OBESITY AND PREGNANCY

CLINICAL PRACTICE GUIDELINE

Institute of Obstetricians and Gynaecologists, Royal College of Physicians of Ireland

and

Clinical Strategy and Programmes Directorate, Health Service Executive

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1.0 Key Recommendations

1. The label of obesity may be upsetting for many pregnant women. Care and communications need to be conducted in a sensitive and respectful manner.

2. Women who are obese should be advised to lose weight before becoming pregnant.

3. Obese women should take high dose folic acid supplementation periconceptionally to reduce the risk of congenital malformations such as Neural Tube Defects (NTDs).

4. All pregnant women should have their weight and height measured accurately at their first antenatal visit. Their Body Mass Index (BMI) should be calculated and entered in the obstetric records.

5. Obese women should have their mid-arm circumference (MAC) measured at their first antenatal visit. If the MAC is > 33cms, a large cuff should be used to measure their blood pressure.

6. Women with a BMI > 29.9 kg/m^2 should have an oral Glucose Tolerance Test to screen for gestational diabetes mellitus at 24 to 28 completed weeks gestation.

7. Obese women undergoing caesarean section should be given routine antibiotic prophylaxis and thromboprophylaxis. All obese women who are immobilised antepartum or postpartum should receive thromboprophylaxis. Thromboprophylaxis dosage should be based on maternal weight, not BMI, at her first antenatal visit. Early mobilisation of obese women postpartum should be encouraged to prevent venous thromboembolism.

8. Intravenous access, if required, should be established early in labour in women with moderate to severe obesity.

9. Obese women should receive extra support to help them initiate and continue breastfeeding.

10. Provided there are no obstetric or medical contradictions, obese women should be encouraged to keep exercising during and after pregnancy.

11. An audit should be conducted in each maternity unit to determine whether the facilities and equipment are suitable for the care of morbidly obese women.

2.0 Purpose and Scope

The purpose of this guideline is to improve the management of obese women before, during and after pregnancy. These guidelines are intended for healthcare professionals, particularly those in training, who are working in HSE-funded obstetric and gynaecological services. They are designed to guide clinical judgement but not replace it. In individual cases a healthcare professional may, after careful consideration, decide not to follow a guideline if it is deemed to be in the best interests of the woman.

3.0 Background and Introduction

Maternal obesity, based on a Body Mass Index (BMI) > 29.9 kg/m^2, has emerged as an important risk factor in modern obstetrics worldwide (Barry et al, 2009; Dennedy and Dunne, 2010). In the short-term, it has been associated with an increase in pregnancy complications such as gestational diabetes mellitus (GDM), pre-eclampsia, congenital malformations and fetal growth abnormalities, and has been associated with an increase in obstetric interventions such as caesarean section and induction of labour (Dennedy and Dunne, 2010; Leddy et al, 2008). In the longer term, maternal obesity is associated with an increased lifelong risk of diabetes mellitus and cardiovascular disease for the woman and an increased risk of childhood obesity for her offspring (Whitaker, 2004; Reilly et al, 2005; Catalano and Ehrenberg, 2006; Oken, 2009).

Concerns about the increase in clinical risks are fuelled by evidence that the prevalence of maternal obesity is high and rising (Flegal et al, 2002; Heslehurst et al, 2007). There is presently no national data on maternal obesity levels in Ireland. In a recent prospective study in Dublin, where BMI was measured accurately in the first trimester, 19% of women were categorised as obese (Fattah et al, 2010). In Galway, 25% of women were found to be obese at their first antenatal visit (Lynch et al, 2008). Similar levels have been reported in Britain and the United States (Huda et al, 2010; Heslehurst et al, 2007).

Apart from clinical considerations, maternal obesity, particularly severe or Class III obesity (BMI > 39.9 kg/m^2), poses major technical challenges for the maternity services (Heslehurst et al, 2007; CMACE, 2010). Intravenous access and neuroaxial blockade are more difficult. Standard hospital facilities and equipment are often inadequate for managing women with severe obesity. The prevalence of Class III maternal obesity was 1.6% in Dublin (1.4% in primigravidas, 1.8% in multigravidas), 1.8% in Galway and 2.0% in the UK (Fattah et al, unpublished observations; Dennedy and Dunne, 2010; CMACE, 2010).

4.0 Methodology

Medline, EMBASE and Cochrane Database of Systematic Reviews were searched using terms relating to obesity, pregnancy and interventions. Searches were limited to humans and restricted to the titles of English language articles published between December 2000 and December 2010. Relevant meta-analyses, systematic reviews, intervention and observational studies were reviewed.

Guidelines reviewed included the CMACE/RCOG Joint Guideline (2010); Society of Obstetricians and Gynaecologists of Canada, Clinical Practice Guideline 239 (2010); Queensland State Guideline on obesity (2010); American College of Obstetrics and Gynecology Review on obesity and pregnancy (Leddy et al, 2008).

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The guideline was also reviewed by the Association of Improvements in the Maternity Services, Ireland (AIMS).

5.0 Clinical Guidelines

5.1 Pre-pregnancy Care

In their own health interests, women of childbearing age who are overweight or obese should be encouraged to lose weight whether they plan to conceive or not. Obesity is associated with Polycystic Ovarian Syndrome (PCOS) and anovulation (Ramsey et al, 2006; Balen and Anderson, 2007). Obese women planning a pregnancy are more likely to conceive if they lose weight although there is little evidence that one diet is better than another for enhancing reproduction (Balen et al, 2007).

The incidence of congenital malformations, including neural tube defects (NTDs), are higher in obese women compared with normal women (Rasmussen et al, 2008). Periconceptual folate supplementation prevents NTDs, and lower serum folate levels have been reported in obese women (Mojtabai, 2004; Frey and Hauser, 2003). [It is recommended that obese women should take high dose (5mg) folic acid for at least one month before conception and continue throughout the first trimester] (CMACE, RCOG, 2010). As half of pregnancies are unintended, there is a case for all women, particularly obese women, of childbearing age to take folate supplements (Finer and Henshaw, 2006).

Many women are not seen in hospitals prepregnancy or present late in pregnancy to the maternity services. Primary care has an important role to play in prepregnancy care of the obese woman, as well as contributing to the different models of antenatal care. It is important, therefore, that women have their weight measured at their first antenatal visit in a primary care setting.

5.2 Calculation of Body Mass Index

Internationally, obesity is based on the World Health Organization categorisation of Body Mass Index (BMI), which is calculated from measurements of height and weight (see Appendix One and Two). BMI is inexpensive, practical and easily applicable in large populations which makes it suitable for epidemiological studies. However, BMI is a surrogate marker of adiposity and does not measure adipose tissue directly. As a result, it does have limitations and provides no information on fat distribution (Fattah et al, 2010; Prentice and Jebb, 2001).

Most of published research on obesity is also based on self-reporting of height and weight which has been shown to be unreliable (Niedhammer et al, 2000). Women underreport their weight, particularly if they are obese. In a recent Dublin study in early pregnancy, self-reporting led to 22% of women being assigned to the wrong BMI category, and obesity was underestimated by 5% (Fattah et al, 2009). In practice, failure to make the diagnosis of obesity means that, for example, the woman may not be screened inadvertently during pregnancy for diabetes mellitus resulting potentially in adverse clinical consequences such as fetal macrosomia and shoulder dystocia.

All women should have their height and weight measured with their shoes off standing erect using a wall-mounted metre-stick (to the nearest 0.1 cm). Their weight should be measured wearing light clothing (to the nearest 0.1 kg), and the BMI calculated. **BMI should be calculated at the first antenatal visit**, ideally in the first trimester. Contrary to previous reports, mean weight and body composition does not change in early pregnancy (Fattah et al, 2010).

