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**Factors Associated with Maternal Obesity and Obstetric Outcomes
Among South Asian and European Women**

by

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**A thesis submitted in partial fulfilment of the requirements for the
Degree of Doctor of Philosophy**

**University of Warwick
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GLOSSARY OF TERMS

Term	Synonyms & Abbreviations	Applied Definition
Anterpartum haemorrhage	APH	A bleeding from or in to the genital tract, occurring from 24+0 weeks of pregnancy and prior to the birth of the baby. The most important causes of APH are placenta praevia and placental abruption, although these are not the most common ⁴
Body Mass Index	BMI	A simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults ² . It is defined as the weight in kilograms divided by the square of the height in metres (kg/m ²) ²
Caesarean Section		A caesarean section is an operation to deliver a baby. It involves making a cut in the front wall of a woman's abdomen (tummy) and womb ³
Diabetes		Diabetes is a lifelong condition that causes a person's blood sugar level to become too high. The two main types of diabetes are type 1 diabetes & type 2 diabetes ³
European		White British and European born in UK or not
Final mode of birth		Type of delivery either spontaneous, ventouse, forceps, vaginal breech or caesarean section.
First generation South Asian		South Asian not born in UK
Forceps		Forceps are smooth metal instruments that look like large spoons or tongs to help deliver the baby. They're curved to fit around the baby's head ³
Gestational Diabetes	Gestational Diabetes Mellitus (GDM)	Gestational diabetes is a type of diabetes that affects women during pregnancy. ³ Normally, the amount of glucose in the blood is controlled by a hormone called insulin. ³ However, during pregnancy, some women have higher than normal levels of glucose in their blood and their body cannot produce enough insulin to transport it all into the cells. ³ This means that the level of glucose in the blood rises ³
HELLP syndrome	HELLP	<p>HELLP syndrome is a rare liver and blood clotting disorder that can affect pregnant women.³ It is most likely to occur immediately after the baby is delivered, but can appear any time after 20 weeks of pregnancy, and in rare cases before 20 weeks.³</p> <p>The letters in the name HELLP stand for each part of the condition:</p> <ul style="list-style-type: none"> • 'H' is for haemolysis – this is where the red blood cells in the blood break down³ • 'EL' is for elevated liver enzymes (proteins) – a high

		<p>number of enzymes in the liver is a sign of liver damage³</p> <ul style="list-style-type: none"> • 'LP' is for low platelet count – platelets are cells in the blood that help it to clot³
Hypertension	High Blood Pressure	Condition of blood pressure which is constantly higher than the recommended level ³
Later generation South Asian		South Asian born in UK
Maternal height		The height measurement of pregnant women at booking
Maternal Obesity	Obese Pregnant Women	Defined as obesity during pregnancy, increases health risks for both the mother and child during and after pregnancy ¹
Maternal weight		The weight measurement of pregnant women at booking
Obstetric Outcomes		Results of the pregnancy, including before, during and after birth
Pre-eclampsia		Pre-eclampsia is a condition that affects some pregnant women, usually during the second half of pregnancy (from around 20 weeks) or soon after their baby is delivered. ³ Early signs of pre-eclampsia include having high blood pressure (hypertension) and protein in your urine (proteinuria). ³ In some cases, further symptoms can develop, including swelling of the feet, ankles, face and hands caused by fluid retention (oedema), severe headache, vision problems and pain just below the ribs ³
Pregnancy induced hypertension	Gestational Hypertension, PIH	Condition of high blood pressure during pregnancy ³
Preterm delivery	Premature labour	Baby born before the 37 th week of pregnancy ³
Previous Medical Problems		Having any medical problems before getting pregnant including diabetes, heart problems and hypertension
Spontaneous cephalic vaginal	Spontaneous birth	Birth of an infant without any aid from an attendant ⁵ .
Still birth		A stillbirth is a baby born dead after 24 completed weeks of pregnancy ³ .
Vaginal breech		Delivery in which the fetal buttocks present first ⁵ .
Ventouse		A ventouse (vacuum extractor) is an instrument that is attached to the baby's head by suction. A soft or hard plastic or metal cup is attached by a tube to a suction device ³

Public Health England, 2014

² WHO, 2013

³ NHS. 2014

⁴ RCOG, 2014

⁵ Medical-dictionary, 2014

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DECLARATION

I am aware of the university regulations governing plagiarism and I declare that this thesis is all my own work except where I have stated otherwise.

