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# NURSING INTERVENTIONS IN THE MANAGEMENT OF GESTATIONAL DIABETES IN PRENATAL CARE PATIENTS

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Laurea University of Applied Sciences

## Nursing Interventions in the Management of Gestational Diabetes in Prenatal Care Patients.

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**Nursing Interventions in the Management of Gestational Diabetes in Prenatal Care Patients**

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Gestational Diabetes Mellitus (GDM) accounts for 90-95% of all cases of diabetes in pregnancy. Family history, obesity and insulin resistance are some of the risk factors of GDM. GDM complications that affect the mother, baby and infant can be long-term or short-term.

The purpose of this thesis is to describe the nursing interventions in the management of GDM in prenatal care patients.

The method used in this thesis is a literature review with an inductive qualitative content analysis. To gather important literature that is up-to-date, two databases were searched. These are Laurea FINNA and Sage Premier 2012, and a total number of 24 articles accepted.

Four main categories in the management of GDM were derived from the data analysed. These include; self-care management, medication, education and training, and social support. It was deduced from the data that there is a distinct lack of knowledge amongst pregnant women with GDM on how to implement a self-care management plan in their daily living. As a result, depression, stress, anxiety and eating disorders arise.

In conclusion, effective management and reduction in the prevalence of GDM is through self-care management. A well-balanced diet through the Medical Nutrition Therapy (MNT) is a chief foundation of managing GDM. Nurses play an important role in counseling and educating women with GDM by providing indepth information on nutrition as stated by a clinical dietician. Nurses require further education and training on the general knowledge, management and prevention of GDM.

Aspects such as language and culture should be put into consideration when educating both GDM pregnant women and professional healthcare team in order to have a good comprehension in the effective management of GDM .

Keywords: Gestational Diabetes Mellitus (GDM), Prenatal Care, Nursing Interventions

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## 1 Introduction

International Diabetes Federation, IDF (2015) states that 415 million individuals have diabetes at the moment and is foreseen to increase to 642 million by 2040. A disturbing figure of 193 million people with diabetes are presently not identified by healthcare professionals. In 2015, diabetes caused the death of 5.0 million people (IDF 2015). "Of all types of diabetes, Gestational Diabetes Mellitus (GDM) accounts for approximately 90-95% of all cases of diabetes in pregnancy" (ADA 2009; Landon & Gabbe 2011) and is perceived as a rapidly increasing health concern throughout the world (Ferrara 2007; Bener, Saleh & Al-Hamaq 2011).

According to Moss, Crowther, Hiller, Willson, and Robinson (2007), the burden that GDM places on both the individual and the healthcare system financially is undisputable. Approximately 817 dollars is spent on treating one case of GDM for diet-treated clients and 3000 dollars for insulin-treated clients (Moss et al 2007). Fallah, Chen and Lefebvre (2011) and Canadian Institute for Health Information (CIHI) (2013) state that the mean value spent on GDM complications in areas of cesarean section and neonatal intensive care admission in Canada is 4000 dollars and 7000 dollars accordingly (Fallah et al 2011; CIHI 2013).

König, Junginger, Reusch, Louwen and Badenhoop (2014, 42) state that "in 2013, more than 21 million live births globally were affected by diabetes during pregnancy, with more than 79,000 children developing type 1 diabetes (T1DM)" (König et al. 2014, 42). Most pregnant women with GDM recuperate after child birth (Skupien, Cyganek & Malnecki 2014) while 50% can develop type 2 diabetes mellitus (T2DM) within 20 years (Cunningham, Leveno, Bloom, Hauth, Rouse & Spong 2010; Ferrara 2007). GDM can return in future pregnancies in women that have had GDM (Kim, Berger & Chamany 2007).

One of the writers witnessed a scenario in Africa, where a friend of hers gave birth to a big baby through natural birth, thereby disfiguring the baby. This captured our interest on the chosen topic, so as to acquire more knowledge on GDM that can be applied in some of the hospitals back home. The purpose of this thesis is to describe the nursing interventions in the management of gestational diabetes in prenatal care patients so as to manage or prevent complications for the mother and baby and to prevent the other

types of diabetes (T1DM and T2DM) from occurring. Literature review will be used to compile known information on the topic.

## 2 Concepts

The main concepts of the thesis are defined and explained in this chapter.

### 2.1 Gestational Diabetes Mellitus (GDM)

GDM is defined as glucose intolerance that is first identified during pregnancy (ADA 2012; Landon 2009 & IDF 2013). This means that pregnant women with GDM had no diabetes before pregnancy according to the definition. The breakdown of glucose in the body is performed by the hormone, insulin. Insulin maintains maternal metabolism and during pregnancy, its physiology is altered (Lowe & Karban 2014) due to hormonal changes. These hormones (estrogen, progesterone, prolactin, cortisol and growth hormones) prevent insulin from functioning by blocking it, thereby making it resistant (Feig 2008). The beta cell stores and releases insulin in the body but when insulin becomes resistant, beta cell becomes insufficient to surmount its resistance (Metzger, Lowe, Dyer, Trimble, Chaovarindr, Coustan, Hadden, McCance, Hod, McIntyre, Oats, Persson, Rogers & Sacks 2008), resulting in the development of GDM (Kapustin 2008). Insulin resistance is at its peak during the second and third trimesters of gestation (Feig 2008).

The prevalence of GDM in some countries is as follows: 4-10% in the United States of America, 5% in the United Kingdom (Agarwal, Dhatt & Shah 2010; Gandhi, Bustani, Madhuvrata & Farrell 2012), 28% in Nepal, <1% in Germany (Jiwani, Marseille, Lohse, Damm, Hod & Kahn 2012), 11.1% in Malaysia (Ravichandran & Karalasingam 2009), 5% in Australia (Australian Institute of Health and Welfare (AIHW) 2010), 6.8% in China (Zhang, Dong, Zhang, Li, Wen, Gao & Hu 2011), 4.9% in Iran (Sayehmiri, Bakhtiari, Darvishi & Sayehmiri 2013), and 10.3-11.2% in Finland (Lamberg, Raitanen, Rissanen & Luo-to 2012). As regards to GDM in Africa, the calculated rate per hundred is unclear due to the type of screening method adopted in relation to cost (Jiwani et al. 2012). GDM prevalence rate differs globally due to different diagnostic criteria and individual traits (Galtier 2010).

### 2.1.1 Risk factors

The risk factors for GDM are family history of GDM or T2DM, maternal age over 30-35 years, obesity (Carolan 2013), maternal overweight, insulin resistance, maternal metabolic syndrome (Chu, Callaghan, Kim, Schmid, Lau, England & Dietz 2007), minority race and low socioeconomic status (Link & McKinlay 2009), lack of vitamin D (Senti, Thiele, & Anderson 2012), prior parturition of a baby greater than 4000g, polycystic ovary disease, previous newborn death, previous delivery through surgery, large amount of bad cholesterol in the food, prior stillbirth, hypertension during gestation, and multiple gestation (Ashwal & Hod 2015).

### 2.1.2 Screening and Diagnosis

Screening for GDM is usually done within 24-28 weeks of pregnancy through the one-step approach of using fasting Oral Glucose Tolerance Test (OGTT) (Leary, Pettitt & Jovanovic 2010) and the two-step approach. In the two-step approach, both the glucose challenge test (GCT) and OGTT are implemented. In GCT (nonfasting), plasma glucose concentration or serum is carried out 1h after a typical 50g oral glucose load (Virally & Laloi 2010). If the plasma glucose concentration is  $\geq 7.8$  mmol/l, 100g OGTT is performed on the fasting client (ADA 2014). The various diagnostic guidelines in the determination of GDM as stipulated by different organizations is shown in table 1.

Organisation	Fasting Plasma Glucose	Glucose Challenge	1-h plasma glucose	2-h plasma glucose	3-h plasma glucos
World Health Organization (WHO) 1999*	$\geq 7.0$	75g OGTT	Not required	$\geq 7.8$	Not required
American Congress of Obstetricians and Gynecologists (ACOG)**	$\geq 5.3$	100g OGTT	$\geq 10.0$	$\geq 8.6$	$\geq 7.8$
Canadian Diabetes Association (CDA)***	$\geq 5.3$	75g OGTT	$\geq 10.6$	$\geq 8.9$	Not required
International Association of Diabetes and Pregnancy Study Groups	$\geq 5.1$	75g OGTT	$\geq 10.0$	$\geq 8.5$	Not required



(IADPSG)****					
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\* one value is sufficient for diagnosis

\*\* two or more values are required for diagnosis

\*\*\* two or more values required for diagnosis

\*\*\*\* one value is sufficient for diagnosis

Table 1: Most commonly used diagnostic guidelines for GDM (WHO 1999; ACOG 2011; CDA 2008 & IADPSG 2010)

According to the table above, the OGTT is carried out after fasting the whole night, that is, 8-14 hours. 75g anhydrous glucose is mixed in 250ml-300ml water and taken by a pregnant patient after 2 hours. When the plasma glucose is  $\geq 7.0$ , then a person is seen to have GDM (WHO 1999) (needs to be updated because it is not evidence-based and is over 10 years old). According to ACOG 2011, treatment of GDM depends on 100g, 3hour oral glucose tolerance test. Microvascular disease can be determined by fasting plasma glucose rate of 7.0mmol/L with a 2hour glucose value of  $\geq 11.1$  in 75g oral glucose tolerance test (CDA 2008). From the HAPO study on women in the third trimester of pregnancy, it was evaluated that fasting plasma glucose  $\geq 5.8$ mmol/l and 2hour plasma glucose  $> 11.1$ mmol/l produced data in relation to maternal glycemia and particular side effects in implementing a criteria for diagnosing and categorizing GDM (IADPSG 2010).

In Sweden, screening of GDM is part of the Swedish Medical Surveillance of Pregnancy (Mödrahälsövård 2008). Here, the WHO guidelines of using 75g oral glucose tolerance tests are adopted. GDM is diagnosed when 2h value of blood glucose is greater or equal to 9.0mmol/l (WHO 1999). In most third world countries, only pregnant women who are at a risk of developing GDM are screened due to financial constraints (Jiwani et al. 2012).

### 2.1.3 Complications

GDM complications affect the mother, fetus/baby and infants. It can be short-term or long-term. For the fetus/baby, there is macrosomia (fetal size greater than 4kg), increased rate of stillbirth, birth asphyxia (deprivation of oxygen to a newborn) (Henriksen 2008), birth injury (shoulder dystocia, brachial plexus injuries, clavicle fractures) (Chu et al. 2007). There is also decrease in neonatal blood glucose level (hypoglycaemia) (Reece, Leguizamon & Wiznitzer 2009), polycythaemia (high amounts of red

blood cells in the blood) (Hopewell, Steiner, Ehrenkranz, Bizzarro & Gallagher 2011), death of newborn (Reece 2010), hypocalcaemia (Hay Jr 2012), low apgar scores (a method to quickly summarize the health of a newborn). As a result of the above complications, the baby is admitted into the neonatal intensive care unit for a longer period of time (AIHW 2010).

Infants of GDM mothers are faced with long-term complications such as delayed motor development, obesity, diabetes (Hillier, Pedula, Schmidt, Mullen, Charles & Pettitt 2007; Slining, Adair, Goldman, Borja & Bentley 2010), cardiovascular alterations, hypertension (Simeoni & Barker 2009), malignant neoplasm ( cells that look less like the normal cell of origin) (Wu, Nohr, Bech, Vestergaard & Olsen 2012), and schizophrenia (Wegelius, Tuuulio-Henriksson, Pankakoski, Haukka, Lehto, Paunio, Lönnqvist & Suvusaari 2011).

Complications for the mother with GDM are delivery through surgery, pregnancy hypertension, pre-eclampsia, induced labour (Ju, Rumbold, Willson & Crowther 2008), cardiovascular disease, obesity, type 2 diabetes (Kim 2010; Malcolm 2012), GDM reoccurring in future pregnancies (Kim, Berger & Chamany 2007), expulsion of fetus, prolonged labour pain (Schneidernan 2010), delayed milk production from the mammary glands (Salahudeen, koshy & Sen 2013). Mothers with the above complications stay longer than usual in the hospital (AIHW 2010). Mothers with GDM are usually anxious, afraid, depressed, and concerned about their own health and the health of their unborn baby (Devsam, Bogossian & Peacock 2013).

## 2.2 Prenatal Care

Prenatal care is the care a woman receives during gestation. Antenatal visits to a health care centre involves body examination, ultra sound examination, urine tests, Body mass index measurements, blood tests if required (March of Dimes 2011). Midwives provide prenatal care for the pregnant clients in Sweden (Mödrahälsovård 2008) and United Kingdom (Whitehouse 2010). In Finland, it is the public health nurses and midwives that provide care at the maternity clinics (neuvola). In Africa, nurses and midwives provide antenatal care.

According to the experiences of one of the writers, prenatal care visits in Finland starts once the pregnancy has been confirmed positive. The first visit is usually from 7-9 weeks, second visit 13-14 weeks depending on the municipality, third visit 16-17 weeks, fourth visit 22-23 weeks, fifth visit 27-28 weeks, sixth visit 30-31 weeks, seventh visit 33-34 weeks, eighth visit 36 weeks, ninth visit 37-38 weeks, tenth visit 40-41 weeks if required, eleventh visit 42 weeks. If no contractions in the forty-second week, an induction of labour is done. Most women start parturition from week 38. During the antenatal visit, the woman's weight, blood pressure, hemoglobin, and urine are assessed and recorded in the maternity card. The urine is checked for protein and glucose. An ultrasound is scheduled for week 12 and week 20 of the pregnancy. The fetus's heartbeat and body size are also observed during the antenatal visits.

Whitehouse (2010) states that up-to-date information on health promotion, disease prevention is provided during antenatal visits for the pregnant clients to make lifestyle changes for better fetal growth and development. The care is designed to discover and treat harmful situations during gestation (Whitehouse 2010). In Sweden, clients receive care for free, based on the fact that they are funded by taxes (Mödrahälsovård 2008). This system of funding and free care also applies in Finland. The routine antenatal care timetable from conception to delivery in the United Kingdom is shown in figure 1.