The BMI category should be taken into account in planning pregnancy care. Adults are often sensitive about being labeled “obese” and there is also a risk of stigmatisation. **It is important that information about obesity and its risks are communicated in an informative, yet sensitive manner** (Schmied et al, 2010; Furber and McGowan, 2010). In particular, written comments in the medical records should be factual and non-judgemental.

5.3 Obesity and Miscarriage

Spontaneous miscarriage is the commonest complication of pregnancy. Earlier reports suggested that obese women have an increased risk of early miscarriage both after spontaneous conception and infertility treatment (Lashen et al, 2004; Bellver et al, 2003). The largest study included 1644 obese primigravidas but not multigravidas (Lashen et al, 2004). Furthermore, only historical miscarriages after six weeks gestation from previous pregnancies were recorded (Lashen et al, 2004). A recent meta-analysis involving 16 studies concluded that obesity may increase the risk of miscarriage after spontaneous and assisted conception, but there was insufficient evidence to describe the effect of obesity on miscarriage in specific groups (Metwally et al, 2008). Only two of the 16 studies were prospective and both were in women who had ovulation induction.

In a recent Irish prospective observational study of 1200 women, the overall miscarriage rate was 2.8% (n=33) after fetal heart activity had been confirmed sonographically in the first trimester (Turner et al, 2010). The rate of miscarriage was not increased in women with a BMI > 29.9 kg/m^2 compared to women in the normal BMI category. The study, however, could not rule out an increase in miscarriage associated with moderate to severe (Class 2-3) obesity.

Obesity is associated with polycystic ovary syndrome and irregular menses. Obesity also makes sonography technically more challenging (Paladini, 2009). For both these reasons, particular caution should be taken in making the diagnosis of miscarriage in obese women before 8 weeks amenorrhoea. If available, **a transvaginal ultrasound probe should be used to date the pregnancy in the first trimester**.

5.4 Obesity and antenatal care

There is no evidence that one model of antenatal care is superior to another for obese women during pregnancy. A disadvantage of a designated antenatal clinic for obese women is that it risks stigmatising obesity. Also, the large percentage of obese women in the Irish population might overwhelm the services provided at such a clinic.

However, **women with moderate to severe obesity (BMI >34.9 kg/m^2) are not suitable for a home birth** because of the associated high incidence of co-morbidities and the need for early intravenous access, especially for the management of postpartum haemorrhage (CMACE, 2010). While obese women should be integrated in the standard antenatal clinics, **there is a strong case for an antenatal consultation with the anaesthetic team for severely obese women** so that potential difficulties with venous access, regional or general anaesthesia can be identified (Fitzsimmons and Modder, 2010). If the hospital has an Anaesthetic Clinic, this is an ideal setting for such an antenatal consultation. In addition, **the anaesthetic team should be notified when a women with a BMI > 39.9 kg/m^2 presents in labour or as an emergency**.

There are differing views on whether women should continue to be weighed during pregnancy. In the United States, there is particular emphasis on gestational weight gain (GWG) and the Institute of Medicine (IOM) has recently published revised guidelines for weight gain during pregnancy (Rasmussen et al, 2010). Concerns about maternal obesity has led the Institute to revise downwards their recommendations for GWG within each BMI category (Appendix Three). Overweight and obese women gaining weight within IOM recommendations have less pre-eclampsia and emergency caesarean sections, however they continue to be at increased risk of gestational diabetes, small for gestational age, preterm and perinatal mortality compared with those who gain less than the IOM recommendations (Beyerlein et al, 2010). Weight gain above the IOM recommendations has been associated with poor maternal and fetal outcomes independent of pre pregnancy BMI.

In contrast, Britain's National Institute for Health and Clinical Excellence (NICE) recommends that women should not be weighed at all during pregnancy as it may produce unnecessary anxiety with no added benefit. There are uncertainties about whether prepregnancy weight

gain or GWG is more important in determining clinical outcomes. Furthermore, GWG is less in obese women compared with normal women irrespective of any interventions (Farah et al, 2011). There have also been inconsistencies in the way GWG is measured (Turner and Farah, 2010). In obese women, GWG is not, for example, predictive of the birth weight (Farah et al, 2011).

At present, there is insufficient evidence to justify a repeat measurement of maternal weight in all pregnancies. In individual pregnancies, however, if there are concerns about excessive weight repeat measurements on accurate scales may be a useful motivational tool to help women avoid and address obesity post-pregnancy and before starting the next pregnancy. It has recently been suggested that pregnancy may be an especially powerful "teachable moment" for the promotion of healthy eating and physical activity behaviour among women (Phelan, 2010). The strongest predictor of weight retention one year postpartum is the amount of weight gained during pregnancy (Phelan, 2010).

Recent trends have shown an increase in women undergoing bariatric surgery prior to pregnancy (Shekelle et al 2008). In the case of gastric banding, the band should be loosened or removed during pregnancy. Both women with gastric banding and bypass need to be managed by a multidisciplinary team to ensure adequate nutritional intake and appropriate management. Adherence to a good maternal diet and vitamin supplementation avoids maternal and infant risk of nutritional deficiency (Shekelle et al 2008).

5.5 Obesity and diet

Recommendations for healthy eating during pregnancy have previously been published in Ireland and are also available from the HSE. A recent systematic review to assess the benefits of antenatal interventions for pregnant women who are overweight or obese identified seven trials that compared dietary intervention with standard care (Dodd et al, 2010). There was considerable variation in the nature of the dietary interventions, but any benefits were uncertain. **Nonetheless, women should be advised about the importance of healthy eating before and during pregnancy**. Obese women have been demonstrated to have poor nutrient intakes, despite having calorie dense diets (Markovic 2009, IUNA 2011). Referral to a dietitian should be considered to assess the level of nutrient deficiency and imbalance in the obese woman's diet and to promote behavioural modification via nutritional counselling as part of a multidisciplinary care team.

There is evidence that prepregnancy obesity predicts poor vitamin D status in mothers and their neonates (Bodner et al, 2007; Lewis et al, 2010). Endogenous vitamin D production requires skin exposure to sunlight. In Ireland, particularly in winter, there is insufficient exposure to sunlight of the appropriate wavelength. **Obese women should be advised to take 10 micrograms (400IU) Vitamin D supplementation during pregnancy and breastfeeding** (CMACE, 2010; Yu et al, 2009).

There is a need to conduct trials in the area of dietary intervention with more homogenous end points, including the evaluation of the risk of harm from calorie restriction (Thangaratinam and Jolly, 2010). The importance of good nutrition during pregnancy for optimal maternal and

neonatal outcomes, including avoidance of excessive intake of high energy, low nutrient dense foods which may promote adiposity and promotion of a healthy diet including fresh meat and fish, low-fat dairy foods, vegetables, high-fibre cereals, fruit and water should be emphasised to all mothers.

Obese women already gain less weight during pregnancy than normal weight women (Farah et al, 2011). A dietary intervention is challenging because of the difficulty of compliance and verification of compliance. This may be more difficult for socially deprived women in the present economic climate. In addition, it is likely that 2-10% of obese women will develop gestational diabetes mellitus and will require specific dietary advice for blood glucose management as part of their normal antenatal care.

The national guidelines for healthy eating in pregnancy can be found at
http://www.hse.ie/eng/services/healthpromotion/Healthy%20Eating/
and for ease of use a two page patient information leaflet is in Appendix Seven.

