.

**Further Information and contact details**

If you are willing to take part in the study, please advise your local hospital's research team:


**Diabetes Research Team, Tel: 01244 3653619**

Thank you very much for your consideration.

# Appendix E - GDM Education Session PowerPoint

## Presentation content

Countess of Chester Hospital **NHS**  
NHS Foundation Trust



### Gestational Diabetes

our values

- we respect each other
- we have a can do attitude
- we strive for improvement
- we take pride in the services we provide
- we are welcoming, friendly and caring
- we put patients at the heart of everything we do

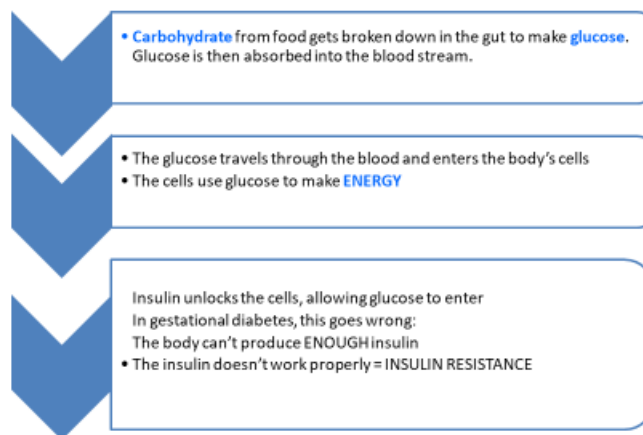
The Countess of Chester Hospital NHS Foundation Trust working in partnership with Western Cheshire Primary Care Trust

## Topics

- What is gestational diabetes
- Treatment
- Healthy eating
- Physical activity
- How will it affect me and my baby
- Monitoring and management
- After GDM advice

## Gestational diabetes

- Gestational diabetes occurs when the amount of **glucose** (sugar) in the blood is too high
- It usually happens during 2<sup>nd</sup> or 3<sup>rd</sup> trimester
- It can be due to insulin resistance from pregnancy hormones and/or from not enough insulin being produced





## Risk Factors

- Overweight
- Family history of type 2 diabetes
- Being over 35 years
- Unexplained problems in previous pregnancies
- Very large baby in previous pregnancy
- Previous gestational diabetes
- Family origin is South Asian, Black Caribbean or Middle Eastern
- Polycystic Ovary Syndrome

## Diagnosis

- Usually diagnosed by two or more blood tests:
- Fasting blood glucose – 5.1mmol/l or over
- Oral Glucose Tolerance Test – 7.8mmol/l or over

*Factors affecting blood sugar levels:*

- *Carbohydrate*
- *Alcohol, Smoking, Stress*
- *Exercise*

## Treatment

- Diet
  - Lifestyle
  - Metformin
  - Insulin
- Most women will be able to treat their gestational diabetes by diet and lifestyle alone, but 10-20% will need metformin and/or insulin if this alone is not effective in order to reduce the risk of complications



# Carbohydrates

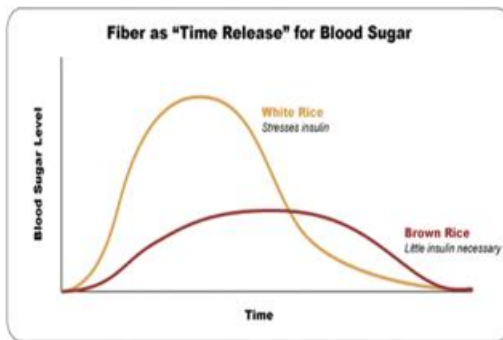
- Starchy



- Sugary



## How will they effect my blood sugar levels?



Sugary



Starchy





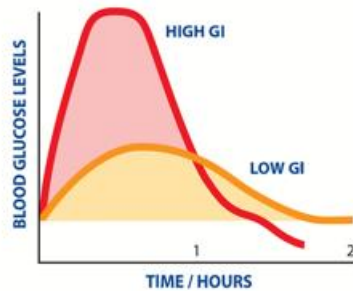
## Starchy carbohydrates

- Amount of carbohydrate needed can vary  
But as a rule;
- Have a starchy carbohydrate at each meal
- Spread your carbohydrate foods throughout the day
- Roughly 1/3 of plate should have some high fibre starchy carbohydrate



## Glycaemic Index

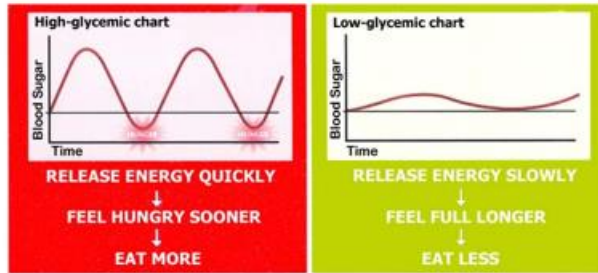
- Ranking of carbohydrate food:
- Each food is given a value
- Foods that break down quickly given high GI value
- Foods that break down slowly given low GI value





## Benefits







- Improve blood glucose control
- Keep you feeling fuller for longer
- Help with weight control



### What to choose:

- All starchy foods are fine but try to choose more low GI foods
- These have **less impact on blood glucose levels**.
- They often contain more fibre, which is good for your digestive system and helps to fill you up for longer.