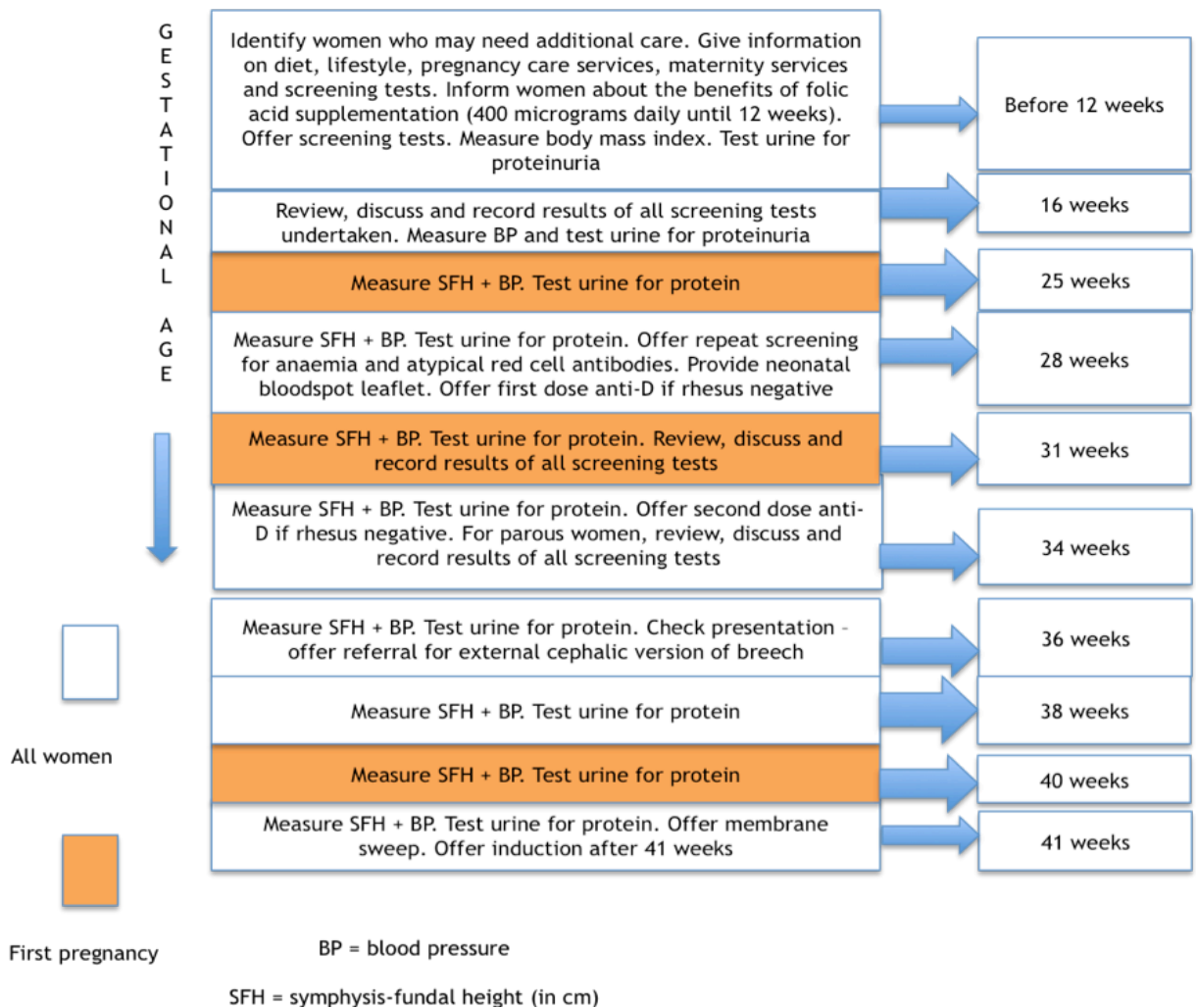


Figure 1: The routine antenatal care timetable from conception until delivery (Whitehouse 2010 Retrieved from the Oxford handbook of general practice 3rd edition)

### 2.3 Nursing Interventions

Nursing interventions are systematic research based findings exercised by nurses to benefit the patient (Bulechek, Butcher, Dochterman & Wagner 2013). In order to achieve the required goal, a nursing process needs to be implemented. Nursing process is defined as a key element for achieving patient centered outcomes (American Nurse Association 2017) through assessment, planning, implementation and evaluation of nursing care. Berman, Koziar and Erb (2010) state that assessment is the systematic and continuous collection, organisation, validation and documentation of information (Berman et al. 2010). Patient's health needs should be a cornerstone for nursing assessment rather than disease pathology (Wilkinson 2007). Nurses are required to make correct and important observations when assembling, affirming and arranging information together for

a collective decision to be made by putting into consideration the physical, psychological, spiritual, social and cultural aspects (Dougherty, Lister & West-Oram 2015).

Nursing diagnosis is one's clinical perception about a certain health or illness leading to its confirmation (Dougherty et al. 2015). Gathering of meaningful and suitable information from the patient provides substantial diagnostic accuracy in a patient's health care path. Planning recognises the nursing patient outcomes and formulates desired nursing interventions (Alfaro-Lefevre 2014) which are implemented and later evaluated. Nursing and Midwife Council (NMC) 2010 states that the composition and quality of documentation are a degree of principles of procedure associating to the competence and discernment of the nurse (NMC 2010).

### 3 Purpose of the study and Research question

The purpose of this study is to describe the nursing interventions in the management of gestational diabetes in prenatal care patients. The choice of this topic was influenced by our desire to acquire better understanding of existing research since we are from developing countries where there is little knowledge as regards to the topic.

The research question is; What kind of nursing interventions are implemented in the management of gestational diabetes in prenatal care patients?

## 4 Methodology

### 4.1 Literature Review

The research method chosen for this thesis is a literature review, which is an evaluated summary of other research (Coughlan, Cronin & Ryan 2013, 2). Machi and McEvoy (2009) state that "literature review is a critical appraisal of other research on a given topic that helps to put that topic in context" (Machi & McEvoy 2009). Literature review is key to establish, notify and summon data that can be used in academic group discussions. Reviewing provides a summary of up-to-date knowledge on a given aspect that is not based on a personal perspective. Literature review is predated by research question and how it is going to be discussed depends on the methodology one uses that may either be qualitative or quantitative research (Coughlan et al. 2013, 2). The literature review methodology was chosen so as to gather relevant and up-to-date data that can be disseminated to the developing countries especially Africa where we come from.

Engberg (2008) asserts that structured reviews are research studies and like all research enquiries, they require explicit and transparent methodology which in turn facilitates the aim of reaching an unbiased conclusion ( Engberg 2008). A literature review is guided by the inclusion and exclusion criteria that must be rationalized in order to yield reasonable findings (Coughlan et al. 2013, 38).

### 4.2 Database Search

The data search to answer the research question was executed between 20th of June 2017 and the 31st of July 2017. The databases used were Laurea Finna and Sage premier 2012. Laurea Finna retrieves articles from many of the journals that laurea has access to such as Cumulative Index to Nursing and Allied Health Literature (CINAHL)/EBSCOHost, pubmed, proquest, and Elsevier Sd Freedom collection. Laurea Finna is an electronic search portal that belongs to Laurea University of Applied Sciences, and Sage premier 2012 is an online database that has so many different scientific journals. Different search words were used so as not to miss out on vital information/findings. The keywords that were used for this search along with their synonyms were: Gestational diabetes mellitus (pregnancy diabetes/maternal diabetes), nursing interventions (management), and prenatal care (antenatal care). The Boolean operator "AND" was used to connect the keywords so as to get data/articles containing all of the

keywords used in the search. During the data search, titles and abstracts were scrutinized to get data that was relevant to the research question. The total number of articles that were relevant to the research question is illustrated in table 2.

Search Terms	Database	Total number of articles	1st Selection Stage	2nd Selection Stage	3rd Selection Stage
Nursing Interventions AND Gestational Diabetes AND Prenatal Care	Laurea Finna	27	0	0	0
	Sage Premier 2012	294	6	3	2
Nursing Interventions AND Gestational Diabetes	Laurea Finna	1,916	94	31	7
	Sage Premier 2012	771	18	5	1
Nursing Interventions AND Maternal Diabetes AND Prenatal Care	Laurea Finna	1,304	29	10	3
	Sage Premier 2012	423	5	1	0
Nursing Interventions AND Pregnancy Diabetes AND Prenatal Care	Laurea Finna	1,323	33	12	2
	Sage Premier 2012	465	5	0	0
Nursing Interventions AND Gestational Diabetes AND Antenatal Care	Laurea Finna	576	25	11	0
	Sage Premier 2012	251	5	1	2
Gestational Diabetes AND Prenatal Care AND Management	Laurea Finna	4,738	37	22	1
	Sage Premier 2012	410	10	5	6



Totals	Laurea Finna	9,884	218	86	13
	Sage Premier 2012	2,614	49	15	11
		12,498	267	101	24

Table 2: The literature search process, showing the number of retrieved articles and the different selection stages

#### 4.3 Inclusion and exclusion criteria

The search was restricted to full text only (has all the important information), peer reviewed articles (trustworthy), english language (easy to comprehend) and published between 2007 and 2017 (recent). With the above restrictions, 12,498 articles were retrieved. 267 articles of relevance to the study were chosen after reading the titles and abstracts. 101 articles were selected after scanning through the introductions and findings. 101 articles selected for indepth reading were screened for duplicates and triplicates before analysing them. 24 articles were finally selected based on the fact that they were of good quality, and relevant to the thesis. The inclusion and exclusion criteria for the chosen articles are shown in figure 2.

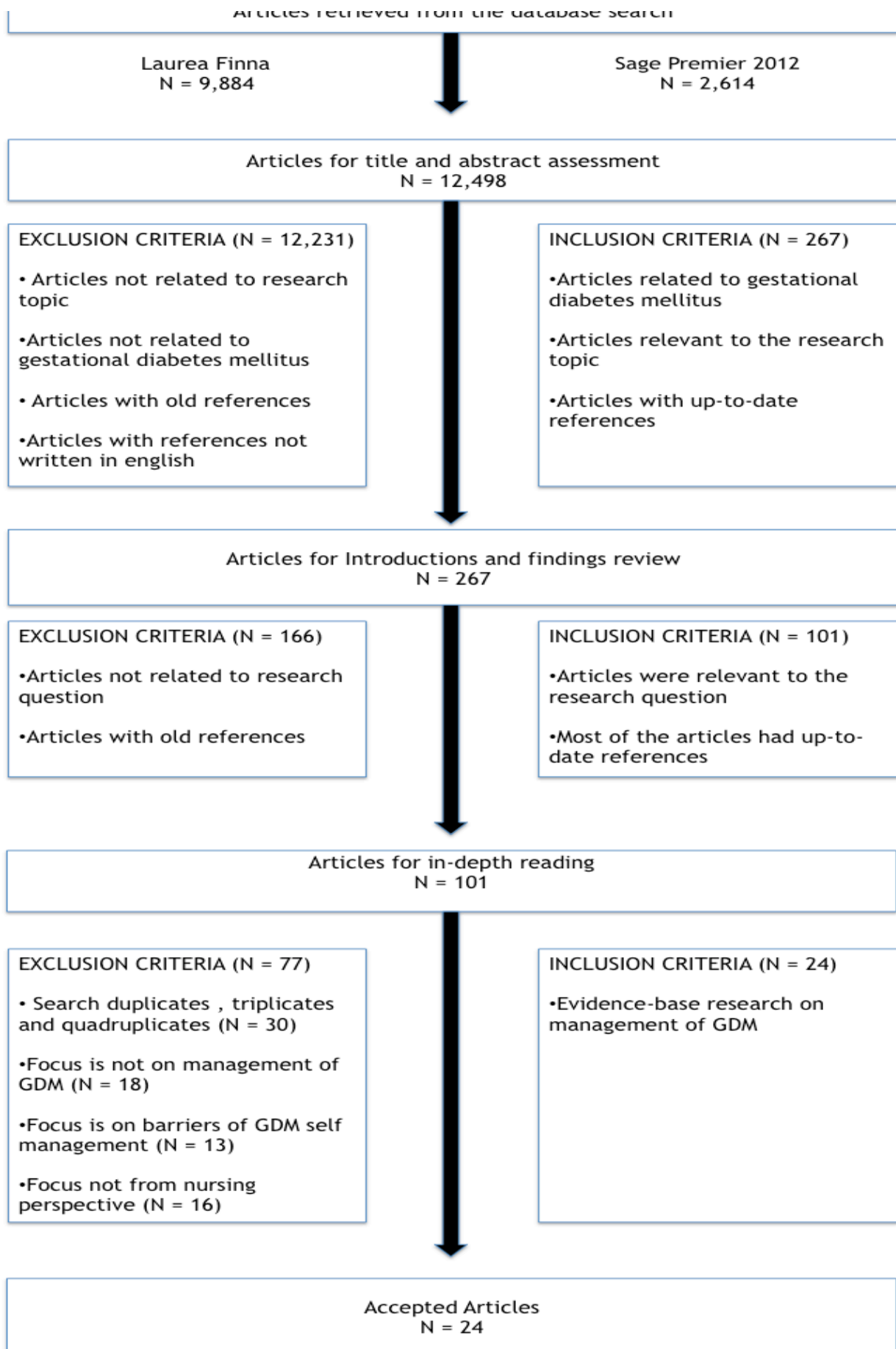


Figure 2: Data selection process

#### 4.4 Data Appraisal

Young & Solomon (2009) define critical appraisal as "a logical process used to identify the strengths and weaknesses of a research article in order to assess the usefulness and validity of research findings". In critical appraisal, a suitable assessment of the study plan for the research question and a meticulous evaluation of the methodology for that design are the major elements (Young & Solomon 2009).

The strength of the accepted articles were appraised using the Johns Hopkins Nursing Evidence-Based Practice Model and Guidelines. It uses a scale of I - V to ascertain the strength of the evidence. Scale/level I is regarded as the strongest form of evidence and scale/level V, the weakest form of evidence (Newhouse, Dearholt, Poe, Pugh & White 2007). The strength of the evidence levels I, II, III, IV and V are shown in table 3.