Signed,

Nor Asyikin Abd Ghafar 12 July, 2019

ABSTRACT

OBJECTIVE: To identify the prevalence of maternal obesity, examine the association between maternal obesity and adverse pregnancy outcomes and explore the differences in lifestyle of obese pregnant women in first generation South Asians versus later generation South Asians in the West Midlands and Europeans.

DESIGN: A mixed methods parallel convergent study. **Quantitative Study:** Population based observational study in the West Midlands, comprising secondary data analysis using the Perinatal Institute dataset. A total of 141,314 completed pregnancies from 2009 – 2012 were studied including 120,481 European (85.3 %) and 20,833 South Asian (14.7%). **Qualitative Study:** Interviews with South Asian and European obese pregnant women attending the antenatal clinic at UHCW, Coventry, and with health professionals to explore the factors influencing obesity in pregnancy. The sample was 15 obese South Asian pregnant women (9 first generation, 6 later generation), 15 European pregnant women and 12 health professionals (4 Obstetricians, 1 Dieticians and 7 Community Midwives).

MEASUREMENTS Quantitative Data: Prevalence of maternal obesity, antenatal and foetal complications and perinatal mortality, presented as raw frequencies and adjusted odds ratios with 95% confidence intervals following multivariate regression analysis. **Qualitative Data:** Views and behaviour concerning food consumption, physical activity and other related factors of obese pregnant women and health professionals.

RESULTS Quantitative Study: Using WHO BMI General Classification, prevalence of obesity among European women (21.2%) was slightly higher compared to South Asian women. However using WHO BMI Asian Specific Classification, the prevalence of obesity among South Asian later generation women increased from 15.5% to 29.3%, and for South Asian first generation women increased from 11.6% to 25.5%. A similar trend was seen for the prevalence of maternal obesity amongst the South Asian subgroups. Maternal obesity increased various obstetric outcomes. South Asian women either first or later generation had higher prevalence of developing GDM when compared to European women. South Asian first generation also had the highest risk to have macrosomic baby when compared to the South Asian later generation and European women as a reference. **Qualitative Study** The lifestyles of some obese pregnant women are no different between the period before pregnancy and pregnancy itself. Most of the health professionals agreed that obese women should be given advice to lose weight before getting pregnant. South Asian obese women need to increase their capability on taking a proper diet, exercise regularly following the recommendation, increased knowledge related to weight management, diet and physical activity to increase their motivation to practice healthy lifestyle. Better opportunity for women of lower socioeconomic status, time management, and social influenced and support may increase the chance of practising a healthy lifestyle. Thus, health professionals need to give specific advice based on the pregnant women's need using specific guidelines and tools.

CONCLUSION Using the WHO Asian Specific BMI Classification increases the prevalence of maternal obesity either among South Asian born in UK or not born in UK. Being obese has a significant impact on increasing the risk of gestational diabetes, hypertensive disease during pregnancy, caesarean section, low birth weight, macrosomia among South Asian women. However, the risk differs between the ethnic groups. Preconception services on weight management and specific guidelines for this group are needed.

CHAPTER 1

INTRODUCTION

In Chapter 1, I will explain my background, including the reasons why I became interested in this research topic. I will also give an outline of my research, including its aims, the studies' background and the structure of my thesis.