Choose <b>MORE</b> often	Choose <b>LESS</b> often
Boiled/ sweet potatoes	Mashed potatoes
Bran-based cereals, porridge, unsweetened muesli	Cornflakes, rice krispies, sugar-coated cereals, sweetened muesli
Wholegrain/ granary/ seeded/ rye bread	White/ brown bread
Basmati rice, pasta	White rice

	GI Meals	
	Low GI	High GI
Breakfast		
Lunch		
Dinner		

## Healthy eating for pregnancy

Fact or Myth?

Being pregnant means I can eat for two

•MYTH

I am craving sugar therefore I should eat sugar

•MYTH

All fish is safe during pregnancy

•MYTH

Fact or myth?

I need to limit my intake of caffeine –

• FACT

I can eat peanuts during pregnancy

• FACT

I should only drink full fat milk –

• MYTH

### Good Fats

- **Fats from plants**
  - Olive oil, rapeseed (canola/vegetable) oil, sunflower oil, avocado, nuts, seeds
- **Omega 3**
  - 2 portions oily fish per week

### Salt

- Too much salt can cause **high blood pressure**
- Aim for **less than 6g per day**

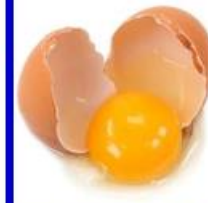
### Bad Fats

- **Animal fats**
  - Fatty meat, poultry skin, cheese, full fat milk & yogurts, cream, butter
- **Trans fats or hydrogenated fats**
  - Some cakes, biscuits, pastries
- **GOOD SNACKS:**
  - Fruit or veg with low fat dip
  - Low fat, low sugar yogurt
  - Nuts
  - High fibre cracker & low fat cheese

## Food safety in pregnancy

Foods to avoid:

- Liver
- Pate
- Cheese with blue veins or mould ripened
- Under cooked meat
- Under cooked or raw eggs
- Raw shellfish
- Unpasteurised cheese or milk
- Under cooked ready meals
- Unwashed fruit and vegetables



### **Alcohol**

- Will have affect on blood glucose levels
- Not recommended during pregnancy

#### •Caffeine:

- No more than 200mg caffeine per day

- 1 mug of tea – 75mg
- 1 mug instant coffee – 100mg
- 1 mug filter coffee – 140mg
- 1 can of cola – 40mg
- 1 can energy drink – 80mg

### **Physical Activity**

- Only need extra 200kcal per day in 3<sup>rd</sup> trimester
- Too much weight gain will increase risk of complications
- Breastfeeding after pregnancy can help with weight loss
- Can improve blood glucose control
- Can reduce high blood glucose readings

## **How will it affect me and my baby?**

### **Risks to Mother**

- Larger baby
- Slight increased risk of infection
- Too much amniotic fluid
- Pre-eclampsia
- Delivery by caesarean section

### **Risks to Baby**

- Shoulder dystocia
- Jaundice
- Hypoglycaemia at birth - breastfeeding



## Risks after pregnancy

- 5-7 times more likely to develop type 2 diabetes
- Almost certain Gestational diabetes with future pregnancies
- Earlier diagnosis in future pregnancies
- Baby – increased risk type 2 and obesity



## Blood Glucose Monitoring

### Monitoring

- Why do blood sugar levels need to be monitored?
  - To see what's happening
  - To assess effect of treatment
- How do we monitor?
- Who monitors?
  - Your doctor, nurse and **YOU**

### Blood glucose level targets

- Done usually 4 times per day
- Pre breakfast, Pre lunch
- Pre evening meal, Pre bed
- Target =
- **Fasting:  $\leq 5.3$  mmol/l**
- **1 hour post meal:  $\leq 7.8$**
- **2 hours post meal:  $\leq 6.4$**

## GDM Management

- ✓ Diabetes specialist team:
  - Consultant and Diabetes Specialist Nurse
  
- ✓ At 36 weeks:
  - Obstetrician and Diabetes Specialist Midwife
  
- ✓ Growth Scans



## After Gestational Diabetes

- Blood glucose levels should return to normal
- Six week post partum check
- Have annual fasting blood glucose tests
- Achieve and maintain a healthy BMI
- Take regular exercise
- Do not smoke
- Do not have pregnancies in rapid succession
- Attend Keeping Your Family Healthy after GD!