Level	Components
I	is characterised by experimental study, randomized controlled trial (RCT), systematic reviews of RCTs, with or without meta-analysis
II	consists of quasi-experimental study, systematic review of a combination of RCTs and quasi-experimental, or quasi-experimental studies only, with or without meta-analysis
III	includes non-experimental study, systematic review of a combination of RCTs, quasi-experimental and non-experimental, or non-experimental studies only, with or without meta-analysis
IV	is made up of opinion of respected authorities and/or nationally recognized expert committees/consensus panels based on scientific evidence (clinical practice guidelines and consensus panels)
V	comprises experiential and non-research evidence (literature reviews, case reports, quality improvement, program or financial evaluation and opinion of nationally recognized expert(s) based on experiential evidence)

Table 3: Strength of levels of Evidence (Dearholt & Dang 2012)

The quality of the accepted articles were appraised using quality guides A, B or C of the Johns Hopkins Nursing Evidence-Based Practice Model and Guidelines. Quality guide A is high quality, quality guide B, good quality and quality guide C, low quality. The quality guides for levels I, II and III are illustrated in table 4.

Quality	Components
A	consists of consistent, generalizable results; sufficient sample size for the study design; adequate control; definitive conclusions; consistent recommendations based on comprehensive literature review that includes thorough reference to scientific evidence
B	comprises reasonable consistent results; sufficient sample size for the study design; some control, fairly definitive conclusions; reasonably consistent recommendations based on fairly comprehensive literature review that includes some reference to scientific evidence
C	is made up of little evidence with inconsistent results; insufficient sample size for the study design; and conclusions cannot be drawn

Table 4: Quality guides of evidence for levels I, II and III (Dearholt & Dang 2012)

The quality guide for level IV is shown in table 5

Quality	Component
A	consists of material officially sponsored by a professional, public, private organization, or government agency; documentation of a systematic literature search strategy; consistent results with sufficient numbers of well-designed studies; criteria-based evaluation of overall scientific strength and quality of included studies and definitive conclusions; national expertise is clearly evident; developed or revised within the last 5 years
B	comprises material officially sponsored by a professional, public, private organization, or government agency; reasonably thorough and appropriate systematic literature search strategy; reasonably consistent results, sufficient numbers of well-designed studies; evaluation of strengths and limitations of included studies with fairly definitive conclusions; national expertise is clearly evident; developed or revised within the last 5 years
C	consists of material not sponsored by an official organization or agency; un-

	defined, poorly defined, or limited literature search strategy; no evaluation of strengths and limitations of included studies, insufficient evidence with inconsistent results, conclusions cannot be drawn; not revised within the last 5 years
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Table 5: Quality guides of evidence for level IV (Dearholt & Dang 2012)

The quality guide for level V is shown in table 6

Quality	Components
A	is made up of clear aims and objectives; consistent results across multiple settings; formal quality improvement, financial or program evaluation methods used; definitive conclusions; consistent recommendations with thorough reference to scientific evidence
B	comprises clear aims and objectives; consistent results in a single setting; formal quality improvement or financial or program evaluation methods used; reasonably consistent recommendations with some reference to scientific evidence
C	consists of unclear or missing aims and objectives; inconsistent results; poorly defined quality improvement, financial or program evaluation methods; recommendations cannot be made

Table 6: Quality guides of evidence for level V (Dearholt & Dang 2012)

The strength and quality of evidence of the accepted 24 articles is illustrated in table 7.

Level of Evidence	Number of Articles	Quality A (High Quality)	Quality B (Good Quality)	Quality C (Low Quality or Major Flaws)
Level I				
Level II	6	3	2	1
Level III	4		4	
Level IV	1		1	
Level V	13	9	4	
Total	24			

Table 7: Johns Hopkins Nursing Evidence Appraisal

#### 4.5 Data Extraction

Data extraction takes place before data synthesis in a literature review. Accepted articles for the research are reviewed thoroughly and the results that are pertinent to the research question are extracted. A tested data extraction form should be used when extracting relevant data to reduce the risk of bias and errors (Munn, Tufanaru & Aromataris 2014). It is also advised that in the data extraction process, a minimum of two reviewers should evaluate the articles independently to reduce the risk of bias and errors (Buscemi, Hartling, Vandermeer, Tjosvold & Klassen 2006). After the independent evaluation, the authors then come together to compare opinions (Munn et al. 2014).

The two authors reviewed the accepted articles independently and extracted data that was relevant into the extraction form such as aims, titles, level of evidence and conclusions of the individual articles. The complete analysis of the individual articles are illustrated in Appendix 1.

#### 4.6 Data Analysis

Thorne (2008) describes data analysis "as the process of moving from pieces to patterns through the activities of organizing, reading and reviewing mindfully, coding, reflection, thematic deviation and finding meaning" (Thorne 2008).

The qualitative content analysis was used to analyze the data and interpret its meaning (Schreier 2012). The benefit of qualitative research is the abundance of data put together and then explained and categorized in a reasonable and genuine way (Moretti, van Vliet, Bensing, Deledda, Mazzi, Rimondini & Fletcher 2011). In other words, qualitative content analysis reduces the quantity of data, and is flexible (Schreier 2012). It can be used either in an inductive or deductive way (Elo & Kyngäs 2008).

For this research, the inductive method was applied. Elo & Kyngäs (2008) state that "in an inductive approach, organization phase includes; open coding, creating categories and abstraction" (Elo & kyngäs 2008). Inductive research method necessitates looking for designs from inspection and evolution of illustration theories. These designed theories are acquired through sequences of hypothesis (Bernard 2011). In the inductive approach, the researcher starts with the collection of data that is relevant to the research question. After that, he searches for designs in the data and then creates a theory that describes those designs. That is, the researcher moves from distinct data to general theory (Blackstone 2012). Illustration of inductive approach is shown in figure 3

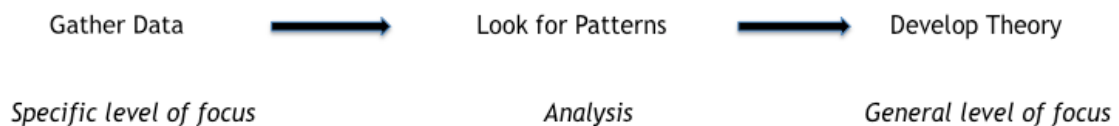


Figure 3: The inductive approach (Blackstone 2012)

The 24 articles that were accepted from the literature search were read thoroughly, and the information gotten were sorted and organized. Data that appeared so many times was identified, grouped under subcategories and then broader main categories so as to be able to manage the data. Throughout the organizing process, distinctively constructed sentences were assigned to each segment of raw data formulating 10 subcategories which were given initial titles. Eventually, 4 main categories with approved titles were generated from the 10 independent subcategories, thus, ending the analysis process. The 4 main categories identified are self-care management, medication, education and training, and social support . The sorting and organization of data is shown in figure 4.

**Summarized Data**

**Subcategories**

**Main Categories**

- Pregnant women should adopt a well-adjusted diet such as high intake of dairy products, fruits, poultry, fish, leafy vegetables, calcium, vitamin D and whey protein to reduce the risk of macrosomia
- Consumption of small meal to reduce postprandial glucose peaks
- Reduced consumption of saturated fat, red meat, refined grains and sweets to reduce the prevalence of GDM
- Increased consumption of dairy products and leafy vegetable to lower the risk of T2DM
- Medical nutrition therapy (MNT) reduces GDM complications
- Carbohydrate limited meals promote standard weight gain, normal glucose levels and exclusion of ketosis (ketonuria and ketonemia)
- Calorie procedure for a normal BMI is 30-35kcal/kg

Nutritional Requirements

- Physical activity decreases glucose levels, boosts insulin sensitivity and enhances the cardiovascular system
- Physical activity reduces gestational weight gain
- Prenatal activity reduces the risk for GDM among sedentary women
- Blood glucose levels (postprandial) after every meal is decreased by a 15 minutes simple exercise engagement
- Glucose monitoring during physical activity is inevitable so as to prevent exercise-induced hypoglycemia
- Imprudent abdominal exercises that lead to muscle contractions should be avoided during pregnancy

Physical Activity

- Self-monitoring of blood glucose levels on a daily basis using the glucometer
- Documentation of calorie intake by the GDM patient
- Monitoring of the weight by the GDM client
- Self-monitoring of blood glucose, recommendations for physical activities, information on healthy foods and general information on GDM using web and smartphone applications such as pregnant+ app.

Self-monitoring

- Insulin is initiated when maternal glycemia and fetal growth characteristics are taken into account

Insulin

- Oral hypoglycemic agents or Oral anti-diabetic medications such as metformin and glyburide is initiated when dietary, exercise and blood glucose self-monitoring fails to achieve the desired glycemic levels

Oral Hypoglycemic Agents

- Nurses/midwives/public health nurses are obliged to monitor GD complications during and after pregnancy for both mother and baby
- Health care professionals require education on risk factors, complications/ barriers as well as management of GDM as the number of cases is estimated to increase in the future
- Health care professionals require education on the different web applications that are best for GDM patient self-monitoring
- They require knowledge on lifestyle changes in the management and prevention of GDM during and after pregnancy

Health care Professionals Education

- Patients require education regarding the symptoms of hyperglycemia and are advised to seek medical attention if those symptoms appear
- Patients require education on the need for family planning to ensure optimum glycemia control before another pregnancy
- Patients need education on how to monitor the blood sugar level using glucometer
- Patients need to be educated on the advantages of breastfeeding. For the GDM patient, blood sugar reduction, decrease in weight retention, and reduction in long term risk of T2DM. For the offspring, decrease in the risk of obesity and metabolic syndrome
- GDM patients require education on recommendations for weight gain during pregnancy
- Patients need education on how to read food labels, know the nutritional values of various foods and beverages as well as appropriate portion sizes
- Patients require education regarding their lifestyle modifications through physical activity and MNT
- Patients need education on the general knowledge of GDM
- Patients require education on medical interventions that can be used in the management of GDM and the administration
- GDM women need education on the avoidance of nicotinic acid and glucocorticoids that worsen insulin resistance
- Patient education should be taught in a language that is understandable by that particular client

Patient Education

- Implementation of guidelines such as MNT guidelines on the management of diabetes in pregnancy (2009)
- International Association of Diabetes and Pregnancy Study Groups guidelines IADPSG (2010)

Written Guidelines

- Support from family and friends helps to adhere to diet and physical activities
- Emotional support e.g empathy

Family Support

- Support from the health care (physicians, dietitians, nurses etc)

Healthcare Professionals Support

Self-care Management

Medication

Education and Training

Social Support



Figure 4: The summarized data, subcategories and main categories of the inductive content analysis process

## 5 Findings

The purpose of this thesis is to describe the nursing interventions in the management of gestational diabetes in prenatal care patients. In order to achieve this, twenty-four (24) articles were reviewed thoroughly and the data obtained is discussed in this section of the thesis. The findings consists of 4 main categories, with 10 subcategories as mentioned earlier. The management of GDM are: self-care management, medication, education and training, and social support as shown in figure 5.

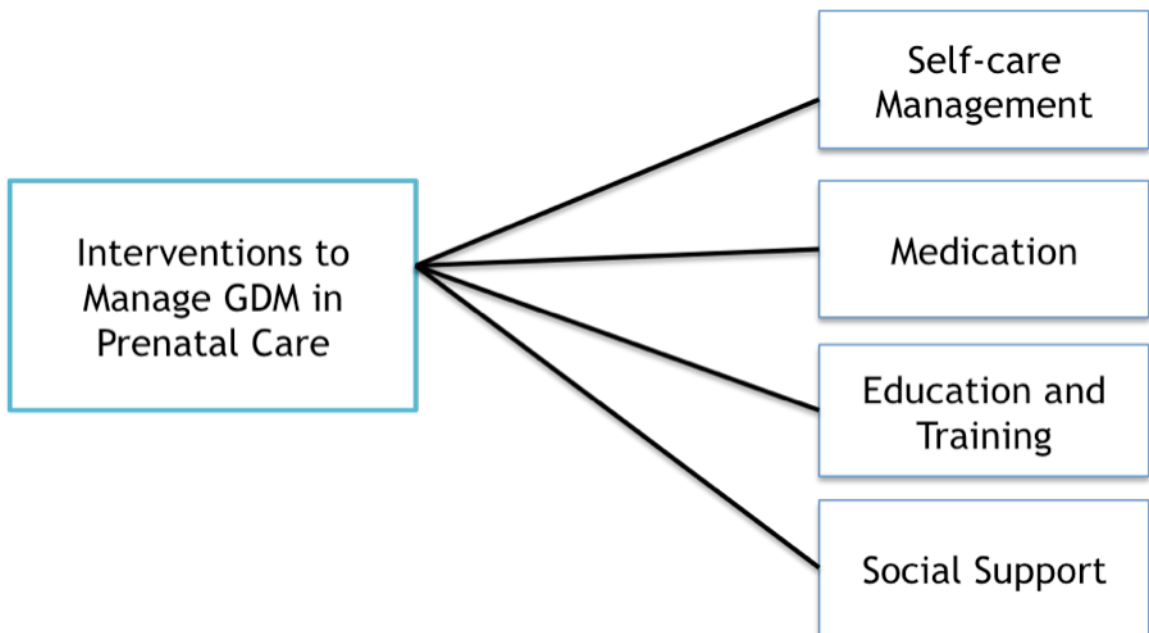


Figure 5: The 4 main categories in the management of GDM in prenatal care

### 5.1 Self-care Management

#### 5.1.1 Nutritional Requirements

The chief foundation of managing a woman with diabetes during pregnancy is through a diet that is well-balanced (Han, Crowther, Middleton & Heatley 2013). The balanced diet should comprise carbohydrates, proteins, fats and nutrition diary. The overall quantity of calories that is to be consumed per day is determined based on the current and ideal body weight of an individual and is known as medical nutrition therapy (MNT). MNT involves the

consumption of adequate nutrients and calories that the body requires during gestation. Underweight women ( $\text{BMI} < 19.8 \text{ kg/m}^2$ ) require 35-40 Kcal/kg/day of the ideal body weight, normal body weight women ( $\text{BMI} 19.8 - 29.9 \text{ kg/m}^2$ ) are to consume 30-32 Kcal/kg/day of the ideal body weight, overweight women ( $\text{BMI} \geq 30 \text{ kg/m}^2$ ) need 24-25 Kcal/kg/day of the ideal body weight (Bao, Bowers, Tobias, Olsen, Chavarro, Vaag, Kiely & Zhang 2014) and unwholesomely obese women, 12 Kcal/kg/day of the ideal body weight (Toiba 2013). In a study conducted in south east China by Li, Björn, Hadziabdic, Hjelm & Rask (2016), to explore beliefs about health and illness and health-related behaviour among urban Chinese women with GDM, it was observed that some women found it challenging to prepare GDM meal and estimate the quantity of diet correctly. According to a participant, she stated that

*"She (doctor) asked me to count the food, such as how many grams. How can I count every meal?...Sometimes I ate more than her advice; sometimes I ate less than her advice. I cannot eat exactly the standard meal". (Sarah) (Li et al 2016, 598).*

Meals containing carbohydrate based calories are recommended not to be consumed in the morning because insulin resistance is at its peak at that time of the day due to the release of cortisol and during gestation, its release is intensified. The diet should comprise three meals and four snacks per day and they should be consumed in little quantity to reduce postprandial glucose peaks (Ashwal & Hod 2015). Wholesome carbohydrates, for example, fibers (whole grains, fruits and vegetables); dairy foods; and healthy oils (monosaturated, polyunsaturated and omega-3 fatty acids) are recommended. Sugar sweetened beverages, saturated fats, trans fats and foods high in cholesterol should be avoided (ADA 2014). An observational study propose that a smaller consumption of saturated fat, red or processed meat, refined grains, and sweets and a greater intake of fiber, poultry and fish earlier or at the time of gestation results in a decreased prevalence of GDM (Zhang & Nung 2011; Karamanos, Thanopoulou, Anastasiou, Assad-Khalil, Albache, Bachaoui, Slama, El Ghomari, Jotic, Lalic, Lapolla, Saab, Marre, Vassallo, Savona-Venture & MGSD-GDM Study Group 2014). A larger accumulation of plasma vitamin B-12, C and D leads to a decreased risk of GDM (Zhang & Nung 2011; Krishnaveni, Hill, Veena, Bhat, Wills, Karat, Yajnik & Fall 2009).