1.1 RESEARCHER'S INTEREST IN THIS PROJECT

I became interested in exploring research on maternal obesity and obstetric outcomes as a result of my previous employment and life experience, and I hope to be the first nutrition specialist in maternal obesity in my country. Currently there are no specific guidelines for obesity management for pregnant women in Malaysia. Hopefully, through the knowledge, skill and experience obtained throughout my PhD journey, I will be able to develop such guidelines and an appropriate intervention programme for maternal obesity in Malaysia.

I have been working with the Ministry of Health in Malaysia as a nutritionist since 2004. I have a BSc degree in Nutrition from the National University of Malaysia, and a MSc in Exercise Science from George Washington University, USA. In 2012, I received a scholarship from Majlis Amanah Rakyat (MARA), Malaysia to pursue my PhD based on my research interests at the University of Warwick.

In my work as a nutritionist I offered many diet and exercise consultations to various age groups. I realised that a healthy lifestyle should start before pregnancy or at least during pregnancy. Pregnant women are usually more concerned with their weight, and with their and their babies' wellbeing (Monte et.al, 2011), so the pregnancy period is the perfect time to understand the mothers' behaviour, their intentions and decisions related to leading a healthy lifestyle.

In Malaysian popular opinion there are still many restrictions associated with pregnancy, including the view that pregnant women should not be physically active, or that they should not eat pineapple. These perspectives made me curious as to why people do not refer to scientific evidence rather than follow their feelings and thoughts or simply trust what they were told by their parents or grandparents, even though we are now living in a modern era.

When I gave birth to my son, Kashif, on the 1st June 2012 at Pontian Hospital (it was a free government hospital), the next day I ate crab. All the pregnant women in the ward, as well as some of the midwives, were staring at me. They were even discussing loudly, purposely wanting me to hear their conversation. In Malay culture it is not considered normal for women to eat seafood (except fish) after giving birth, and in some opinions this is considered impermissible for up to 40 days postpartum. Some women even avoid eating meat after delivery.

Since there are so many taboos around Malaysian practice especially during pregnancy, I decided to pursue a PhD studying the lifestyle of pregnant women. Without proper eating habits and a healthy lifestyle pregnant women may deliver children with nutrient deficiencies, or they may be at increased risk of becoming obese.

1.2 BACKGROUND

Obesity is an emerging issue, with the levels of global obesity nearly doubling since 1980. The prevalence of overweight and obesity is increasing worldwide (WHO, 2000) with more than one billion adults who are overweight and more than 300 million who are obese (WHO, 2013). In England, the proportion of men who were categorized as obese increased from 13% (1993) to 25% (2011), and from 16% (1993) to 26% (2011) among women according to the Health Survey for England (Sutton, 2012). England has been ranked as one of the countries with the highest prevalence of obesity in Europe (DoH, 2011a). Obesity or overweight kills at least 2.8 million adults each year and is associated with diabetes (44%), ischaemic heart disease (23%), and between 7% and 41% of certain cancers (WHO, 2013).

The trend is similar in Asian countries, with the prevalence of overweight having increased in most countries in Asia from 2005 to 2010 (Cheng et al, 2011). The prevalence of obesity-related conditions varies by ethnic group. Some groups such as South Asian and Chinese groups have been found to suffer from an elevated risk of some of these conditions, particularly Type 2 diabetes and hypertension, even if their BMI is low (Razak, 2007). One study in the UK shows that minority ethnic groups including Indians, Pakistani

and Bangladeshi are more likely to report ill health than the White British population, with one exception being the Chinese, who often report better health (Sproston, 2006).

The prevalence of overweight and obesity is also increasing in the pregnant population (Heslehurst et al, 2010). During the past 20 years, there has been an almost twofold increase in the prevalence of maternal obesity with BMIs of more than 30kg/m^2 from 7.6% in 1989 to 15.6% in 2007 (Heslehurst et al, 2010). This trend will increase future resource requirements for maternal services in the UK.