5.6 Obesity and exercise

One possible lifestyle intervention for obese women is a physical exercise programme (Quinn et al, 2008; Kinnunen et al, 2008; Mottola, 2009; Mottolla et al, 2010; Fleten et al, 2010). A Cochrane review of exercise for overweight or obese adults outside pregnancy analysed 43 studies involving 3476 participants (Shaw et al, 2006). When compared with no treatment, exercise alone resulted in small weight losses across studies. Increasing exercise intensity increased the magnitude of weight loss. Exercise also significantly decreased blood pressure, triglycerides and fasting glucose. In a Cochrane review of 6 trials involving 245 women, both exercise and diet and diet alone seemed to enhance weight loss during the postpartum period (Adegboye and Heitmann, 2008).

Observational studies have reported that physical exercise during pregnancy is associated with a decreased risk of pre-eclampsia and gestational diabetes mellitus (GDM) (Dye et al, 1997; Weissgerber et al, 2006; Oken et al, 2006). Studies continuing on into the third trimester are currently lacking (Oostdam et al, 2009). Supervised exercise programmes have been shown to improve maternal fitness without adverse consequences (Kennelly et al, 2002). There is also evidence that women generally take less exercise during their childbearing years (Pomerleau et al, 2010). Data on exercise among obese pregnant women, however, is scarce (Guelinckx et al, 2008).

Maintaining exercise during pregnancy may have many benefits including short terms benefits to the baby and long term benefits for the mother and further pregnancies. Long term effect of continuing vigorous weight-bearing exercise during pregnancy was examined in a follow up observational study in 39 subjects (Clapp, 2008). Women who voluntarily maintained their exercise during pregnancy continue to exercise over time and gained less weight, deposited less fat and had increased fitness and lower cardiovascular risk profile than those who stopped exercise. **Unless there are medical or obstetric contradictions obese women should be encouraged to maintain regular exercise during and after pregnancy** (Artel and O'Toole, 2003). For convenience, an information leaflet is included in Appendix Five.

5.7 Obesity and caesarean section

Obese women are more likely to be delivered by caesarean section than women in the normal BMI category. A retrospective cohort study was conducted in Galway of 5162 women delivered in 2001-3. BMI at the first antenatal visit was calculated (Lynch et al, 2008). Obesity conferred a 2-3 fold increased risk of delivery by emergency caesarean section for both primigravidas (obese RR 2.16; morbidly obese RR 2.30) and multigravidas (obese RR 1.97; morbidly obese RR 2.44). Increasing BMI exerted a progressive adverse effect on vaginal delivery rates for both primigravidas and multigravidas.

In a retrospective cohort study of 8,246 singleton pregnancies in Dublin, the overall caesarean section (CS) rate was 45.3% in women with morbid obesity (BMI > 39.9 kg/m^2) compared with 14.4% in women with a normal BMI ($p<0.001$) (Farah et al, 2009). Morbid obesity was associated with an increase in both elective and emergency caesarean sections, and a decrease in vaginal birth after caesarean section (VBAC) compared with a normal BMI (all $p<0.001$).

In a 2007 meta-analysis of 33 studies, the unadjusted odds ratio (OR) of a caesarean delivery were 1.46 (CI 1.34-1.60), 2.05 (CI 1.86-2.27) and 2.89 (CI 2.28-3.79) among overweight, obese and severely obese women respectively compared with normal weight women (Chu et al, 2007). The increase was also independent of gestational diabetes mellitus. A 2008 meta-analysis found that the CS rate was twice as high in the obese BMI category compared with the ideal BMI (Heslehurst, 2008). However, the increase was significant for emergency sections (n=6 studies), but not for elective sections (n=3 studies).

A 2009 systematic review and meta-analysis of cohort studies of singleton pregnancies examined obesity as an independent risk factor for elective and emergency caesarean section in primigravidas (Poobalan et al, 2009). Only three studies were prospective. The risk of CS was increased by 50% in overweight women and was more than doubled for obese women compared with women who had a normal BMI. There is also evidence that increased BMI is also associated with a lower rate of vaginal birth after caesarean section (Bujold et al, 2005).

A large retrospective study using the North West Thames Regional Maternity database found a slight increase in wound infections (OR 1.27 CI 1.09-1.48) after CS in obese women (Sebire et al, 2001). A recent retrospective review of 194 women who were massively obese (BMI > 49.9 kg/m^2) found 30% had a wound complication (Alanis et al, 2010). Of these, 86% were diagnosed after hospital discharge. Vertical abdominal incisions were associated with increased operative time and blood loss. The authors recommended avoidance of subcutaneous drains and the use of transverse abdominal wall incisions. It is common practice to administer intravenous antibiotic prophylaxis to all women requiring CS, but careful attention should also be paid to wound care intraoperatively and postoperatively. There is evidence that [in women with > 2 cm subcutaneous fat suturing of the subcutaneous space reduces the risk of wound infection and separation] (Cetin and Cetin, 1997).

5.8 Obesity and hypertension

Hypertensive disorders, including pre-eclampsia, complicate 2-10% of all pregnancies and obesity is a reported risk factor. A systematic overview of 13 cohort studies reported that the risk of pre-eclampsia doubles with each 5-7 kg/m^2 increase in BMI (O'Brien et al, 2003). In a more recent meta-analysis of 36 studies with nearly 1.7 million subjects, BMI was a weak predictor of pre-eclampsia (Cnossen et al, 2007). The authors were also unable to correct for important confounding variables associated with pre-eclampsia in obese women such as essential hypertension, diabetes and smoking.

It is recommended that the mid-arm circumference (MAC) should be measured in all pregnant women particularly those with BMI > 29.9kg/m^2 at their first antenatal visit. If the MAC is > 33 cms, a large cuff should be used for BP measurements subsequently.

However, the accurate measurement of blood pressure is important and in obese subjects it is important to use an appropriately sized arm cuff. A large cuff is recommended for adults with a MAC > 33 cms. In a study of 179 pregnant women in Dublin, 15% overall required a large cuff size 44% of women with Class I obesity and 100% of women with Class II – III obesity required a large pressure cuff for blood pressure measurement based on a MAC > 33.0 cm (Hogan et al, 2010). Failure to use a large cuff may lead to overestimation of blood pressure in obese women and potentially increase investigations, hospital admissions and unnecessary obstetric interventions. National studies in the US have reported a significant increase in MAC in adults, particularly in the 20-39 year age group (Ostchega et al, 2005). A large cuff size was required in 39% of people with hypertension and 47% with diabetes mellitus.

5.9 Obesity and stillbirth

A meta-analysis was conducted to summarise the epidemiological evidence on the relationship between maternal overweight and the risk of stillbirth (Chu et al, 2007). In 9 studies, the unadjusted OR of a stillbirth was 1.47 (95% CI 1.08-1.94) and 2.07 (95% CI 1.59-2.74) among overweight and obese pregnant women respectively, compared with normal weight pregnant women. The meta-analysis, however, accepted different definitions for BMI categories and only 5 studies were known to use the same definition of stillbirth.

While the findings suggested that maternal obesity increased the risk of stillbirth, the explanation for the association is uncertain. It may be directly related to obesity, or could be due to associated comorbidities such as GDM or hypertensive disorders. In women who are morbidly obese, fetal monitoring with either ultrasound or cardiotocography is technically more difficult. Whatever the explanation for the increased risk, **there should be a low threshold for fetal assessment in women who are obese**. It is also important that obese women are made aware of the limitations of ultrasound examinations.

5.10 Obesity and Gestational Diabetes Mellitus

The incidence of GDM in pregnancy in women who are obese is higher than that of the general obstetric population. The extent of the increase varies from population to population

(Sathyapalan et al, 2009; Chu et al, 2007). In a meta-analysis of 20 studies the unadjusted ORS of developing GDM were 2.14, 3.56 and 8.56 among overweight, obese and severely obese women compared with normal-weight women (Chu et al, 2007).