A trial study on 6513 nonpregnant women (Sahariah, Potdar, Gandhi, Kehoe, Brown, Sane, Coakley, Marley-Zagar, Chopra, Shivshankaran, Cox, Jackson, Margetts & Fall 2016) conducted in Mumbai, India to determine whether increasing women's dietary in-

take of leafy green vegetables, fruits and milk (micronutrient rich-foods) before conception and throughout pregnancy reduced their risk of GDM. 2291 women became pregnant, 2028 reached a gestation of 28 weeks, 1008 were present for an OGTT using the WHO 1999 criteria and 100 had GDM. The results of this trial indicated that these food constituents had an important protective effect against the development of GDM (Sahariah et al 2016). It also stated that leafy green vegetables contain high amount of magnesium and a greater consumption leads to reduced risk of T2DM ( Larsson & Wolk 2007). Intake of large amounts of dairy products reduces the risk of future T2DM due to these components; calcium, vitamin D and whey protein (Tong, Dong, Wu, Li & Qin 2011).

### 5.1.2 Physical Activity

According to van Poppel, Oostdam, Eekhoff, Wouters, van Mechelen & Catalano (2013), physical activity decreases glucose levels, enhances insulin sensitivity and decreases the risk of progressing into T2DM without the presence of obesity. In a clinical study conducted (Oostdam, van Poppel, Eekhoff, Wouters & van Mechelen 2009), it was observed that physical activity intervention had no effect in the reduction of fasting blood glucose, insulin sensitivity and birth weight on obese and overweight pregnant women at risk of GDM in their second and third trimesters (Oostdam et al 2009). In a systematic review, it was identified that physical activity (moderate-to-vigorous intensity physical activity, MVPA) before or during pregnancy decreased the risk for GDM (Tobias, Zhang, van Dam, Bowers & HU 2011; van Poppel et al 2013; Redden, LaMonte, Freudenheim & Rudra 2011).

The United States Department of Health and Human Services, USDHHS (2008) provides physical activity guidelines which states that fit women who are not very active or not performing vigorous-intensity activity should undertake at least 150 minutes (2 hours and 30 minutes) of moderate intensity aerobic activity per week at the time of gestation. The already active gestating women should carry on with the physical activity during pregnancy as long as they are fit and should consult with their healthcare worker on which exercise that needs to be altered. Shelton (2013) proposes 30 minutes of brisk walking three to four times in a week. Snapp & Donaldson (2008) discovered that women who performed brisk walking three or more times in a week for six or more months of gestation had little probability of giving birth to a large for gestational age baby. Women that were inactive before should start with arm exercises. Imprudent abdominal

exercises that lead to muscle contractions should be avoided during pregnancy. Blood glucose level should be monitored before, during and after physical activity to prevent activity prompted hypoglycemia.

### 5.1.3 Self-monitoring

Self-monitoring of blood glucose regularly is preferred to irregular monitoring of plasma glucose (Magon & Seshiah 2011). Blood sugar is assessed seven times daily (prior to and after breakfast, lunch, dinner) and before going to bed at night (Kestila, Ekblad & Ronnema 2007)

A new monitoring method known as continuous glucose monitoring estimates the amount of glucose in subcutaneous interstitial tissue by measuring glucose every one second and saving the numerical mean value every five minutes, making the overall measurements per day 288. This method identifies a distinctly greater degree of GDM women requiring anti-hyperglycemic medication in comparison to self-monitoring of plasma glucose. Continuous glucose monitoring acts as a beneficial device in the prolonged management of GDM (Kestila, Ekblad & Ronnema 2007).

The proposition for weight gain for overweight women during pregnancy is 7kg and for underweight women is 18kg (Ashwal & Hod 2015). Pregnant women with GDM should frequently check their weight to be sure it lies within the stipulated range. Weight can be managed effectively if the diet consumed is well-balanced and the intake of calories measured accurately as mentioned in section 5.1.1 to nurture proper weight gain and fetal growth (Institute of Medicine and National Research Council 2009). Diets that help in weight reduction should be avoided during gestation (IDF 2009). The recommendations for weight gain during gestation as stipulated by Institute of medicine is shown in table 8.

Pre-pregnancy Weight Status	Body Mass Index (kg/m <sup>2</sup> )	Recommended Weight in Pounds
Underweight	< 18.5	28-40
Normal Weight	18.5 - 24.9	25 - 35
Overweight	25.0 - 29.9	15 - 25
Obese	≥ 30.0	11-20

\*Calculations assume a 11 - 14 lbs (0.5 - 2.0 kg) weight gain in the first trimester

Table 8: Weight gain recommendations during pregnancy (Institute of Medicine and National Research Council 2009)

The use of telemedicine is aimed at decreasing the number of GDM outpatients' clinical experience (Rasekaba, Furler, Blackberry, Tacey, Gray & Lim 2015). Mobile applications used by patients with GDM to acquire true advice on blood glucose monitoring are time-saving not only to the patient but nurses and doctors as well. MobiGuide run on Android gadgets (using computer interpretable guidelines) is a patient directing system-combining hospital observing data into a personal health record. When the value of ketonuria shows positive, the system will ask if the patient has been consuming authorized amount of calories and if yes then advised to increase carbohydrate intake to some amount depending on the results. According to observational prospective GDM study in 2012-2014, a group of women in their 34<sup>th</sup> week of gestation, older than 18 years, competent with smart phone and computer technology usage were chosen. Through out the study, 4561BG measurements, 997 ketonuria values, 369 BP measurements and 184 exercise data were attained showing that smart telemedicine were well-adapted and practicable in assisting GDM patients. Keeping track on required blood glucose observation was more articulate than in normal care (Rigla, Martinez-Sarriegui, Garcia-Saez, Pons & Hernando 2017).

The use of bluetooth-enabled BG meter through a smartphone app enabled two-way communication between the patient and diabetes midwife or physician and is analyzed three times a week. Out of the 106 women diagnosed with GDM from 2012-2013 in a pilot survey, 49 participated until delivery and were contented to continue using the smartphone application (Hirst, Mackillop, Loerup, Kevat, Bartlett, Gibson, Kenworthy, Levy, Tarassenko & farmer 2015).

In a randomized controlled trial in Norway, 230 pregnant women with GDM were given a pregnant+ app and standard care and the aim was to assess whether the use of the pregnant+ app along with the standard care resulted in improved glucose levels at regular OGTT. The pregnant+ app mechanically conveys blood glucose figures to the smartphone from the glucometer through bluetooth low energy and makes available a graphic survey showing if the measurements are within the required range. The app gives data on healthy diet, general information on GDM and its management and physical

activity (has 4 icons: blood glucose, food and beverages, physical activity and diabetes information). The results of this study indicated that the pregnant+ app helped the participants manage their GDM, for example, if the blood glucose levels are high as shown on the graph, the women are able to control the levels. The availability of basic data on GDM, important phone numbers and hospital routine on the pregnant+ app reduced distress, worries and frequent hospital visits (Garnweidner-Holme, Borgen, Garitano, Noll & Lukasse 2015).

## 5.2 Medication

### 5.2.1 Insulin

Insulin is a generally accepted treatment method in the medical management of GDM (Bone 2015). Medical interventions such as use of insulin in the management of gestational diabetes mellitus within meal times and at bedtime are more effective than twice a day dosage. Research carried out on 322 pregnant women with GDM showed that rapid acting insulin is conducive for pregnancy because it lowers postprandial glucose peaks, keeps blood sugar under normal-range (Mathieson, Kingsley, Amiel, Heller, McCance, Duran, Bellaire & Raben 2007) and maternal hypoglycemia threat lowered by 28% in the United States of America (US food and drug Administration 2017).

Insulin therapy as a supplement to dietary plan is considered when the abdominal circumference is over the 70th percentile (Kjos & Schaefer-Graf 2007). The quantity of insulin prescribed is based on the body weight (0.7-1.0 Units/kg) of the patient. Insulin dosage rises up to 50% from the initial dosage between 20-32 weeks of gestation. The mean quantity of insulin in the first trimester is 0.7 Units/kg, in the second trimester 0.8 Units/kg and in the third trimester 0.9-1 Unit/kg. Insulin can be administered through multiple dosage injections or continuous subcutaneous infusion (Ashwal & Hod 2015).

### 5.2.2 Oral hypoglycemic agents

Oral hypoglycemic agents (glyburide, metformin) are now being seen as the drug of choice when GDM is not contained by diet. They are becoming a substitute over insulin due to their easy administration, reduced cost, greater approval (Balsells, Garcia-Patterson, Sola, Roque, Gich & Corcoy 2015) and hypoglycemia and weight gain not occurring (Amin, Suksomboon, Poolsup & Malik 2015). For the management of GDM with Oral agents, the National Institute for Health and Care Excellence (NICE) approves met-

formin, ACOG proposes both glyburide and metformin, and The United States Food and Drug Administration has no recommendation yet (Metzger et al 2008).

Glyburide (glibenclamide) increases the insulin output from the pancreatic beta cells, broken down by the liver with a peak concentration of 2-3hours and has a half-life of 7-10 hours (Anjalakshi, Balaji, Balaji & Seshiah 2007). Glyburide is taken 30-60 minutes before a meal for better gestational results, has no transplacental passage to the fetus, thereby leading to a safe pregnancy (Navneet & Seshiah 2011). The cost effectiveness of glyburide in the treatment of GDM is seen to be more than that of insulin. On average, the cost saving on glyburide per person was 165.84 dollars (Nicholson, Bolen, Witkop, Neale, Wilson & Bass 2009). According to a systematic review done by Dhulkotia, Ola, aser & Farrell (2010), both insulin and oral hypoglycemic agents were effective and significant in glycemic control and gestation, and thus used as alternatives of insulin in pregnancy. Out of 10,778 women with treated gestational diabetes, the number of those that used glyburide elevated from 7.4% in 2000 to 64.5% in 2011 (Camelo, Boggess, Stumer, Brookhart, Benjamin & Jonsson 2014).

Metformin, an oral substitute agent for insulin can be used together with proper diet, exercise programs and other medications to control hyperglycemia in GDM. The fact that insulin does not tackle the main problem, insulin resistance, metformin a safe alternative and efficient oral hypoglycemic agent is implemented. Metformin increases insulin sensitivity, blood glucose tolerance, decreases the risk of hypoglycemia and weight gain. Being in tablet form, metformin is accepted and preferred in most GDM pregnant women (Hyer, Balani, Johnson & Shehata 2009). Based on metformin in gestation study (MIG) 2007, patients with a fasting glucose > 6mmol/L, 1-h postprandial blood glucose > 8mmol/L, 2-h postprandial blood glucose > 7mmol/L acquired before breakfast and 1-2h after meal were introduced to 500mg of metformin twice a day. Results showed that most of the patients exhibited a fast improvement in blood sugar levels within a week. Those that had a persistent high blood glucose got an addition of insulin to treat hyperglycemia (Rowan, Hague, Gao, Battin & Moore 2008).

### 5.3 Education and Training

#### 5.3.1 Healthcare professionals education

US population predictors, Passel & Cohn (2008) state that "the fastest growing hispanic population at higher risk for diabetes will increase from 14% in 2005 to 29% in 2050"

(Passel & Cohn 2008). Therefore diabetes educationalists must be ready for the expanding growth (United States Department of Health and Human Services Office of Minority Health, UDHSOMH 2015). Aspects such as culture, language are a cornerstone for a successful research outcome and goal achievement (Nielsen, Courten & kapur 2012).

### 5.3.2 Patient Education

Self management education is inevitable in the management of gestational diabetes for better antenatal outcomes during gestation (Coustan 2013). It has been discovered from other studies that most pregnant women with GDM especially in low income countries had no knowledge on GDM, its risk factors, preventive measures and lifestyles interventions such as proposed physical activity and well-balanced diet (Poth & Carolan 2013). Pregnant women need to have a good knowledge on GDM and the lifestyle interventions that manage or reduce GDM and future T2DM. They require education on family planning to guarantee maximum glycemia control prior to a future conception (Ashwal & Hod 2015). Pregnant women should be educated on the weight gain recommendations during gestation (Phelan, Phipps, Abrams, Darroch, Schaffner & Wing 2011). They should be taught how to read food labels, know the nutritional content of various types of foods and drinks (beverages) and right amount of food to be consumed per meal (Sullivan 2014). They should be guided on the type of physical activity to indulge in during gestation.