Maternal obesity has been associated with an increased risk of hypertensive disorders, gestational diabetes mellitus, several adverse reproductive outcomes, caesarean delivery, macrosomia, shoulder dystocia, and foetal death (ACOG, 2005). In the long term the consequences may be even more severe, as maternal obesity may increase the risk of Type 2 diabetes mellitus for mother and child, and also increase the risk of the child suffering from obesity later in life (Gillman et al, 2003).

Compared to the general population in the UK, South Asian populations tend to have larger families, less access to health care facilities, and an increased risk of developing diseases related to obesity (NOO,2011). Furthermore, these minority ethnic groups were the fastest growing sub-population (Karlsen & Nazroo, 2010; Szczepura, 2011).

Heslehurst et al (2012) compared the incidence of obesity amongst pregnant women using the Asian specific BMI criteria ($\text{BMI} \geq 27.5 \text{ kg/m}^2$) which have been suggested by NICE in 2013, and the general BMI criteria (for others) ($\text{BMI} > 30 \text{ kg/m}^2$). Results show that South Asian women have a higher odds of obesity in the first trimester (OR 1.72, 95% CI 1.66-1.79) by comparison to White women. The percentage of South Asian obese pregnant

women also increased twofold from 10.6% to 20.5% when using the WHO Asian-specific obesity criteria ($\text{BMI} > 27.5 \text{ kg/m}^2$) compared to the usual BMI cut-off point for obesity ($\text{BMI} > 30 \text{ kg/m}^2$) (Heslehurst et al, 2012). This is the first national maternal obesity dataset to have been analyzed using the WHO Asian-specific BMI criteria within the UK (Heslehurst et al, 2012).

From 1995-2007, the prevalence of obesity has been consistently higher among the Bangladeshi, Indian and Pakistani populations (South Asian ethnic subgroups) compared to White women (Heslehurst et al, 2012) after using the new BMI criteria for South Asians. Since there is a difference in the incidence of maternal obesity among South Asian women after using the Asian specific BMI criteria, it is really important to study the prevalence and the association of maternal obesity and its health outcomes using the new BMI cut-off points for South Asians.

Based on the current literature, ethnicity is one of the potential barriers when it comes to engaging with the current health service (Smith et al, 2012). Furthermore, there is evidence that dietary patterns have changed due to migration, with more second generation migrants reporting adopting aspects of the British diet compared to the first generation (Landmand et al, 2001). The South Asian population in the UK was also found to be significantly less active when compared to the White population (Obesity and Ethnicity, 2011).

There is research related to maternal obesity and health, in general; however, the amount of literature on South Asian pregnant women with obesity, in particular, is minimal. The available guidelines and reports for weight management for pregnant women are also not specific for the South Asian population.

Following discussions with all my supervisors, Dr Wendy Robertson, Professor Gillian Hundt, Professor Jason Gardosi and Professor Siobhan Quenby, it was agreed that the focus of my PhD would be to do research on factors associated with maternal obesity and obstetric outcomes among the South Asian obstetric population in the West Midlands, with a comparison of first and later generation South Asians with Europeans as a reference population. A mixed methods study has been developed for this purpose, using quantitative and qualitative methods.

- Quantitative - secondary data analysis using the West Midland's Perinatal Institute dataset
- Qualitative research - interviews with South Asian and European obese pregnant women attending the antenatal clinic at University Hospital Coventry and Warwickshire (UHCW), Coventry, and health professionals exploring factors influencing obesity in pregnancy.

1.3 RESEARCH AIMS

The aim of this study is to identify the prevalence of maternal obesity, examine the association between maternal obesity and adverse pregnancy outcomes, and explore the differences in lifestyle between obese pregnant women who are first generation South Asians versus later generation South Asians, as well as Europeans in the West Midlands.