The guidelines for GDM published by the HSE in August 2010 recommend that **all women with a BMI > 29.9 kg/m^2 should be screened at 28 weeks gestation for GDM**. If there are other risk factors, consideration should be given to screening obese women at an earlier gestation (Jarvie and Ramsey, 2010). If the OGTT is abnormal during pregnancy, it should be repeated postpartum to confirm that it is not still abnormal due to Type 2 diabetes mellitus. In an American retrospective study of 344 women, 36% had persistent abnormal glucose tolerance but only 45% underwent postpartum glucose testing (Russell et al, 2006).

In certain ethnic groups, adiposity is increased by a lower level of BMI and a lower threshold at which selective screening for GDM is recommended (see Appendix Six).

5.11 Obesity and labour

Observational studies have reported an increase in labour complications in obese women, for example, dystocia and postpartum haemorrhage (PPH) (Sebire et al, 2001; Cedergen, 2004;). There is no evidence that labour should be induced in the absence of other obstetric indications of labour.

Transabdominal electronic fetal monitoring may be technically challenging with increasing levels of abdominal obesity. **In view of the importance of obtaining an adequate fetal heart trace, consideration should be given to using a fetal scalp electrode early in labour.**

Women with severe obesity (BMI > 39.9 kg/m^2) should have venous access established early in labour and the anaesthetist on emergency duty should be informed after she is admitted in labour. Ideally, women with severe obesity should have a functioning epidural catheter placed at the earliest opportunity during labour. Apart from providing analgesia and alleviating physiological challenges during labour, the presence of a functioning epidural catheter can also be used to induce anaesthesia quickly in the event of an emergency caesarean section, thus avoiding general anaesthesia, which carry increased risks in obese women. In view of the increased risk of PPH, the third stage of labour should be actively managed in obese women (CMACE, 2010).

5.12 Obesity and venous thromboembolism

The incidence of venous thromboembolism (VTE) during pregnancy is estimated at 5-12 per 10,000 pregnancies and is distributed equally in each trimester (Bourjeily et al, 2010). The incidence of VTE within six weeks postpartum is 3-7 per 10,000 deliveries. The increased incidence compared with age-matched controls has been attributed to pregnancy-related venous stasis, vascular damage and physiological hypercoagulability (Bourjeily et al, 2010). VTE is important because pulmonary embolism (PE) is the leading cause of maternal mortality in the developed world and is potentially preventable. A recent seminar reported that

a maternal BMI > 29.9 kg/m^2 was associated with an increased risk (OR 1.8 95% CI 1.3-2.4) of antepartum and postpartum VTE (Bourjeily et al, 2010).

In the Framington Offspring Study, increased BMI was associated with a prothrombotic profile in women outside pregnancy (Rosito et al, 2004), but there is scant information on the relationship between the risk of VTE and BMI during pregnancy. In 395,335 maternities from the North West Thames region for 1988-1997, BMI was recorded in early pregnancy (Simpson et al, 2001). Maternal obesity was not associated with an increased risk of antenatal VTE, but was associated with a small increase (1.7 CI 1.1-2.6) in postnatal VTE.

In an American inpatient sample, maternal obesity carried an increased risk (OR 4.5) of VTE (James et al, 2006). The risk factor with the highest OR (51.8) for VTE was thrombophilia. In a Danish population-based nested case-control study of 129 cases, smoking and obesity in early pregnancy were risk factors (Larsen et al, 2007). In a Norwegian register-based case-control study 615 cases of VTE in pregnancy and puerperium were identified from 1990-2003, obesity was not studied but risk factors for antenatal VTE were assisted reproduction and gestational diabetes, and for postnatal VTE were CS and pre-eclampsia (Jacobsen et al, 2008a). All these risk factors are associated with obesity.

The association between maternal obesity and VTE is weak. If there is an increased risk, we do not know at what level or category of BMI the increase occurs. Nor do we know whether any association is due to obesity alone, or whether it is due to comorbidities or confounding variables, such as CS. Any effect of obesity on VTE risk is strongly influenced by immobilisation (Jacobsen et al, 2008b).

Obese women are more likely to require delivery by CS (Chu et al, 2007). Compared with vaginal delivery elective CS increases the risk of VTE two fold, and emergency CS increases the risk four fold. A recent Cochrane review of 13 trials with 1774 women concluded that there is not enough evidence to show which are the best ways to prevent VTE antepartum or postpartum, including after CS (Tooher et al, 2010).

In 1995, the RCOG recommended selective thromboprophylaxis post CS but the recommendations were implemented in only a fifth of the cases (Duhl et al, 2007). It now recommends that all women undergoing emergency CS and all obese women undergoing emergency or elective CS should receive heparin prophylaxis for at least 7 days postnatal (RCOG, 2009), The use of thromboprophylaxis for CS is widespread in Europe (Duhl et al, 2007).

In contrast, routine thromboprophylaxis after CS is not recommended in the United States (Duhl et al, 2007; Bates et al, 2008). A systematic review of 64 studies reported a 2% frequency of significant bleeding with low molecular weight heparin (LMWH), including wound haematoma (Duhl et al, 2007). There is a consensus, however, that **obese women undergoing CS should receive thromboprophylaxis.**

The RCOG recommends that **women who are morbidly obese (BMI > 39.9kg/m^2) should receive thromboprophylaxis irrespective of the mode of delivery** (RCOG, 2009). A VTE

risk assessment should be undertaken in morbidly obese women at their first antenatal visit. It should be repeated if there are pregnancy complications, especially those resulting in immobilisation, and again repeated before the woman is discharged postpartum. **The majority of VTEs occur after a vaginal delivery, therefore, it is important that any risk assessment is not confined to women post caesarean section.**

The pharmacokinetics of LMWH change during pregnancy and dosage should be based on weight at the first visit, not BMI (see Appendix Seven). The doses should be increased for all women with a booking weight > 90 kgs but some units may prefer to give half the recommended daily dose twice daily for women > 90 kgs. The recommended doses for women who are obese are not, however, evidence-based. For tinzaparin, the dose may need to be reduced if the creatinine clearance is < 20 ml/minute (RCOG, 2009).

In a multicentre study in pregnant women a higher dose of tinzaparin was required than in the non-pregnant state and 75 IU/kg appeared to be required in a woman weighing > 90 kgs (Smith et al, 2004). In the recent study of women with Class II and III maternal obesity, the dose of LMWH was less than recommended in 85% of women antenatally and 84% of women postnatally (CMACE, 2010). Postnatal thromboprophylaxis was underused both in terms of frequency and duration of use.

All maternity units should have in place guidelines for thromboprophylaxis in obese women which addresses the indications, dosage and duration. A national guideline for thromboprophylaxis in pregnancy is presently under development. Treatment must be tailored to individual risks and benefits.

There is no scientific evidence to support the use of graduated elastic compression stockings to prevent VTE in pregnancy. They are also difficult to fit properly particularly in advanced pregnancy, and thigh-length stockings risk becoming bloodstained (RCOG, 2009). There is a pragmatic case to be made for recommending stockings for pregnant women at high risk of VTE, particularly if they are hospitalised and have a contraindication to LMWH.

5.13 Obesity and breastfeeding

Early in pregnancy, obese women should be encouraged to breastfeed and be made aware of the benefits to their own and their child's health. (ADA 2009). Obese women are less likely to intend, initiate and continue breastfeeding. These associations remain when age, parity and educational levels are taken into account (Amir and Donath, 2007). Thus, **obese women may need extra support postpartum with breastfeeding in the hospital and following discharge home** (Mok et al, 2008).