Counseling is required for the gestation client to be able to control her diet within the public framework, for example, foods in big folk get-together and meals cooked by friends and family members (Ho, Tran & Chesla 2015). According to the study conducted by Li et al (2016) to explore the beliefs about health and illness and health-related behaviour among urban women with GDM in the south east of China, it was difficult for some of the participants to adhere to the advice on diet management. According to a participant, she stated that

*"My mother-in-law cooks for me. It is impossible to tell her I must eat other things...The other people will think I am too fussy....I ate what I can eat from the dining table". (Emma) (Li et al 2016, 593,598).*



Breastfeeding should be promoted in patients with GDM as it reduces the risk of metabolic syndrome (Hayes 2014; Crume, Ogden, Mayer-Davies, Hamman, Norris, Bischoff, McDuffie & Dabelea 2012) and obesity in infants (Crume et al 2012). The advantages of breastfeeding for GDM women as demonstrated by studies are: decreases blood glucose, lowers the risk of future T2DM (Gunderson, Hedderston, Chiang, Crites, Walton, Azevedo, Elmasian, Young, Salvador, Lum, Quesenberry, Lo, Sternfeld, Ferrara & Selby 2012), and decreases weight retention (Baker, Gamborg, Heitmann, Lissner, Sorensen & Rasmussen 2008).

### 5.3.3 Written Guidelines

The Institute of Medicine, IOM (2011) defines clinical written guidelines as "statements that include recommendations intended to optimize patient care that are informed by a systematic review of evidence and an assessment of the benefits and harms of alternative care options". Written guidelines should be trustworthy and aimed at promoting better health outcomes.

IADPSG (2010) assessed a report on the findings of the hyperglycemia and adverse pregnancy outcome (HAPO) study on 23,000 pregnant women of different ethnicity. The results showed that moderate degrees of high blood sugar during gestation led to an increase in macrosomia, caesarean delivery and excessive insulin circulation in the blood (neonatal hyperinsulinemia). These findings led to the establishment of the prenatal screening guidelines for the diagnosis of GDM. The recommendations for GDM diagnosis is shown in tables 9 and 10.

	<b>Overt Diabetes</b>
Fasting plasma glucose	≥ 126 mg/dl - (≥ 7.0 mmol/L)
HbA1c	≥ 6.5% - (≥ 6.5%)
Random plasma glucose	≥ 200 mg/dl - (11.1 mmol/L)

HbA1c glycated hemoglobin

Table 9: IADPSG guidelines for the diagnosis of overt diabetes in pregnancy (IADPSG 2010)

	Hyperglycemia in Pregnancy*
Fasting plasma glucose	≥ 92 mg/dL – (≥ 5.1 mmol/L)
1-hour plasma glucose	≥ 180 mg/dL – (≥ 10.0 mmol/L)
2-hour plasma glucose	≥ 153 mg/dL – (≥ 8.5 mmol/L)

\* Diagnosis is based on one or more of 75-g OGTT thresholds equaled or exceeded

Table 10: IADPSG guidelines for the diagnosis of hyperglycemia in pregnancy (IADPSG 2010)

The other guidelines for the diagnosis of GDM as recommended by different organizations are mentioned in table 1.

MNT is a treatment program aimed at achieving an optimal blood glucose level by reducing calorie intake. The program involves counseling, educating, glucose self-monitoring in order to manage pre-eclampsia, maternal hospitalization and neonatal death in women with GDM. During this program, a professional dietician provides the clients with individual dietary counseling with indepth education on nutrition (Perera, Nakash, Covarrubias, Cano, Torres, Gonzalez & Ortega 2009). Section 5.1.1 explains the MNT recommendations for calorie intake during pregnancy.

## 5.4 Social Support

### 5.4.1 Family Support

A study carried out in the United States of America indicated that a large number of African Americans with GDM were able to modify their lifestyles with the support of their loved ones so as to reduce or prevent T2DM (Bieda 2009). In the study carried out by Li et al (2016), A participant stated that

*”My mother-in-law takes care of me and my husband as well. It is natural that the whole family takes care of you because you are pregnant...So the family’s support is important” (Anna) (Li et al 2016, 597).*

In a qualitative study on the perceived needs in women with gestational diabetes carried out in 2015 in Iran on pregnant women with GDM that are within 24th to 36th week

of pregnancy, it was observed that most of the participants obtained excellent support from family members (Khooshehchin, Keshavarz, Afrakhteh, Shakibazadeh & Faghizadeh 2016). According to a participant, she stated that,

*"My husband is a great supporter and really helps me. He says never think about bad things and try to be optimistic" (Frances) (Khooshehchin et al 2016)*

Some of the participants expressed their dismay in not receiving the support they needed from their loved ones (Khooshehchin et al 2016). Family support can be in the form of loved ones eating the same meal as the GDM woman, participating in the same physical activity, showing empathy.

#### 5.4.2 Healthcare Professionals Support

Healthcare professionals can inspire pregnant women in improving self-efficacy for exercise through promoting physical activity in a group (Kaiser & Razurel 2013). It is of essence to encourage physical activity before pregnancy as it has been discovered that it reduces the risk of getting GDM as mentioned earlier (Redden et al 2011). The risk of future diabetes, adverse effects of pregnancy and lifestyle modifications are managed when there is adequate support (Kaptein, Evans, McTavish, Banerjee, Feig, Lowe & Lipscombe 2015). Lack of support makes them defenseless (Devsam et al 2013) and is perceived as a prenatal risk factor and has adverse effects on gestation (Elsenbruch, Benson, Rucke, Rose, Dudenhausen, Pincus-Knackstedt, Klapp & Arck 2007).

Family and healthcare professionals support improves treatment of GDM in a way that issues like depression, eating disorders, stress, anxiety are addressed and effectively managed (Magon & Seshiah 2011). Support ensures that the women with GDM are in safe hands (Devsam et al 2013).

## 6 Discussion

### 6.1 Discussion of the findings

GDM, a rampant health concern is seen to be on an increase through out the world and accounts for 90-95% of all cases in gestation (ADA 2009; Landon & Gabbe 2011). GDM as a result of glucose intolerance has led to complications for the mother, baby and infants. Maternal age over 30-35 years, obesity, family history of GDM are some of the risk factors in pregnant women that nurses should pay attention to during screening at 24-28 weeks of pregnancy (Carolan 2013).

All the 24 articles reviewed with the exception of one article concentrated on the general interventions by healthcare professionals but not on nursing interventions in the management of GDM as the research question states, " What kind of nursing interventions are implemented in the management of gestational diabetes in prenatal care patients?". Four main categories unfolded from the data analysis: self-care management, medication, education and training, and social support. All the interventions deduced from the findings can be implemented by nurses and are somehow connected, that is, it is impossible to discuss one without referring to the others.

Nurses play a role in all the four main categories that were mentioned in the findings through education. Nurses are meant to provide clients with authentic, adequate, and up-to-date information in a culturally applicable manner (International Council of Nurses (ICN) 2012, 2). Education of the clients is the key to attaining the interventions in the management of GDM in prenatal care. The GDM women are able to implement self-care management (diet, exercise and self-monitoring) through the information they receive at the prenatal care centres in the form of leaflets, books, pregnancy app, counseling sessions to mention but a few. There are some obstacles that prevent pregnant women with GDM from practicing these lifestyle interventions. According to Downs, Chasen-Taber, Evenson, Leiferman & Yeo (2012), during gestation, women experience difficulty in performing physical activity and eating well-balanced meal due to nausea, tiredness, dyspnea (shortness of breath), heartburn (due to gastric reflux), leg cramps, body soreness and inadequate time (Downs et al 2012). To overcome these barriers, social support has to be implemented which involves the family members, nurses and other healthcare professionals. Women without social support are exposed to stress and decreased self-care. GDM can be managed effectively and future T2DM prevented or even delayed if self-care management is adopted and general knowledge on GDM disseminated.

Medication is usually introduced when diet fails to achieve the desired glycemia level. Nurses educate the clients on how to administer insulin or how to take the oral hypoglycemia agents as prescribed by the physician. Nurses should inform GDM women on the benefits of oral hypoglycemic agents over insulin and vice versa.

Nurses can improve their professional growth through continual learning as explained in the findings. According to ICN (2012), they have a responsibility to themselves and to their clients to make certain that their nursing expertise is up-to-date (ICN 2012, 3). A default on the part of the nurses to update their knowledge endangers the lives of their clients thereby, countering the ethical responsibility of nurses to promote health, prevent illness and to restore health (ICN 2012, 1). Management of GDM in prenatal care can be accomplished if nurses are open to novel knowledge.

Nurses should inform GDM mothers about the written guidelines for exercise, diet, and weight management and the need to adhere to them. Weight loss meals are not proposed during gestation but for overweight GDM women, IDF (2009) described that 30% reduction in energy intake does not result to ketosis (burning of fat instead of carbohydrate for energy).

In conclusion, effective management and reduction in the prevalence of GDM is through self-care management (diet, exercise and self-monitoring). A well-balanced diet through the Medical Nutrition Therapy (MNT) is a chief foundation of managing GDM. Nurses play an important role in counseling and educating women with GDM by providing indepth information on nutrition as stated by a clinical dietician. Nurses require further education and training on the general knowledge, management and prevention of GDM so as to provide suitable guidance to the GDM women.

## 6.2 Ethical Considerations

Ethical consideration helps a researcher to emphasize the aim of research by conveying genuine data, with sincerity and avoiding error. Information acquired from research should be based on trust, mutual respect, accountability and fairness (Sudeshna & Datt 2016).

As seen in the thesis, contributions of authors and researchers were recognized with either reference at the end of each sentence or ideas stated put in quotes (University of New South Wales, UNSW 2013). This is evidence that plagiarism was avoided at all cost. There was display of interest and full time involvement of participants at own will as we read through the findings in the 24 articles.

Copyrights were highly respected as seen in the 30 articles with duplicates, triplicates and quadruplicates that were sorted and excluded as shown in figure 2.

References were clearly written down as seen in laurea thesis guidelines to allow disclosure of sources (Laurea.fi)

### 6.3 Trustworthiness

The concept trustworthiness involves the aspect of credibility and is defined as the "trustworthiness, verisimilitude and plausibility of the research" (Tracy 2010). Satyendra & Srilata (2014) define credibility as "confidence in the trust of findings". These authors discuss Lincoln and Guba (1985)'s characteristics on trustworthiness as credible, dependable, transferable and conformable.

Credibility is a cornerstone of developing trustworthiness. It involves triangulation, random sampling, adoption of research methods initiated in qualitative investigation, tactics to ensure honesty in participants during data collection, negative case analysis, member checks, background, qualification and experience of the investigators (Lincoln and Guba 1985).

The writers used a qualitative method of data collection called literature review for the thesis. 12,498 articles were attained by including articles with full text, peer review, English language and published from year 2007-2017 and in the end, 24 articles were accepted after the inclusion and exclusion approach as shown in figure 2, pg 18. With Johns Hopkins Evidence-Based Practice Model and Guidelines table 7, pg 22, the 24 articles were appraised using quality guidelines A, B OR C. It is only one article that was rated in category C hence concluding that information collected from these different articles were considered of quality and useful to the research question on GDM.

Different study groups were used in the research with same methods being experimented on how to manage GDM. This helped investigators to find out the various management methods and their acceptability to the participants in order to reach a final conclusion, thus preventing investigator bias and promoting triangulation.

Satyendra & Srilata (2014) linked conformability to objectivity and defined it as “the degree of neutrality or the extent to which findings of a study are shaped by respondents but not research bias or interest” (Satyendra & Srilata 2014). As we read through the 24 articles, we discovered that it was participants’ decision to engage in the research and those who opposed were not forced. This helped to ensure honesty from informants and collection of facts.

Each article presented the background, qualification and experience of the researchers thus considering them trustworthy to be used and the writers concluded that the different study findings in these 24 articles were eligible in the management of GDM.

References used in some articles were seen in other articles with the same information in different countries. This showed that not only did other article writers trust the data collected from other sources but were able to use the data worldwide. The writers agreed that the information was certified in answering the thesis topic because it was dependable and transferable. Transferability was linked to external validity meaning that findings can be used in other contexts while dependability was linked to reliability implying that findings are constant and can be replicated (Satyendra & Srilata 2014).

#### 6.4 Limitations

Despite the fact that the aims and purpose of the research were attained, there were some unpreventable limitations. As novice writers, flaws are inevitable.

Firstly, all the articles reviewed were carried out in both developed and developing countries (so many countries were involved) with different interventions in the management of GDM.

Secondly, with the literature search criteria being restricted to full text, english language and not older than ten years, some vital information may have been missed in articles written in other languages and older than ten years. Relevant data might have been

lost as well in articles without free access due to cost. The Laurea UAS does not have access to so many research portals thereby leading to loss of data in articles that could have been found in those sites.

Thirdly, the articles reviewed were mainly level V with few II's and III's, thereby making the thesis lack high quality evidence materials. Further research is strongly needed to strengthen the results of this thesis.

## 6.5 Recommendations

From the findings, the writers recommend that nurses should receive adequate training on the management of GDM clients in prenatal care. Aspects such as language and culture should be put into consideration when educating both GDM pregnant women and professional healthcare team in order to have a good comprehension in the effective management of GDM .

Furthermore, the literature review used in this thesis was restricted to English language articles and developed and developing countries (with one article on Africa). The writers recommend further research to be conducted on studies carried out in Africa in order to establish the validity of our findings.