1.4 RESEARCH QUESTIONS & OBJECTIVES

1.4.1 Research Question 1

What is the prevalence of maternal obesity and of complications associated with maternal obesity among first generation South Asians versus later generation South Asians versus the European reference population in the West Midlands?

Objectives for RQ 1

- i. To examine the prevalence of maternal obesity among first generation South Asians compared to the later generation South Asian population versus the European reference population over a four-year period, from 2009 to 2012, in the West Midlands.
- ii. To examine the prevalence of maternal obesity among Indian, Pakistani and Bangladeshi women compared to the European reference population over the four-year period from 2009 to 2012 in the West Midlands.

- iii. To examine antenatal and foetal complications associated with maternal obesity among the first generation compared to later generation South Asians versus the European reference population in the West Midlands.
- iv. To examine antenatal and foetal complications associated with maternal obesity among Indian, Pakistani and Bangladeshi women compared to the European reference population in the West Midlands.

1.4.2 Research Question 2

What are the dietary and physical activity patterns in obese pregnant women and how do socioeconomic, cultural and environmental factors affect the food consumption and physical activity of obese pregnant women when comparing first generation South Asians to later generation South Asians and to European pregnant women?

Objectives for RQ 2

- i. To explore the views and reported behaviour concerning food consumption of obese pregnant women and to compare the experiences of first generation South Asians and later generation South Asians, as well as European pregnant women.
- ii. To explore the difference in views and reported behaviour concerning physical activity of obese pregnant women, as well as to compare the experiences of first generation South Asians, later generation South Asians, and European pregnant women.
- iii. To explore the socioeconomic, cultural and environmental factors that affect the food consumption and physical activity of obese pregnant women, comparing

first generation South Asians with later generation South Asians and European pregnant women.

1.4.3 Research Question 3

What are the views of health professionals (obstetricians, dieticians and midwives) in relation to the knowledge and attitudes of obese pregnant women on diet, physical activity and environmental factors associated with obesity during pregnancy?

Objectives for RQ 3

- i. To explore the views of health professionals on the food consumption of obese pregnant women who are first generation South Asians versus later generation South Asians and European pregnant women.
- ii. To explore the views of health professionals on factors affecting the physical activity of obese pregnant women who are first generation South Asians versus later generation South Asians and European pregnant women.
- iii. To explore the views of health professionals on environmental factors that affect the food consumption and physical activity of obese pregnant women who are first generation South Asians versus later generation South Asians and European pregnant women.

1.5 THE STRUCTURE OF THE THESIS

Chapter 2 presents a literature review of the material available on maternal obesity, with a section on obstetric outcomes and health intervention during pregnancy including both quantitative and qualitative research studies. Chapter 3 presents the methodology used in my research, explaining the general theoretical research frameworks, the philosophical paradigm, and the source of each component used in this study.

Chapter 4 presents the methods used for the quantitative analysis. There are two chapters for the quantitative results (Chapter 5 and Chapter 6) exploring the first research question. Chapter 5 will compare the quantitative analysis findings on first and second generation South Asian pregnant women with European women as the reference population. Chapter 6 will compare the Indian, Pakistani and Bangladeshi populations with European pregnant women as the reference population.

Chapter 7 presents the methods used for the qualitative analysis. Chapters 8 and 9 will showcase the results of the qualitative analysis, and meet the objectives for the second and third research questions. Chapter 8 will focus on exploring the views of obese pregnant women, while Chapter 9 will focus on the views of health professionals.

Chapter 10 will be the last chapter, and it will contain the main discussion, taking into account both the quantitative and the qualitative analysis results.

CHAPTER 2

LITERATURE REVIEW

2.1 OVERVIEW

This chapter will define obesity and maternal obesity for the general population and the South Asian population, and the prevalence of obesity and maternal obesity in the UK and global populations. I will then examine the obstetric and foetal outcomes of maternal obesity. The policy and guidelines related to obesity during pregnancy will be explained in this literature review as well, alongside the behaviour and lifestyle of pregnant women. In the final part of the chapter, the research gap that this study will fill will be described.