Breastfeeding mothers who have undergone bariatric surgery need vitamin and mineral supplementation (Shekelle et al 2008). As maternal intake of some nutrients eg Vitamin B12 directly affects breastmilk composition, a dietetic review is warranted to check for adequate intakes of key nutrients.

6.0 Hospital Equipment and Facilities

The standard facilities and equipment in maternity units may not be adequate for the obstetric care of a woman with severe obesity (Walsh et al in press). **An audit of each unit should be conducted to determine the availability of large patient equipment with appropriate safe working loads and widths.**

The audit should include the following:

- Ward and delivery beds
- Wheelchairs
- Operating tables and trolleys
- Chairs without arms
- Ultrasound scan couches
- Weighing scales
- Large blood pressure cuffs
- Long epidural and spinal needles
- Lifting equipment
- Theatre gowns
- Toilets
- Circulation space
- Accessibility including doorway widths and thresholds

If the appropriate equipment is not available, particularly in the operating theatres and delivery suite, a procurement plan should be drawn up and implemented.

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8.0 Implementation Strategy

- Distribution of guideline to all members of the Institute and to all maternity units.
- Implementation through HSE Obstetrics and Gynaecology programme local implementation boards.
- Distribution to other interested parties and professional bodies.

9.0 Key Performance Indicators

(i) Proportion of pregnant women who have their BMI measured accurately in early pregnancy and then noted in medical records.
(ii) Proportion of women with a booking BMI >29.9 kg/m^2 who started folic acid supplementation before pregnancy.
(iii) Proportion of pregnant women with a booking BMI >29.9 kg/m^2 who were screened for gestational diabetes mellitus during pregnancy.
(iv) Proportion of women with a booking BMI >29.9 kg/m^2 whose pregnancy was complicated by a venous thromboembolism and whether they received thromboprophylaxis or not.
(v) Obstetric intervention rates analysed by BMI category.

10.0 Qualifying Statement

These guidelines have been prepared to promote and facilitate standardisation and consistency of practice, using a multidisciplinary approach. Clinical material offered in this guideline does not replace or remove clinical judgment or the professional care and duty necessary for each pregnant woman. Clinical care carried out in accordance with this guideline should be provided within the context of locally available resources and expertise.

This Guideline does not address all elements of standard practice and assumes that individual clinicians are responsible to:

- Discuss care with women in an environment that is appropriate and which enables respectful confidential discussion.
- Advise women of their choices and ensure informed consent is obtained.
- Meet all legislative requirements and maintain standards of professional conduct.
- Apply standard precautions and additional precautions as necessary, when delivering care.
- Document all care in accordance with local and mandatory requirements.

Appendix One

World Health Organization (WHO) Body Mass Index (BMI) Categorisation

Classification	BMI(kg/m²)	
	Principal cut-off points	**Additional cut-off points**
Underweight	**<18.50**	**<18.50**
Severe thinness	<16.00	<16.00
Moderate thinness	16.00 - 16.99	16.00 - 16.99
Mild thinness	17.00 - 18.49	17.00 - 18.49
Normal range	**18.50 - 24.99**	**18.50 - 22.99**
		23.00 - 24.99
Overweight	**≥25.00**	**≥25.00**
Pre-obese	25.00 - 29.99	25.00 - 27.49
		27.50 - 29.99
Obese	**≥30.00**	**≥30.00**
Obese class I	30.00 - 34.99	30.00 - 32.49
		32.50 - 34.99
Obese class II	35.00 - 39.99	35.00 - 37.49
		37.50 - 39.99
Obese class III	≥40.00	≥40.00

http://apps.who.int/bmi/index.jsp?introPage=intro_3.html

Appendix Two

Body Mass Index calculators

BODY MASS INDEX CALCULATOR				
Name	Jane Doe			
Age	35	years-old		
Gender	Female			
Height	5	feet	11	inches
Weight	168.00	pounds		
BMI	23.43			

http://exceltemplates.net/calculator/bmi-calculator/

Body Mass Index (BMI) Chart for Adults

Obese (>30) | Overweight (25-30) | Normal (18.5-25) | Underweight (<18.5)