## References

- Agarwal, M.M., Dhatt, G.S. & Shah, S.M. (2010). Gestational diabetes mellitus simplifying the international association of diabetes and pregnancy diagnostic algorithm using fasting plasma glucose. *Diabetes Care* 33 (9), 2018-2020.
- Alfaro-LeFevre, R. 2014. *Applying Nursing Process: The Foundation for Clinical Reasoning*. Philadelphia: Lippincott Williams & Wilkins.
- American College of Obstetricians and Gynecologists 2011. Screening and diagnosis of gestational diabetes mellitus. Committee Opinion No. 504. *Obstetrics and Gynecology*, 118: 751-753.
- American Diabetes Association (ADA) 2012. Diagnosis and classification of Diabetes Mellitus. *Diabetes Care*, 35 (Suppl. 1), S64-S71.
- American Diabetes Association 2009. Standards of medical care in diabetes. *Diabetes Care*. 32 (Suppl. 1), S13-S61.
- American Diabetes Association 2014. Standards of medical care in diabetes. *Diabetes Care*, 37 (1), S14-S80. doi: 10.2337/dc14-So14.
- Amin, M., Suksomboon, N., Poolsup, N. & Malik, O. 2015. Comparison of glyburide with metformin in treating gestational diabetes mellitus: A systematic review and meta-analysis. *Clin Drug Investig*; 35: 343-351.
- Annesley, T.M. 2010. The Discussion Section: Your Closing Argument. *Clinical Chemistry*; 56: 1671-1674. <http://clinchem.aaccjnl.org/content/56/11/1671> Accessed 30 November 2017.
- Anjalakshi, C., Balaji, V., Balaji, M.S. & Seshiah V. 2007. A perspective study comparing insulin and glibenclamide in gestational diabetes mellitus in Asian Indian women. *Diabetes Res Clin Pract*; 76: 474-475.
- Ashwal, E. & Hod, M. 2015. Gestational diabetes mellitus: Where are we now? *Clinica Chimica Acta, International Journal of Clinical Chemistry*, 451 (Pt A): 14-20. doi: 10.1016/j.cca.2015.01.021.
- Australian Institute of Health and Welfare (AIHW) 2010. *Diabetes in pregnancy: its impact on Australian women and their babies*. Canberra.
- Baker, J.L., Gamborg, M., Heitmann, B.L., Lissner, L., Sorensen, T.I. & Rasmussen, K.M. 2008. Breastfeeding reduces postpartum weight retention. *American Journal of Clinical Nutrition*; 88 (6): 1543-1551. doi:10.3945/ajcn.2008.26379.
- Balsells, M., Garcia-Patterson, A., Sola, I., Roque, M., Gich, I. & Corcoy, R. 2015. Glibenclamide, metformin, and insulin for the treatment of gestational diabetes: a systematic review and meta-analysis. *British Medical Journal*, doi: 10.1136/bmj.h102.

- Bao, W., Bowers, K., Tobias, D.K., Olsen, S.F., Chavarro, J., Vaag, A., Kiely, M. & Zhang, C. Prepregnancy low-carbohydrate dietary pattern and risk of gestational diabetes mellitus: a prospective cohort study. *Am J Clin Nutr*, 99: 1378-1384.
- Bener, A., Saleh, N.M. & Al-Hamaq, A. 2011. Prevalence of gestational diabetes and associated maternal and neonatal complications in a fast-developing community: global comparisons. *International Journal of Womens Health*; 3:367-373.
- Berman, A., Kozier, B. & Erb, G.L. 2010. *Kozier and Erb's Fundamentals of Nursing*. Frenchs Forest, NSW: Pearson.
- Bernard, H.R. 2011. *Research Methods in Anthropology*. 5th ed., AltaMira Press.
- Bieda, J. 2009. Perceptions of risk for the development of type 2 diabetes in African-American women with gestational diabetes (Unpublished doctoral dissertation). University of Michigan, Ann Arbor.
- Blackstone, A. 2012. *Principles of Sociological Inquiry: Qualitative and Quantitative Methods* (v. 1.0). Maine: Saylor Foundation.
- Bone, R.L. 2015. Big Babies: An exploration of gestational diabetes. *International journal of Childbirth*; 3 (30): 42-45.
- Buscemi, N., Hartling, L., Vandermeer, B., Tjosvold, L. & Klassen T.P. 2006. Single data extraction generated more errors than double data extraction in systematic reviews. *Journal of Clinical Epidemiology*, 59 (7), 697-703.
- Camelo, C.W., Boggess, K., Stumer, T., Brookhart, M.A., Benjamin Jr, D.K. & Jonsson, F.M. 2014. Trends in glyburide compared with insulin used for gestational diabetes treatment in the United States, 2000-2011. *Obstetrics Gynecology*; 123: 1177-1184.
- Canadian Diabetes Association 2008. *Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada*. *Canadian Journal of Diabetes*, 32 (Suppl 1).
- Canadian Institute for Health Information 2013. The cost of giving birth in Canada. <http://publicationsgc.ca/collections/Collection/H118-38-2006E.pdf> Accessed 9 October 2017.
- Carolan, M. 2013. Women's experiences of gestational diabetes self management: A qualitative study. *Midwifery*. 29 (6), 637-645. doi:10.1016/j.midw.2012.05.013.PMID:22877761.
- Carolan-Olah, M., Steele, C. & Krenzin, G. 2015. Development and initial testing of a GDM information website for multi-ethnic women with GDM. *BMC Pregnancy and Childbirth*, 15: 145.
- Chu, S.Y., Callaghan, W.M., Kim, S.Y., Schmid, C.H., Lau, J., England, L.J. & Dietz P.M. 2007. Maternal obesity and risk of gestational diabetes mellitus. *Diabetes Care*, 30:2070-2076.
- Coughlan, M., Cronin, P. & Ryan, F. 2013. Doing a Literature Review in Nursing, *Health and Social Care*, 2-38.

Coustan, D.R. 2013. *Medical Management of Pregnancy Complicated by Diabetes*. 5th ed. Alexandria, VA: American Diabetes Association.

Crume, T.L., Ogden, L.G., Mayer-Davies, E.J., Hamman, R.F., Norris, J.M., Bischoff, K.J., McDuffie, R. & Dabelea, D. 2012. The impact of neonatal breast-feeding on growth trajectories of youth exposed and unexposed to diabetes in utero: The EPOCH study. *International Journal of Obesity*; 36 (4): 529-534. doi:10.1038/ijo.2011.254.

Cunningham, G.F., Leveno, J.K., Bloom, S.L., Hauth, J.C., Rouse, D.J. & Spong, C.Y. editors 2010. *Gestational diabetes*, in *Williams Obstetrics*. 23<sup>rd</sup> edition. Chapter 39. New York: McGraw Hill, 859-884.

Dearholt, S. & Dang, D. 2012. *Johns Hopkins Nursing Evidence-based Practice: Models and Guidelines*. 2<sup>nd</sup> ed. Honor Society of Nursing. Sigma Theta Tau International.

Devsam, B.U., Bogossian, F.E. & Peacock, A.S. 2013. An interpretive review of women's experiences of gestational diabetes mellitus: proposing a framework to enhance mid-wifery assessment. *Women Birth* S1871-5192(12)00103-5

Dhulkotia, J.S., Ola, B., Fraser, R. & Farrell, T. 2010. Oral hypoglycemic agents vs insulin in management of gestational diabetes: A systematic review and meta-analysis. *Am J Obstet Gynecol*; 203: 457- 459.

Dougherty, L., Lister, S. & West-Oram, A. (editors) 2015. *The Royal Marsden Manual of Clinical Nursing Procedures: Student Edition*, 9<sup>th</sup> ed. The Royal Marsden NHS Foundation Trust. John Wiley & Sons, Ltd.

Downs, D.S., Chasen-Taber, L., Evenson, K.R., Leiferman, J. & Yeo, S. 2012. Physical activity and pregnancy: past and present evidence and future recommendations. *Res Q Exerc Sport*; 83: 485-502.

Elo, S. & Kyngäs, H. 2008. The qualitative content analysis process. *Journal of Advanced Nursing*, 62, 107-115.

Elsenbruch, S., Benson, S., Rucke, M., Rose, M., Dudenhausen, J., Pincus-Knackstedt, M.K., Klapp, B.F. & Arck, P.C. 2007. Social support during pregnancy: effects on maternal depressive symptoms, smoking and pregnancy outcome. *Hum Reprod*; 22 (3): 869-877.

Engberg, S. 2008. Systematic reviews and meta-analysis, *Journal of Wound Ostomy Continence Nursing*, 35 (3): 258-265.

Fallah, S., Chen, X-K. & Lefebvre, D. 2011. Babies admitted to NICU/ICU: province of birth and mode of delivery method. *Healthc Q*. 14:16-20.

Feig, D.S. 2008. Risk of development of diabetes mellitus after diagnosis of gestational diabetes. *Canadian Medical Association Journal*, 179 (3), 229-234.

Ferrara, A. 2007. Increasing prevalence of gestational diabetes mellitus a public health perspective. *Diabetes Care* 30:141-146.

Galtier, F. 2010. Definition, epidemiology, risk factors. *Diabetes Metab*. 36 (2), 628-651.

- Gandhi, P., Bustani, R., Madhuvrata, P. & Farrell, T. 2012. Introduction of metformin for gestational diabetes mellitus in clinical practice: has it had an impact? *Eur. J. Obstet. Gynecol. Reprod. Biol.* 160 (2), 147-150.
- Garnweidner-Holme, L.M., Borgen, I., Garitano, I., Noll, J. & Lukasse, M. 2015. Designing and developing a mobile smartphone application for women with gestational diabetes mellitus followed-up at diabetes outpatient clinics in Norway. *Healthcare (basel)*; 3: 310-323.
- Gunderson, E.P., Hedderston, M.M., Chiang, V., Crites, Y., Walton, D., Azevedo, R.A., Elmasian, C., Young, S., Salvador, N., Lum, M., Quesenberry, C.P., Lo, J.C., Sternfeld, B., Ferrara, A. & Selby, J.V. 2012. Lactation intensity and postpartum maternal glucose tolerance and insulin resistance in women with recent GDM: The SWIFT cohort. *Diabetes Care*; 35 (1): 50-56. doi:10.2337/dc11-1409.
- Han, S., Crowther, C.A., Middleton, P. & Heatley, E. 2013. Different types of dietary advice for women with gestational diabetes mellitus. *Cochrane Database Syst Rev*, 3: CD009275
- Hay Jr, W.W. 2012. Care of the infant of the diabetic mother. *Curr Diab Rep*, 12: 4-15.
- Hayes, S. 2014. Using motivational interviewing to encourage women with gestational diabetes mellitus to breastfeed as a method of reducing their risk of type 2 diabetes mellitus. *Australian Nursing and Midwifery Journal*; 21 (10): 32-35.
- Henriksen, T. 2008. The macrosomic fetus: a challenging current obstetrics. *Acta Obstet Gynecol Scand.* 87 (2), 134-145
- Hillier, T.A., Pedula, K.L., Schmidt, M.M., Mullen, J.A. , Charles, M.A. & Pettitt, D.J. 2007. Childhood obesity and metabolic imprinting: the ongoing effects of maternal hyperglycemia. *Diabetes Care*, 30 (9), 2287-2292.
- Hirst, J.E., Mackillop, L., Loerup, L., Kevat, D.A., Bartlett, K., Gibson, O., Kenworthy, Y., Levy, J.C., Tarassenko, L. & farmer, A. 2015. Acceptability and user satisfaction of a smartphone-based, interactive blood glucose management system in women with gestational diabetes mellitus. *Journal of Diabetes Science and Technology*; 9 (1): 111-115.
- Ho, E.Y., Tran, H. & Chesla, C.A. 2015. Assessing the cultural in culturally sensitive printed patient-education materials for Chinese Americans with type 2 diabetes. *Health Communication*, 30(1), 39-49. doi:10.1080/10410236.2013.835216.
- Hopewell, B., Steiner, L.A., Ehrenkranz, R.A., Bizzarro, M.J. & Gallagher, P.G. 2011. Partial exchange transfusion for polycythemia hyperviscosity syndrome. *Am J Perinatol*, 28: 557-564.
- Hyer, S.L., Balani, J., Johnson, A.J. & Shehata, H. 2009. Metformin treatment for gestational diabetes. *British Journal of Diabetes and Vascular Disease*; 9 (5): 220-225.
- Institute of Medicine 2011. About systematic evidence reviews and clinical practice guidelines. <https://www.nhlbi.nih.gov> Accessed 22 November 2017.

Institute of Medicine and National Research Council 2009. Weight gain during pregnancy: Reexamining the guidelines. Washington, DC: The National Academies Press.

International Association Of Diabetes And Pregnancy Study Groups Consensus Panel 2010. International association of diabetes and pregnancy study groups recommendations on the diagnosis and classification of hyperglycemia in pregnancy. *Diabetes Care*; 33 (3): 676-682.

International Council of Nurses 2012. The ICN Code of Ethics for Nurses. [http://www.icn.ch/images/stories/documents/about/icncode\\_english.pdf](http://www.icn.ch/images/stories/documents/about/icncode_english.pdf) Accessed 8 December 2017.

International Diabetes Federation Clinical Guidelines Task Force 2009. Global guideline on pregnancy and diabetes. Brussels: International Diabetes Federation

International Diabetes Federation 2013. International Diabetes Atlas, 6<sup>th</sup> ed. <http://www.idf.org/diabetesatlas> Accessed 10 October 2017

International Diabetes Federation 2015. International Diabetes Atlas, 7<sup>th</sup> ed. <http://www.idf.org/diabetesatlas> Accessed 9 October 2017.

Jiwani, A., Marseille, E., Lohse, N., Damm, P., Hod, M. & Kahn, JG. 2012. Gestational diabetes mellitus: results from a survey of country prevalence and practices. *J. Matern. Fetal Neonatal Med.* 25 (6), 600-610.

Ju, H., Rumbold, A.R., Willson, K.J. & Crowther, C.A. 2008. Borderline gestational diabetes mellitus and pregnancy outcomes. *BMC Pregnancy Childbirth*, 8: 31.

Kaiser, B. & Razurel, C. 2013. Determinants of postpartum physical activity, dietary habits and weight loss after gestational diabetes mellitus. *Journal of Nursing Management*; 21: 58-69. doi: 10.1111/jonm.12006.

Kaptein, S., Evans, M., McTavish, S., Banerjee, A.T., Feig, D.S., Lowe, J. & Lipscombe, L.L. 2015. The Subjective Impact of a Diagnosis of Gestational Diabetes Among Ethnically Diverse Pregnant Women: A Qualitative Study. *Can J Diabetes*; 39 (2): 117-122.

Kapustin, J.F. 2008. Postpartum management for gestational diabetes mellitus: Policy and practice implications. *Journal of the American Academy of Nurse Practitioners*. 20 (11), 547-554.