In this literature review, I prioritise identifying the recent systematic reviews that relate to obstetric outcomes and the health status of obese pregnant women. If systematic reviews were not available, the next most appropriate evidence was used, such as epidemiological or longitudinal studies, in order to examine the association between maternal obesity and obstetric outcomes.

2.2 DEFINING OBESITY

Obesity is defined “*as a condition of abnormal or excessive fat accumulation in adipose tissue, to the extent that health may be impaired*” (WHO, 2000). Obesity is categorized as a Body Mass Index (BMI) of more than 30 kg/m² (WHO, 2013). However, the BMI is not an accurate predictor of the distribution of body fat, especially among the Asian populations (Harding, 2008). NICE recommends combining the BMI classification with waist circumference measurement in order to assess the health risk for patients with a BMI of less than 35 kg/m² (NICE, 2006). This is particularly important among South Asian populations who have a high percentage of fat (Harding, 2008) and a higher waist circumference even at a lower BMI (Leung & Stanner, 2011). Asian people have a higher percentage level of body fat compared to Europeans at any given level of BMI (Harding, 2008).

An obese population is at a higher risk of developing the following conditions: coronary heart disease, Type 2 diabetes (Reaven, 2011), cancers (endometrial, breast, and colon), strokes, hypertension (Kurukulasuriya, 2011), dyslipidemia, liver and gallbladder disease, sleep apnoea and respiratory problems, osteoarthritis and gynaecological problems (NHS, 2014 & WHO, 2013). It is also the fifth leading risk for global deaths (WHO, 2015).

Obesity or overweight kills at least 2.8 million adults each year and is attributed to the burden of diabetes (44%), ischaemic heart disease (23%), and between 7% and 41% of certain cancers (WHO, 2015). The prevalence of obesity-related chronic conditions varies by ethnic group. Those of South Asian origin have been found to have an elevated risk of

some of these diseases, especially Type 2 diabetes and hypertension, even if they have a healthy BMI (Razak, 2007).

2.2.1 WHO General Classification of BMI

Overweight and obesity was defined as having too much body fat (WHO,2017). Thus Body Mass Index (BMI) calculation has been used to determine body fat and it is gold-standard methods (Gallagher et al. 1996). BMI is defined as a person's weight in kilograms divided by the square of his height in meters (kg/m^2) (WHO, 2017). The World Health Organization (WHO) states that for adults, the healthy range for BMI is between 18.5 and 24.9 kg/m^2 .

The cut-points for BMI are based on the relationship found between BMI and mortality, which have been found in epidemiological studies such as the Seven Countries study (Visscher et al 2000). This study showed that a BMI $> 30 \text{ kg/m}^2$ is associated with an increase in mortality among never smokers. So as BMI increases so does the risk at the population level, and therefore supports the use of cut-points for BMI giving a value for intervening with public health action.

Table 2.1 details the BMI Classification for the general population by WHO for age 18 and older.

Table 2.1: BMI Classification for General Population

Classification	BMI (kg/m²)
Underweight	Less than 18.50 kg/m ²
Normal Range	18.50 – 24.99 kg/m ²
Overweight	25.00 – 29.99 kg/m ²
Obese	30 kg/m ² or higher
Obese class I	30.00 – 34.99 kg/m ²
Obese class II	35.00 – 39.99 kg/m ²
Obese class III	40 kg/m ² or higher

Source: WHO, 2013

2.2.2 BMI Classification for the Asian Population

NICE have recently issued a new guideline for Asian, Black and other minority groups on assessing BMI and waist circumference thresholds as an intervention to prevent ill health and premature death among adults (NICE, 2013). The details of the BMI classification are in Table 2.2 with a lower BMI threshold of 27.5 kg/m² in Asian populations now recommended to define them as ‘at high risk’.