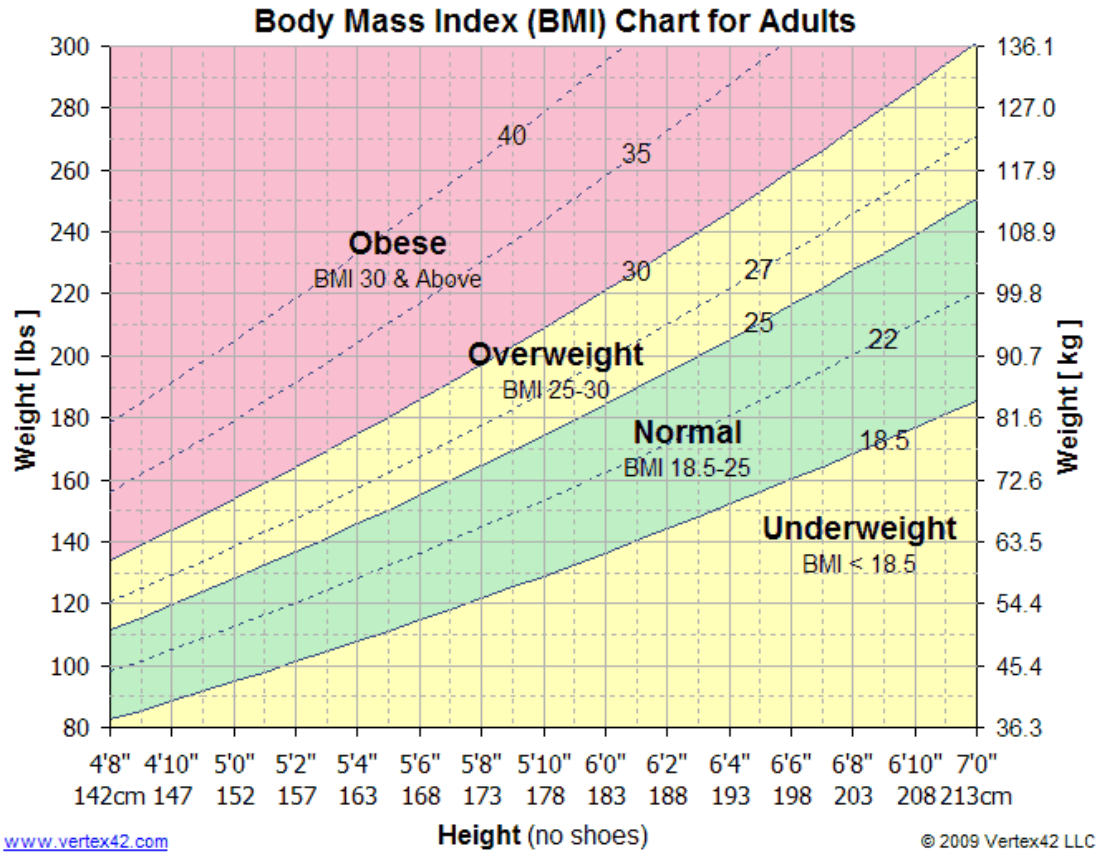
HEIGHT in feet/inches and centimeters

WEIGHT		4'8"	4'9"	4'10"	4'11"	5'0"	5'1"	5'2"	5'3"	5'4"	5'5"	5'6"	5'7"	5'8"	5'9"	5'10"	5'11"	6'0"	6'1"	6'2"	6'3"	6'4"	6'5"
lbs	(kg)	142cm		147	150	152	155	157	160	163	165	168	170	173	175	178	180	183	185	188	191	193	196
260	**(117.9)**	**58**	**56**	**54**	**53**	**51**	**49**	**48**	**46**	**45**	**43**	**42**	**41**	**40**	**38**	**37**	**36**	**35**	**34**	**33**	**32**	**32**	**31**
255	(115.7)	57	55	53	51	50	48	47	45	44	42	41	40	39	38	37	36	35	34	33	32	31	30
250	**(113.4)**	**56**	**54**	**52**	**50**	**49**	**47**	**46**	**44**	**43**	**42**	**40**	**39**	**38**	**37**	**36**	**35**	**34**	**33**	**32**	**31**	**30**	**30**
245	(111.1)	55	53	51	49	48	46	45	43	42	41	40	38	37	36	35	34	33	32	31	31	30	29
240	**(108.9)**	**54**	**52**	**50**	**48**	**47**	**45**	**44**	**43**	**41**	**40**	**39**	**38**	**36**	**35**	**34**	**33**	**33**	**32**	**31**	**30**	**29**	**28**
235	(106.6)	53	51	49	47	46	44	43	42	40	39	38	37	36	35	34	33	32	31	30	29	29	28
230	**(104.3)**	**52**	**50**	**48**	**46**	**45**	**43**	**42**	**41**	**39**	**38**	**37**	**36**	**35**	**34**	**33**	**32**	**31**	**30**	**30**	**29**	**28**	**27**
225	(102.1)	50	49	47	45	44	43	41	40	39	37	36	35	34	33	32	31	31	30	29	28	27	27
220	**(99.8)**	**49**	**48**	**46**	**44**	**43**	**42**	**40**	**39**	**38**	**37**	**36**	**34**	**33**	**32**	**32**	**31**	**30**	**29**	**28**	**27**	**27**	**26**
215	(97.5)	48	47	45	43	42	41	39	38	37	36	35	34	33	32	31	30	29	28	28	27	26	25
210	**(95.3)**	**47**	**45**	**44**	**42**	**41**	**40**	**38**	**37**	**36**	**35**	**34**	**33**	**32**	**31**	**30**	**29**	**28**	**28**	**27**	**26**	**26**	**25**
205	(93.0)	46	44	43	41	40	39	37	36	35	34	33	32	31	30	29	29	28	27	26	26	25	24
200	**(90.7)**	**45**	**43**	**42**	**40**	**39**	**38**	**37**	**35**	**34**	**33**	**32**	**31**	**30**	**30**	**29**	**28**	**27**	**26**	**26**	**25**	**24**	**24**
195	(88.5)	44	42	41	39	38	37	36	35	33	32	31	31	30	29	28	27	26	26	25	24	24	23
190	**(86.2)**	**43**	**41**	**40**	**38**	**37**	**36**	**35**	**34**	**33**	**32**	**31**	**30**	**29**	**28**	**27**	**26**	**26**	**25**	**24**	**24**	**23**	**23**
185	(83.9)	41	40	39	37	36	35	34	33	32	31	30	29	28	27	27	26	25	24	24	23	23	22
180	**(81.6)**	**40**	**39**	**38**	**36**	**35**	**34**	**33**	**32**	**31**	**30**	**29**	**28**	**27**	**27**	**26**	**25**	**24**	**24**	**23**	**22**	**22**	**21**
175	(79.4)	39	38	37	35	34	33	32	31	30	29	28	27	27	26	25	24	24	23	22	22	21	21
170	**(77.1)**	**38**	**37**	**36**	**34**	**33**	**32**	**31**	**30**	**29**	**28**	**27**	**27**	**26**	**25**	**24**	**24**	**23**	**22**	**22**	**21**	**21**	**20**
165	(74.8)	37	36	34	33	32	31	30	29	28	27	27	26	25	24	24	23	22	22	21	21	20	20
160	**(72.6)**	**36**	**35**	**33**	**32**	**31**	**30**	**29**	**28**	**27**	**27**	**26**	**25**	**24**	**24**	**23**	**22**	**22**	**21**	**21**	**20**	**19**	**19**
155	(70.3)	35	34	32	31	30	29	28	27	27	26	25	24	24	23	22	22	21	20	20	19	19	18
150	**(68.0)**	**34**	**32**	**31**	**30**	**29**	**28**	**27**	**27**	**26**	**25**	**24**	**23**	**23**	**22**	**22**	**21**	**20**	**20**	**19**	**19**	**18**	**18**
145	(65.8)	33	31	30	29	28	27	27	26	25	24	23	23	22	21	21	20	20	19	19	18	18	17
140	**(63.5)**	**31**	**30**	**29**	**28**	**27**	**26**	**26**	**25**	**24**	**23**	**23**	**22**	**21**	**21**	**20**	**20**	**19**	**18**	**18**	**17**	**17**	**17**
135	(61.2)	30	29	28	27	26	26	25	24	23	22	22	21	21	20	19	19	18	18	17	17	16	16
130	**(59.0)**	**29**	**28**	**27**	**26**	**25**	**25**	**24**	**23**	**22**	**22**	**21**	**20**	**20**	**19**	**19**	**18**	**18**	**17**	**17**	**16**	**16**	**15**
125	(56.7)	28	27	26	25	24	24	23	22	21	21	20	20	19	18	18	17	17	16	16	16	15	15
120	**(54.4)**	**27**	**26**	**25**	**24**	**23**	**23**	**22**	**21**	**21**	**20**	**19**	**19**	**18**	**18**	**17**	**17**	**16**	**16**	**15**	**15**	**15**	**14**
115	(52.2)	26	25	24	23	22	22	21	20	20	19	19	18	17	17	16	16	16	15	15	14	14	14
110	**(49.9)**	**25**	**24**	**23**	**22**	**21**	**21**	**20**	**19**	**19**	**18**	**18**	**17**	**17**	**16**	**16**	**15**	**15**	**15**	**14**	**14**	**13**	**13**
105	(47.6)	24	23	22	21	21	20	19	19	18	17	17	16	16	16	15	15	14	14	13	13	13	12
100	**(45.4)**	**22**	**22**	**21**	**20**	**20**	**19**	**18**	**18**	**17**	**17**	**16**	**16**	**15**	**15**	**14**	**14**	**14**	**13**	**13**	**12**	**12**	**12**
95	(43.1)	21	21	20	19	19	18	17	17	16	16	15	15	14	14	14	13	13	13	12	12	12	11
90	**(40.8)**	**20**	**19**	**19**	**18**	**18**	**17**	**16**	**16**	**15**	**15**	**15**	**14**	**14**	**13**	**13**	**13**	**12**	**12**	**12**	**11**	**11**	**11**
85	(38.6)	19	18	18	17	17	16	16	15	15	14	14	13	13	13	12	12	12	11	11	11	10	10
80	**(36.3)**	**18**	**17**	**17**	**16**	**16**	**15**	**15**	**14**	**14**	**13**	**13**	**13**	**12**	**12**	**11**	**11**	**11**	**11**	**10**	**10**	**10**	**9**

Note: BMI values rounded to the nearest whole number. BMI categories based on CDC (Centers for Disease Control and Prevention) criteria.

www.vertex42.com BMI = Weight[kg] / (Height[m] x Height[m]) = 703 x Weight[lb] / (Height[in] x Height[in])

http://www.vertex42.com/ExcelTemplates/bmi-chart.html



http://www.vertex42.com/ExcelTemplates/bmi-chart.html

Appendix Three

New American recommendations for total gestational weight gain (GWG) (Institute of Medicine)

Prepregnancy BMI (kg/m^2)	Range (kgs)	Range (lbs)
Underweight (< 18.5)	12.5 – 18.0	28 – 40
Normal weight (18.5 – 24.9)	11.5 – 16.0	25 – 35
Overweight (25.0 – 29.9)	7.0 – 11.5	15 – 25
Obese (> 29.9)	5.0 – 9.0	11 - 20

Reference: Institute of Medicine (2009)

Appendix Four

HEALTHY EATING DURING PREGNANCY

A well balanced diet is important for good health, not only during pregnancy but even before conception. This ensures you have a good store of nutrients to meet the demands of your developing baby. Contrary to popular belief, you don't need to consume twice the amount of food that you usually do - it's the quality of what you eat, not always the quantity, that's important.