Karamanos, B., Thanopoulou, A., Anastasiou, E., Assad-Khalil, S., Albache, N., Bachaoui, M., Slama, C.B., El Ghomari, H., Jotic, A., Lalic, N., Lapolla, A., Saab, C., Marre, M., Vassallo, J., Savona-Venture, C. & MGSD-GDM Study Group 2014. Relation of the Mediterranean diet with the incidence of gestational diabetes. *Eur J Clin Nutr*; 68: 8-13.

Kestila, K.K., Ekblad, U.U. & Ronnema, T. 2007. Continuous glucose monitoring versus self-monitoring of blood glucose in the treatment of gestational diabetes mellitus. *Diabetes Res Clin Pract*; 77: 174-179.

Khooshehchin, T.E., Keshavarz, Z., Afrakhteh, M., Shakibazadeh, E. & Faghihzadeh, S. 2016. Perceived needs in women with gestational diabetes: A qualitative study. *Electronic Physician*; 8 (12): 3412-3420.

- Kim, C. 2010. Gestational diabetes mellitus and risk of future maternal cardiovascular disease. *Expert Rev Cardiovasc Ther*, 8 (12): 1639-1641.
- Kim, C., Berger, D. & Chamany, S. 2007. Recurrence of gestational diabetes mellitus: a systematic review. *Diabetes Care* 30: 1314-1319.
- Kjos, S.L. & Schaefer-Graf, U.M. 2007. Modified therapy for gestational diabetes using high-risk and low-risk fetal abdominal circumference growth to select strict versus relaxed maternal glycemic targets. *Diabetes Care*; 30 (Suppl. 2): S200-S205.
- Krishnaveni, G.V., Hill, J.C., Veena, S.R., Bhat, D.S., Wills, A.K., Karat, C.L.S., Yajnik, C.S. & Fall, C.H.D. 2009. Low plasma vitamin B12 in pregnancy is associated with gestational 'diabesity' and later diabetes. *Diabetologia*; 52: 2350-2358.
- König, A.B., Junginger, S., Reusch, J., Louwen, F. & Badenhop, K. 2014. Gestational diabetes outcome in a single centre study: Higher BMI in children after six months. *Hormone and Metabolic Research*, 46, 11: 804-809.
- Lamberg, S., Raitanen, J., Rissanen, P. & Luoto, R. 2012. Prevalence and regional differences of gestational diabetes mellitus and oral glucose tolerance test in Finland. *European Journal of Public Health*. 2:278-280. Accessed 9 October 2017.
- Landon, M.M 2009. A multicenter randomized trial of treatment for mild gestational diabetes. *New England Journal of Medicine*. 361 (14), 1339-1348.
- Landon, M.B. & Gabbe, S.G. 2011. Gestational diabetes mellitus. *Obstet Gynecol*, 118: 1379-1393.
- Larsson, S.C. & Wolk, A. 2007. Magnesium intake and risk of type 2 diabetes: a meta-analysis. *J Intern Med*; 262: 208-14.
- Laurea.fi  
<https://laurea.uef.fi/sites/linken/studypath/thesis/implementation/Pages/default.aspx> Accessed 1 September 2017.
- Leary, J., Pettitt, D.J. & Jovanovic, L. 2010. Gestational diabetes guidelines in a HAPO world. *Best Pract Res Clin Endocrinol Metab*, 24(4):676-682.
- Li, G., Björn, A., Hadziabdic, E., Hjelm, K. & Rask, M. 2016. Beliefs about health and illness and health-related behaviour among urban women with gestational diabetes mellitus in the south east of China. *Journal of Transcultural Nursing*; 27 (6): 593-602.
- Lincoln, Y.S. & Guba, E.G. 1985. *Naturalistic inquiry*. Newbury Park, CA: Sage Publications.
- Link, C.L. & McKinlay, J.B. 2009. Disparities in the prevalence of diabetes: is it race/ethnicity or socioeconomic status? Results from the Boston Area Community Health (BACH) survey. *Ethn Dis*. 19(3), 288-292.
- Lowe, W. & Karban, J. 2014. Genetics, genomics and metabolomics: new insights into maternal metabolism during pregnancy. *Diabet Med*. 31 (3), 254-262.

Machi, I. & McEvoy, B. 2009. The literature review: Six steps to success. Thousand Oaks, CA: Sage.

Magon, N. & Seshiah, V. 2011. Gestational diabetes mellitus: Non-insulin management. *Indian Journal of Endocrinology and Metabolism*; 15: 284-293.

Malcolm, J. 2012. Through the looking glass: gestational diabetes as a predictor of maternal and offspring long-term health. *Diabetes Metab Res Rev*, 28 (4): 307-311.

March of Dimes. 2011. Your first prenatal care check up. Retrieved October 14, 2017. <http://www.marchofdimes.org/pregnancy/your-first-prenatal-care-checkup.aspx>.

Mathieson, E.R., Kingsley, B., Amiel, S.A., Heller, S., McCance, D., Duran, S., Bellaire, S. & Raben, A. 2007. On behalf of the Insulin Aspart Pregnancy Study Group. Maternal glycaemic control and hypoglycaemia in type 1 diabetic pregnancy. *Diabetes Care*; 30: 771-776.

Metzger, B.E., Lowe, L.P., Dyer, A.R., Trimble, E.R., Chaovarindr, U., Coustan, D.R., Hadden, D.R., McCance, D.R., Hod, M., McIntyre, H.D., Oats, J.J., Persson, B., Rogers, M.S. & Sacks, D.A. 2008. Hyperglycemia and adverse pregnancy outcomes. *New England Journal of Medicine*. 358: 1991-2002.

Moretti, F., van Vliet, L., Bensing, J., Deledda, G., Mazzi, M., Rimondini, M. & Fletcher, I. 2011. A Standardized approach to qualitative content analysis of focus group discussion from different countries. *Patient Education and Counseling*, 82, 420-428.

Moss, J.R., Crowther, C.A., Hiller, J.E., Willson, J.K. & Robinson, J.S. 2007. Australian carbohydrate intolerance study in pregnant women group. Costs and Consequences of treatment for mild gestational diabetes - evaluation from ACHOIS randomised trial. *BMC pregnancy childbirth*. 7:27.

Munn, Z., Tufanaru, C. & Aromataris, E. 2014. Data Extraction and Synthesis: the steps following study selection in a systematic review. *The American Journal of Nursing*, 114 (7), 49-54.

Navneet, M. & Seshiah, V. 2011. Gestational diabetes Mellitus: Non-insulin management. *Indian Journal of Endocrinology and Metabolism*; 86 (115): 206-207.

Newhouse, R., Dearholt, S., Poe, S., Pugh, L. & White, K. 2007. Johns Hopkins Nursing Evidence-based Practice Model and Guidelines. Indianapolis: Sigma Theta Tau International.

Nicholson, W., Bolen, S., Witkop, C.T., Neale, D., Wilson, L. & Bass, E. 2009. Benefits and risks of oral diabetes agents compared with insulin in women with gestational diabetes: A systematic review. *Obstet Gynecol*; 113: 193-205.

Nielsen, K.K., Maximilian de Courten, & Kapur, A. 2012. Health system and societal barriers for gestational diabetes mellitus (GDM) services-lessons from World Diabetes Foundation supported GDM projects. *BMC International Health and Human Rights*. 12:33. <http://www.biomedcentral.com/1472-69X/12/33>. Accessed 19 October 2017.

Nursing and Midwife Council 2010. Record Keeping: Guidance for Nurses and Midwives. London: NMC. Available at: [www.nmc-uk.org/Documents/NMC-Publications/NMC-Recording-Keeping-Guidance.pdf](http://www.nmc-uk.org/Documents/NMC-Publications/NMC-Recording-Keeping-Guidance.pdf)

Oostdam, N., van Poppel, M.N., Eekhoff, E.M., Wouters, M.G. & van Mechelen, W. 2009. Design of foit for 2 study: the effects of an exercise program on insulin sensitivity and plasma glucose levels in pregnant women at high risk for gestational diabetes. *BMC Pregnancy Childbirth*; 9:1.

Passel, J.F. & Cohn, D. 2008. U.S. population predictions. <http://www.pewhispanic.org/2008/02/11/us-population-projections-2005-2050/> Accessed 22 November 2017.

Perera, O.P., Nakash, M.B., Covarrubias, A.P., Cano, A.R., Torres, A.R., Gonzalez, C.O. & Ortega, F.V. 2009. A medical nutrition therapy program improves prenatal outcomes in Mexican pregnant women with gestational diabetes and type 2 diabetes mellitus. *The Diabetes Educator*; 35 (6): 1004-1013.

Phelan, S., Phipps, M.G., Abrams, B., Darroch, F., Schaffner, A. & Wing, R.R. 2011. Practitioner advice and gestational weight gain. *Journal of Women's Health*; 20 (4), 585-591. doi:10.1089/jwh.2011.2316

Poth, M. & Carolan, M. 2013. Pregnant women's knowledge about the prevention of gestational diabetes mellitus: A qualitative study. *British Journal of Midwifery*, 21 (10), 692-700.

Rasekaba, T.M., Furler, J., Blackberry, I., Tacey, M., Gray, K. & Lim, K. 2015. Telemedicine interventions for gestational diabetes mellitus: a systematic review and meta-analysis. *Diabetes Res Clin Pract*; 110: 1-9.

Ravichandran, J. & Karalasingam, S.D. 2009. Preliminary report of national obstetrics registry, Ministry of Health, Malaysia, 18 (11), 30-31.

Redden, S.L., LaMonte, M.J., Freudenheim, J.L. & Rudra, C.B. 2011. The association between gestational diabetes mellitus and recreational physical activity. *Maternal Child Health Journal*; 15: 514-519. doi:10.1007/s10995-010-0586-7.

Reece, E.A. 2010. The fetal and maternal consequences of gestational diabetes mellitus. *J. Matern. Fetal Neonatal Med.* 23 (3), 199-203.

Reece, E.A., Leguizamon, G. & Wiznitzer, A. 2009. Gestational diabetes: the need for a common ground. *Lancet*, 373 (9677): 1789-1797.

Rigla, M., Martinez-Sarriegui, I., Garcia-Saez, G., Pons, B. & Hernando, M.E. 2017. Gestational diabetes management using smart mobile telemedicine. *Journal of Diabetes Science and Technology*; 1-5.

Rowan, J.A., Hague, W.M., Gao, W., Battin, M.R. & Moore, M.P. 2008. For the MIG Trial Investigators. Metformin versus insulin for the treatment of gestational diabetes. *N Engl J Med*; 359 (19): 2003-2015.

Sahariah, S.A., Potdar, R.D., Gandhi, M., Kehoe, S.H., Brown, N., Sane, H., Coakley, P.J., Marley-Zagar, E., Chopra, H., Shivshankaran, D., Cox, V.A., Jackson, A.A., Mar-



- getts, B.M & Fall, C.H.D. 2016. A daily snack containing leafy green vegetables, fruit, and milk before and during pregnancy prevents gestational diabetes in a randomized, controlled trial in Mumbai, India. *The Journal of Nutrition*; suppl 1453S-1460S. doi:10.3945/jn.115.223461.
- Salahudeen, M.S., Koshy, A.M. & Sen, S. 2013. A study of the factors affecting time to onset of lactogenesis-II after parturition. *Journal of Pharmacy Research*, 6 (1), 68-72.
- Satyendra, C.P. & Srilata, P. 2014. Establishing reliability and validity in qualitative enquiry. A critical examination. *Jharkhand journal of development and management studies*; 12 (1): 5743-5753.
- Sayehmiri, F., Bakhtiari, S., Darvishi, P. & Sayehmiri, K. 2013. Prevalence of Gestational Diabetes Mellitus in Iran: A systematic review and meta-analysis study. *Iranian Journal of Obstetric Gynecology and Infertility*. 15 (40), 16-23.
- Schneiderman, E.H. 2010. Gestational diabetes: an overview of a growing health concern for women. *J. Infus. Nurs.* 33 (1), 48-54.
- Schreier, M. 2012. *Qualitative content analysis in practice*. Thousand Oaks, CA: Sage.
- Senti, J., Thiele, D.K. & Anderson, C.M. 2012. Maternal vitamin D status as a critical determinant in gestational diabetes. *Journal of Obstetric, Gynecologic, and Neonatal Nursing*, 41: 328-338.
- Shelton, S. 2013. Management of diabetes and comorbidities in pregnancy. Presented at 28<sup>th</sup> Annual Clinical Conference on Diabetes; May 23-26; Orlando, FL.
- Skupien, J., Cyganek, K. & Malecki, M.T. 2014. Diabetic pregnancy: an overview of current guidelines and clinical practice. *Curr Opin Obstet Gynecol*, 26:431-437.
- Simeoni, U. & Barker, D.J. 2009. Offspring of diabetic pregnancy: Long-term outcomes. *Seminars in fetal and neonatal medicine*. 14 (2), 119-124.
- Slining, M., Adair, L.S., Goldman, B.D., Borja, J.B. & Bentley, M. 2010. Infant overweight is associated with delayed motor development. *J Pediatr*. 157 (1): 20-25 e1.
- Snapp, C.A. & Donaldson, S.K. 2008. Gestational diabetes mellitus: Physical exercise and health outcomes. *Biological Research for Nursing*; 10 (2): 145-155.
- Sudeshna & Datt, S. 2016. Importance of ethical considerations in a research. <https://www.projectguru.in/publications/importance-ethical-considerations-research/> Accessed 17 November 2017.
- Sullivan, D.H. 2014. Obesity prevention starts prenatally. *International Journal of Child-birth Educators*; 29 (2): 10-11.
- The American Nurse Association 2017. *Nursing Process*. <http://www.nursingworld.org/EspeciallyForYou/What-is-Nursing/Tools-You-Need/TheNursingProcess.html>
- Thorne, S. 2008. *Interpretive description*. Walnut Creek, CA: Left Coast Press.