What is a healthy diet?

A good general rule is to cut down on sugar, fat and salt and eat more fresh fruit, vegetables and high fibre cereals. If you are already on a special diet for medical reasons, make sure to consult your doctor or dietician. The table below provides guidelines to help meet your requirements.

HEALTHY FOODS TO ENJOY

Meat, fish and other proteins **3 servings daily** *(For protein and iron)* One serving is…… 50g cooked lean meat of poultry 75 g cooked fish 2 eggs (limit to 5 per week) 200 ml cup cooked beans, peas or pulses	**Milk and Dairy** **5 servings daily** *(For calcium, vitamins, minerals and protein)* One serving is…… 200ml (1/3 pint) low-fat milk (vitamin D fortified) 25 g Light cheddar cheese 1 small bowl cottage cheese 125 g low fat yogurt
Cereals, breads and other starches **6 to 9 servings daily** *(For vitamins, minerals, energy and fibre)* One serving is… 1 small bowl breakfast cereal (wholegrain) 1 medium potato or yam 3 dessertspoons cooked pasta or rice 1 slice bread (preferably wholegrain) 1 small pitta, chappati or naan	**Fruit and Vegetables** **More than 5 servings daily** *(For vitamins, minerals, antioxidants and fibre)* One serving is… 125 ml unsweetened fruit juice 1 medium piece fresh fruit or two small ones 3 dessertspoons cooked fruit or veg 1 bowl homemade vegetable soup Small bowl of salad greens

Healthy fats: Use mainly monounsaturated and polyunsaturated oils in cooking, such as olive, rapeseed and safflower oils. Use small amounts of butter and enjoy nuts, seeds, oily fish and avocado as heart-healthy additions.

Do not skip meals! Always take regular meals and snacks, evenly spaced throughout the day, to ensure to you are able to eat all the foods you need and keep your energy up.

IMPORTANT NUTRIENTS

Iron is necessary for healthy blood. Good dietary sources include meat, fish, poultry and egg yolks, green leafy vegetables, fortified breakfast cereals, peas, beans and lentils. In addition, foods rich in Vitamin C such as citrus fruits (oranges, grapefruit) can help the absorption of iron from your food, whereas strong tea or coffee can prevent it. Because of the high requirements of iron during pregnancy, your doctor may prescribe iron tablets for you if necessary.

Folate and Folic acid are vitamins essential for the formation and healthy growth of cells in your baby's body and can help prevent some birth defects, such as Spina Bifida. Folate is found in dark green leafy vegetables, bovril and marmite. Folic acid is found in fortified breakfast cereals and breads. Women are advised to take folic acid supplements until 12 weeks, some women may be advised to continue throughout pregnancy.

Calcium is essential for the development of healthy teeth and bones. Good dietary sources include milk, yoghurt and cheese. Smaller amounts are found in green vegetables, and tinned fish like sardines and salmon. If you don't like milk, cheese or yoghurt, discuss alternative sources with your doctor or dietician.

Vitamin D: Vitamin important for calcium absorption. Eggs, fortified milk and margarines, fortified breakfast cereals and oily fish such as salmon, sardines, herring and tuna are good sources of vitamin D. Your body also makes vitamin D from sunlight in summer months, so try to spend some time outdoors.

Omega-3 has been shown to improve babies' brain development. The best source is oily fish e.g. Salmon, trout, mackerel, sardines, kippers and herring. Flaxseed and linseed contain omega-3 but they also affect some hormones and ideal amounts are unknown.

Common problems during pregnancy

Morning sickness, despite its name, can occur at any time during the day for the first 12 to 15 weeks. Small frequent meals throughout the day may help. Take food dry, such as dry toast without butter, or plain biscuits, sip fluids slowly throughout the day, suck on ice-cubes or ice-pops.
Constipation is a common problem and can be relieved by regular exercise and increasing your combined fibre and fluid intake. High fibre foods include wholegrain breakfast cereals, wholemeal bread, wholewheat pasta, wholegrain rice, fruit and vegetables. Raw bran is best avoided as it can interfere with the absorption of important nutrients. Drink at least 8 to 10 cups of fluid daily including water, unsweetened fruit juices, with tea or coffee in moderation.
Heartburn may be a problem, especially during the end of pregnancy. Eating small, frequent meals and avoiding large meals particularly late at night will help. Avoid spicy and fatty foods, fizzy drinks. Milky foods may help to alleviate the symptoms. Try to relax at meal times.
A guide to Weight Gain
Everyone has different energy and weight gain requirements in pregnancy depending on pre-pregnancy weight. The best guide is your rate of weight gain and appetite. Recommended weight gain is between 6.8 kg to 15.9 kg (about 1 to 2 ½ stone) for a single baby, it will be more if you are underweight, carrying twins or multiple babies. Most of your weight gain will occur in the last half of pregnancy (just under ½ kg or one pound each week if your weight is normal).
If you are gaining too much weight or too quickly cut down on fried and fatty foods, sweets, cakes, biscuits and sugary foods and drinks. These foods have loads of calories but little nutrition. Focus on the food groups on the front of this leaflet.
Do not try to lose weight when you are pregnant.

Foods to avoid
Some foods should be avoided because they can contain bacteria, high levels of vitamin A or other toxins, like mercury, that may be harmful to you and your unborn baby.

- AVOID soft boiled or raw eggs (such as in homemade mayonnaise, mousse, or cheesecake).
- Do not take cod liver oil.
- AVOID soft, mold-ripened or unpasteurized cheeses like Camembert, Brie, Stilton, blue cheese. It is safe to eat pasteurized cheddar, blarney, mozzarella, edam, and parmesan cheeses, cottage cheese and cream cheese.
- Limit all caffeine containing drinks (coffee, tea, colas, energy drinks) to 3 or 4 per day.
- AVOID soft whipped ice cream.
- AVOID swordfish, marlin, shark and tilefish.
- Limit your tuna intake to one fresh steak or two medium tins of tuna per week (280g total).
- AVOID paté, raw fish sushi and raw, undercooked or reheated meat, poultry or fish and smoked, uncooked fish.
- AVOID liver and liver products.
- Always check the sell by and best before dates on all food and drink!

Food Hygiene

- It is important to handle food properly and practice good hand washing daily to prevent food poisoning and infection.
- Use separate cutting boards for raw meat versus cooked.
- Use separate cutting boards for meat versus fruit and vegetables.
- Keep fridge at less than 5° C and freezer less than -18°C.
- Clean cutting boards with food-safe disinfectant.
- Wash all fresh fruit, vegetables and salad well.
- Store raw meat at the bottom of the fridge to prevent juices from dripping onto other foods.
- Reheat left over food until it is steaming hot.
- When eating at restaurants or takeaways make sure food looks, smells and tastes fresh.

ALCOHOL
Should be avoided during pregnancy, it is not recommended and may harm your baby.

SMOKING
Smoking harms your baby's development, speak to your midwife about ways to stop.

Vitamins: Speak with your Doctor Midwife or Dietician before taking any supplements.

Appendix Five

Patient Information leaflet on exercise in pregnancy

Exercise and Pregnancy

All women are encouraged to exercise as part of a healthy lifestyle during pregnancy. In particular, aerobic and strength training exercise is recommended. Your physiotherapist and your doctor can guide you with your exercise programme.