- Tobias, D.K., Zhang, C., van Dam, R.M., Bowers, K. & Hu, F.B. 2011. Physical Activity Before and During Pregnancy and Risk of Gestational Diabetes Mellitus A meta-analysis. *Diabetes Care*; 34 (1): 223-229.
- Toiba, R. 2013. Gestational diabetes- Diagnosis, Treatment and Outcomes. *Today's Dietitian*; 48-54.
- Tong, X., Dong, J.Y., Wu, Z.W., Li, W. & Qin, L.Q. 2011. Dairy consumption and risk of type 2 diabetes mellitus; a meta-analysis of cohort studies. *Eur J Clin Nutr*; 65: 1027-1031.
- Tracy, S.J. 2010. Qualitative quality: Eight "Big-tenth" Criteria for excellent qualitative research. *Qualitative inquiry*, 16 (10): 837-851.
- United States Department for Health and Human Services 2008. 2008 physical activity guidelines for Americans.  
<http://www.health.gov/paguidelines/guidelines/default.aspx#toc> Retrieved 13 November 2017.
- United States Department of Health and Human Services Office of Minority Health 2015. Diabetes and hispanic Americans.  
<https://minorityhealth.hhs.gov/omh/browse.aspx?lvl=4&lvlid=63> Accessed 19 October 2017.
- United States Food and Drug Administration 2017.  
[http://www.accessdata.fda.gov/drugatfda\\_docs/label/2008/020357s031,021202s016lbl.pdf](http://www.accessdata.fda.gov/drugatfda_docs/label/2008/020357s031,021202s016lbl.pdf) Accessed 20 October 2017.
- University of New South Wales 2013. Why is referencing important?  
<http://student.unsw.edu.au/why-referencing-important> Accessed 17 November 2017.
- van Poppel, M.N., Oostdam, N., Eekhoff, M.E., Wouters, M.G., van Mechelen, W. & Catalano, P.M. 2013. Longitudinal relationship of physical activity with insulin sensitivity in overweight and obese pregnant women. *J Clin Endocrinol Metab*; 98 (7): 2929-2935.
- Wegelius, A., Tuulio-Henriksson, A., Pankakoski, M., Haukka, J., Lehto, U., Paunio, T., Lönnqvist, J. & Suvisaari, J. 2011. An association between high birth weight and schizophrenia in a Finnish schizophrenia family study sample. *Psychiatry Research*, 190, 2/3, 181-186.
- Whitehouse, k. 2010. Organization of antenatal care. *Royal College of General Practitioners*, 3 (9): 528-538.
- Wilkinson, J.M. 2007. *Nursing Process and Critical Thinking*. Upper Saddle River, NJ: Pearson Prentice Hall.
- World Health Organization 1999. *Definitions, Diagnosis and Classification of Diabetes Mellitus and its Complications. Part 1: Diagnosis and Classification of Diabetes Mellitus*. WHO/NCD/NCS/99. 2<sup>nd</sup> ed. Geneva: World Health Organization.

Wu, C.S., Nohr; E.A., Bech, B.H., Vestergaars, M. & Olsen, J. 2012. Long-term health outcomes in children born to mothers with diabetes: A population-based cohort study. *PloS One*, 7 (5), 1-7. doi: 10.1371/journal/pone.0036727

Virally,M. & Laloi, M.M. 2010. Methods for the screening and diagnosis of gestational diabetes mellitus between 24 and 28 weeks of pregnancy. *Diabetes and metabolism*, 36:549-565.

Zhang, C. & Nung, Y. 2011. Effect of dietary and lifestyle factors on the risk of gestational diabetes: review of epidemiologic evidence. *Am J Clin Nutr*; 94 suppl: 1975S-1979S.

Zhang F., Dong, L., Zhang, C.P., Li, B., Wen, J., Gao, W. & Hu, G. 2011. Increasing prevalence of gestational diabetes mellitus in Chinese women from 1999 to 2008. *Diabetic medicine*, 28 (6), 652-657.

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Appendix 1: Data Extraction Form

Authors, Year	Title	Level of Evidence (Johns Hopkins)	Aim	Conclusions
Li, G., Björn, A., Hadziabdic, E., Hjelm, K. & Rask, M. (2016)	Beliefs about health and illness and health-related behaviour among urban women with gestational diabetes mellitus in the south east of China	Qualitative exploratory study  (Level III, Quality B)	To explore beliefs about health and illness and health-related behaviour among urban Chinese women with GDM in a Chinese sociocultural context	The women's beliefs were influenced by Chinese culture. Certain cultural aspects were beneficial to them in terms of controlling their blood glucose for their babies' health, obtaining family support, and reducing their stress from GDM
Amin, M., Suksomboon, N., Poolsup, N. & Malik, O. (2015)	Comparison of Glyburide with Metformin in Treating Gestational Diabetes Mellitus	Systematic review and meta-analysis of randomized controlled trials  (Level II, Quality B)	To compare the efficacy and safety of glyburide with metformin in treating GDM	Treatment of GDM with glyburide increases the risk of higher birth weight among infants making them prone to pregnancy complications such as shoulder dystocia, birth trauma, and birth asphyxia.  Metformin is seen to be an efficacious and better choice than glyburide in treating GDM
Kachoria, R. & Oza-Frank, R. (2014)	Differences in Breastfeeding Initiation by Maternal Diabetes Status	Literature review  (Level V, Quality A)	To examine trends in breastfeeding at hospital discharge from 2006 to	Breastfeeding initiation rates vary by diabetes status and race

	and Race, Ohio 2006-2011		2011 by diabetes status  To determine associations between breastfeeding, diabetes status and maternal and infant characteristics	Maternal characteristics affect women of different races differently
Halperin, I.J. & Feig, D.S. (2014)	The Role of Life Interventions in the Prevention of Gestational Diabetes	Literature review  (Level V, Quality A)	To examine the epidemiologic data linking healthy lifestyle choices to reduced risk of GDM  To compare this with the interventional trials of diet and exercise to prevent GDM	Lifestyle interventions introduced in pregnancy have the potential to prevent the development of GDM and other complications
Khooshehchin, T.E., Keshavarz, Z., Afrakhteh, M., Shakibazadeh, E. & Faghihzadeh, S. (2016)	Perceived needs in women with gestational diabetes	Qualitative study  (Level III, Quality B)	To describe facilitators and barriers that impact lifestyle modifications by women with gestational diabetes  To gain an understanding of the ongoing prenatal and postpartum needs of women with GDM  To discuss implications for best practices, health policies concerning diabetes prevention in “at risk” women	It is essential to provide adequate support and education based on the culture and the perceived needs for the mothers with GDM and their family members



<p>Sahariah, S.A., Potdar, R.D., Gandhi, M., Kehoe, S.H., Brown, N., Sane, H., Coakley, P.J., Marley-Zagar, E., Chopra, H., Shivshankaran, D., Cox, V.A., Jackson, A.A., Margetts, B.M &amp; Fall, C.H.D. (2016)</p>	<p>A Daily Snack Containing Leafy Green Vegetables, Fruit, and Milk before and during Pregnancy Prevents Gestational Diabetes</p>	<p>Randomized, Controlled Trial  (Level II, Quality B)</p>	<p>To test whether increasing women's dietary intake of leafy green vegetables, fruit, and milk before conception and throughout pregnancy reduced their risk of GDM</p>	<p>Improving dietary micro-nutrient quality by increasing intake of leafy green vegetables, fruit, and/or milk may have an important protective effect against the development of GDM</p>
<p>Khan, T., Macaulay, S., Norris, S.A., Micklesfield, L.K. &amp; Watson, E.D. (2016)</p>	<p>Physical activity and the risk for gestational diabetes mellitus amongst pregnant women living in Soweto</p>	<p>A cohort study  (Level II, Quality C)</p>	<p>To determine whether there is an association between physical activity, sedentary behaviour and risk of GDM in pregnant black women living in urban Soweto in South Africa</p>	<p>No conclusion available</p>
<p>Doran, F. &amp; Davis, K. (2010)</p>	<p>Gestational diabetes mellitus in Tonga: insights from healthcare professionals and women who experienced gestational diabetes mellitus</p>	<p>Qualitative, individual, semi-structured, face-to-face interviews  (Level III, Quality B)</p>	<p>To gain contextual insights from Tongan healthcare professional and women who had developed GDM</p>	<p>GDM was reportedly well-managed through lifestyle interventions</p>
<p>Borgen, I., Garnweidner-Holme, L.M., Jacobsen, A.F., Bjerkan, K., Fayyad, S., Joranger, P., Lilleengen, A.M., Mosdøl, A., Noll, J., Småstuen, M.C., Terragni, L., Torheim, L.E. &amp; Lukasse, M. (2017)</p>	<p>Smartphone application for women with gestational diabetes mellitus</p>	<p>A randomized controlled trial  (Level II, Quality A)</p>	<p>To assess whether the use of the pregnancy+ app in addition to standard care results in better glucose levels at routine OGTT, 3 months postpartum, compared with standard care only</p>	<p>Smartphone for GDM is useful in managing GDM</p>

Chen, P., Wang, S., Ji, J., Ge, A., Chen, C., Zhu, Y., Xie, N. & Wang, Y. (2015)	Risk factors and Management of Gestational Diabetes	Literature review (Level V, Quality A)	To highlight the various risk factors associated with GDM along with the available therapeutic options in the treatment and management of the disease	A modification of lifestyle along with insulin therapy can sufficiently aid in the treatment and control of GDM
Ashwal, E. & Hod, M. (2015)	Gestational diabetes mellitus: Where are we now?	Literature review (Level V, Quality A)	No aim available	Pharmacological treatment (insulin or oral anti-diabetic drugs) reduces fetal maternal morbidity and mortality related with GDM
Bone, R.L. (2015)	Big Babies: An Exploration of Gestational Diabetes	Literature review (Level V, Quality B)	No aim available	In order to eradicate mother-daughter cycle of GDM, maintaining an ideal body weight through diet and/or physical exercise in the postpartum phase is imperative.
Mays, L. (2014)	Gestational Diabetes and Postpartum Metabolic Syndrome	Literature review (Level V, Quality A)	To promote positive health outcomes for women with GDM through childbirth educators	Healthy behaviours such as diet, exercise, and breastfeeding decreases the chances of negative health outcomes such as the development of metabolic syndrome.
Javid, F.M., Simbar, M., Dolatian, M., Majg, H.A. & Mahmoodi, Z. (2016)	A Comparative Study and Physical Activity of Women With and Without Gestational Diabetes	A comparative (case and control group) (Level II, Quality A)	To determine and compare dietary style and physical activity in women with gestational diabetes and healthy preg-	Gestational diabetes can be prevented by appropriate counseling and making pregnant women aware of having an ap-

			nant women	propriate and healthy lifestyle during pregnancy by the midwife
Magon, N. & Seshiah, V. (2011)	Gestational diabetes mellitus: Non-insulin management	Literarure review (Level V, Quality A)	To improve pregnancy outcomes  To promote healthy life-style changes for the mother that will last long after delivery	MNT is the most common therapy which suffices for GDM. Pharmacological treatment is considered if deemed necessary
Whitehouse, K. (2010)	Organization of antenatal care	Literature review (Level V, Quality A)	To identify high-risk women who will require obstetric-led care	Antenatal care provides information, support and monitoring during the physiological course of pregnancy
Hirst, J.E., Mackillop, L., Loerup, L., Kevat, D.A., Bartlett, K., Gibson, O., Kenworthy, Y., Levy, J.C., Tarassenko, L. & farmer, A. (2015)	Acceptability and user satisfaction of a smartphone-based, interactive blood glucose management system in women with gestational diabetes mellitus	Pilot study (Level III, Quality A)	To determine women's satisfaction with using the GDM-health system and their attitudes toward their diabetes care	GDM-health is acceptable and convenient for a large proportion of women
Cheng, Y.W. & Caughey, A.B. (2008)	Gestational diabetes: diagnosis and management	Literature review (Level V, Quality A)	To review the diagnosis and management of gestational diabetes	Frequent blood glucose monitoring, nutrition counselling and frequent physician contact allow for individualized care to achieve optimal outcomes
Perera, O.P., Nakash, M.B., Covarrubias, A.P., Cano, A.R., Torres, A.R.,	A Medical Nutrition Therapy Program Improves Perinatal Outcomes in	Quasi-experimental design	To assess the effect of a medical nutrition therapy (MNT) program on perina-	An intensive MNT program, including counseling, education, and capil-

Gonzalez, C.O. & Ortega, F.V. (2009)	Mexican Pregnant Women with Gestational Diabetes and Type 2 Diabetes Mellitus	(Level II, Quality A)	tal complications in Mexico City	lary glucose self-monitoring has a positive effect over preeclampsia, maternal hospitalization, and neonatal death in women with diabetes in pregnancy
Melamed, N. & Yogev, Y. (2009)	Can pregnant diabetics be treated with glyburide:	Literature review (Level V, Quality A)	To determine the efficacy of glyburide	Owing to its ease of administration, convenience and low cost, glyburide will become the first line of medical treatment in patients with GDM within the next few years
Reece, E.A., Leguizamón, G. & Wiznitzer, A. (2009)	Gestational diabetes: the need for a common ground	Literature review (Level A, Quality B)	To report the controversies surrounding the causes, screening, diagnosis, management, and prevention of gestational diabetes	Screening, early detection, and management can greatly improve outcomes for women with this condition and their babies
Rigla, M., Martinez-Sarriegui, I., Garcia-Saez, G., Pons, B. & Hernando, M.E. (2017)	Gestational Diabetes Management Using Smart Mobile Telemedicine	Pilot study (Level III, Quality B)	To test the feasibility and acceptance of a mobile decision-support system for GDM	Artificial-intelligence-augmented telemedicine can offer a good alternative, saving resources while maintaining the standards of care proposed in the clinical guidelines
Hyer, S., Balani, J., Johnson, A. & Shehata, H. (2009)	Metformin treatment for gestational diabetes	Literature review (Level V, Quality A)	To describe the experience with metformin in GDM and review the experience	Offering of metformin to GDM women where lifestyle measures are inadequate to achieve

				euglycaemia has resulted in a considerable easing of the workload burden for the diabetes specialist nurses who previously had large numbers of women at each clinic for initiation of insulin treatment
Thung, S.F. & Landon, M.B. (2013)	Managing gestational diabetes: timing, selection and use of pharmacotherapy	Literature review (Level V, Quality B)	To present the available data to help providers understand what therapies are available, their unique strengths and weaknesses  To initiate and escalate doses to achieve maternal euglycemia	Metformin reduces peripheral insulin resistance. Glyburide enhances insulin secretion.