Can I exercise if I have a medical condition?

Talk to your healthcare provider before beginning a programme of exercise as there are some medical conditions that require medical supervision while exercising. Your healthcare provider may recommend that you complete a health screening prior to commencing exercise. The PARmed-X for pregnancy (Physical Activity Readiness Medical Examination) is a guideline to health screening that is often used.

What are the Benefits of Exercise during Pregnancy?

There are many physical and psychological health benefits to remaining physically active throughout your pregnancy. Benefits of pregnancy exercise include improved fitness and weight maintenance, increased muscle tone, strength and endurance. Exercise may prevent and treat gestational diabetes mellitus, may relieve lower back pain, constipation, reduce ankle swelling and varicose veins. In addition, it prepares your body for labour and promotes a sense of wellbeing.

What Exercise is recommended during pregnancy?

Aerobic and strength conditioning exercise is recommended during pregnancy.

Examples of aerobic exercise, also known as cardiovascular exercise include brisk walking, jogging/running, swimming, dancing, aerobics and aqua aerobics.

Examples of strength conditioning exercise include resistance training or weightlifting and flexibility exercises. It is also recommended that you commence or continue pelvic floor muscle training to prevent urinary and faecal incontinence. Your physiotherapist can teach and guide you in pelvic floor muscle training.

What Exercise is not recommended during pregnancy?

You can discuss your specific exercise with your healthcare provider (Doctor or Physiotherapist) to clarify any risk and to modify the exercise if necessary.
It is not recommended to exercise while lying flat on your back after week 16 of pregnancy.

You should avoid exercises with a risk of abdominal injury. These include squash, soccer and basketball. You should also avoid exercises with a high risk of falling. These include gymnastics, horse riding, downhill skiing and cycling.

Scuba diving should be avoided throughout pregnancy.

What is the recommended duration and frequency of exercise?

Usually, 30 minutes exercise on most, if not all, days of the week is recommended. If 30 minutes in the same session is not possible, then this time can be divided into 10 or more minute sessions to make up 30 minutes e.g. 3 x 10 minute sessions or 2 x 15 minute sessions.

How do I ensure I exercise at a safe intensity?

Make sure you do a warm-up and cool-down.
Do the 'talk test'. While exercising you should always be able to carry out a conversation. If you are too breathless to do this you are exercising too hard.

Use the Borg scale to rate your perceived exertion. Perceived exertion is how hard you feel your body is working or the intensity of your exercise. It is based on the physical sensations you feel during exercise, including increased heart rate, increased breathing rate, increased sweating and muscle fatigue. The scale ranges from 6 to 20. You should aim for a rating of between 12 to14 on the scale. This means "somewhat hard" and indicates that you are exercising at a moderate intensity. Use the scale to speed up or slow down your movements to reach your desired range.

Borg Perceived exertion scale

6	No exertion at all
7	Extremely light
8	
9	Very light - (easy walking slowly at a comfortable pace)
10	
11	Light
12	
13	**Somewhat hard**
14	
15	Hard
16	
17	Very hard
18	
19	Extremely hard
20	Maximal exertion

Target heart rate cannot be used to monitor exercise in pregnancy as there is a varied response of heart rate to exercise during pregnancy.

What should I wear while exercising?

Wear comfortable clothes that will help you to remain cool. Removable layers can be useful. Wear a comfortable bra that fits well and gives your breasts support and wear well fitting supportive runners.

What should I do prior to exercising?

Maintain adequate nutrition and hydration. Bring a drink with you while exercising, it will keep you hydrated and help to keep you cool.

When should I avoid exercising?

If you are feeling unwell.
If you have gestational diabetes mellitus and your blood glucose level is below 5.

When should I stop exercising?

Stop exercising and call your doctor if you get any of the following symptoms:
Dizziness or feel faint
Increased shortness of breath
Chest pain
Headache
Muscle weakness
Leg pain or swelling
Uterine contractions
Decreased fetal movement
Vaginal bleeding
Leaking of amniotic fluid from the vagina

Appendix Six

Guidelines for the management of pre-gestational and gestational diabetes mellitus from pre-conception to the postnatal period.
Health Service Executive, 2010

Screening and diagnosis of gestational diabetes
Universal screening for gestational diabetes remains controversial. To date, the American Diabetes Association, the International Diabetes Federation and the National Institute for Health and Clinical Excellence recommend selective screening for gestational diabetes. Therefore; we recommend the following:

At the booking antenatal visit, all patients should be screened for recognised risk factors for gestational diabetes. Identification of any of the following risk factors should prompt a 75g OGTT at 24-28 weeks' gestational age:

- Family history of diabetes in a first degree relative
- Body mass index ≥30kg/m2
- Maternal age ≥ 40years
- Previous unexplained perinatal death
- Current glycosuria
- Women on long term steroids
- Previous delivery of a baby weighing ≥4.5kg
- Polycystic Ovary Syndrome
- Polyhydramnios and/or macrosomia in existing pregnancy
- Ethnicity associated with a high prevalence of diabetes: (India/ Pakistan/Bangladesh/ Black Caribbean/ Saudi Arabia/ United Arab Emirates/ Iraq/ Jordan/ Syria/ Oman/ Qatar/ Kuwait/Lebanon/Egypt10
- If GDM is suspected at an earlier or later gestation than 24-28 weeks, on the basis of fetal macrosomia, polyhydramnios or glycosuria, a 75g OGTT should be performed. If negative at an early gestation, the OGTT should be repeated between 24-28 weeks gestation.
- While some centres re-screen women with a history of gestational diabetes with a 75g OGTT at 24-28 weeks gestation, it is recommended that the woman be referred at booking for combined diabetes/obstetric antenatal care.

Two hour 75g oral glucose tolerance test (OGTT) during pregnancy

- The OGTT is a diagnostic procedure; therefore women with pre-existing diabetes do not require this test.
- Women should consume their normal diet for three days prior to test.
- Each woman should be advised not to alter her current diet prior to test.
- Each woman should fast (no food or fl uids, except water) for 12 hours prior to the test.
- Fasting blood glucose should be reserved.
- 75g of carbohydrate (CHO) is administered to drink over a 10-15 minute period.
- The patient should be directed to sit quietly during the test.
- Smoking is discouraged.
- A venous sample of blood glucose is reserved 1 hour and 2 hours from commencing the CHO drink.
- Date and time each sample.

Diagnosis of gestational diabetes

A diagnosis of gestational diabetes is made when one or more values are met or exceeded.

Diagnosis of GDM with 75g OGTT

Fasting	5.1mmol/L
1 hour	10.0mmol/L
2 hour	8.5mmol/L

Appendix Seven

Suggested thromboprophylactic doses for antenatal and postnatal LMWH

Weight (kg)	Enoxaparin	Dalteparin	Tinzaparin
< 50	20 mg daily	2500 units daily	3500 units daily
50–90	40 mg daily	5000 units daily	4500 units daily
91–130	60 mg daily*	7500 units daily*	7000 units daily*
131–170	80 mg daily*	10 000 units daily*	9000 units daily*
> 170	0.6 mg/kg/day*	75 units/kg/day*	75 u/kg/day*
High prophylactic			
(intermediate) dose for women weighing 50–90 kg	40 mg 12-hourly	5000 units 12-hourly	4500 units 12-hourly
Treatment Dose	1 mg/kg/12 hourly antenatal; 1.5 mg/kg/daily postnatal	100 units/kg/12 hourly or 200 units/kg/daily postnatal	175 u/kg/daily (antenatal and postnatal)

* may be given in two divided doses

** adopted from RCOG Guideline no. 37 (2009)

*** Doses of tinzaparin has been increased in 131-170 kg category compared with the previous RCOG Guideline