Table 2.2: WHO advice on BMI public health action points for Asian populations (WHO 2004)

White European populations	Asian populations	Description
Less than 18.5 kg/m ²	Less than 18.5 kg/m ²	underweight
18.5 – 24.9 kg/m ²	18.5 – 23 kg/m ²	increasing but acceptable risk
25 – 29.9 kg/m ²	23 – 27.5 kg/m ²	increased risk
30 kg/m ² or higher	27.5 kg/m ² or higher	high risk

Source: NICE, 2013 (p11)

Some studies have examined the relationship between increasing BMI and risk of ill health in populations of Asian or Caucasian origin (Unwin, 1997). The studies concluded that even at low levels of BMI, Asian populations have a higher chance of having obesity-related illnesses when compared to the Caucasian population (Unwin, 1997). The exact reasons for this situation still remain unclear.

2.2.3 Waist Circumference (WC)

High levels of central or abdominal adiposity in adults increases their risk of having obesity-related diseases, including the most common non-communicable diseases: type 2 diabetes, hypertension and heart disease (NOO, 2009). The South Asian population was found to have a more centralised distribution of body fat and to show a higher risk of having obesity-related diseases at lower waist circumference levels (Deurenberg et al.,

2002 & Rush et al, 2004). In a recent literature review it is suggested that there is no universal cut-off value for waist circumference (WC) that can be applied worldwide; the threshold varies across ethnicities (Qiao & Nyamdori, 2010). In 2013, NICE took the initiative of doing a separate WC threshold recommendation for different ethnic groups in the UK (NICE, 2013) (Table 2.3).

Table 2.3: International guidance on Waist Circumference (WC) Thresholds

Ethnicity	Men	Women
European	$\geq 94\text{cm}$ (37 inches)	$\geq 80\text{cm}$ (31.5 inches)
South Asians / Chinese/ Japanese	$\geq 90\text{cm}$ (35 inches)	$\geq 80\text{cm}$ (31.5 inches)
Ethnic South and Central Americans	Use South Asian recommendations until more specific data is available	
Sub-Saharan Africans	Use European data until more specific data is available	

Source: NICE, 2013 (p12)

2.3 PREVALENCE OF ADULT OBESITY

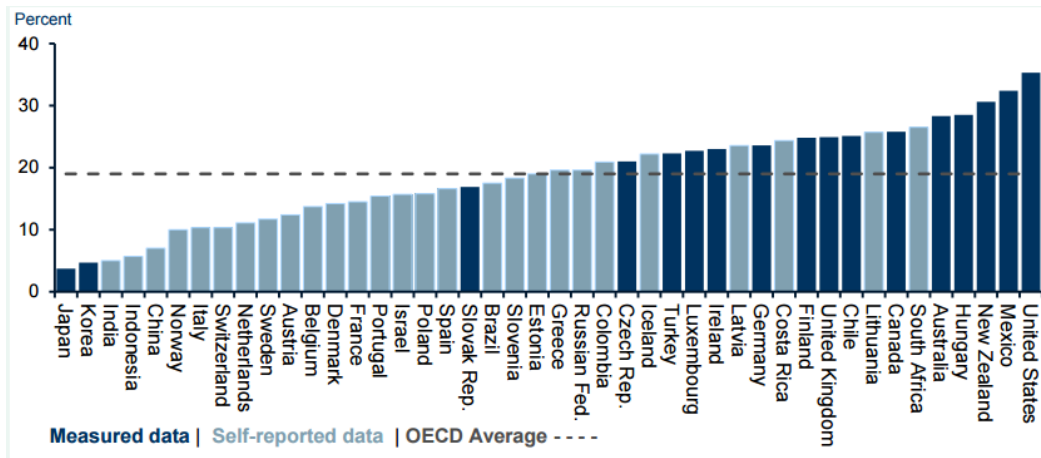
2.3.1 Global

According to a report by WHO (2015), in 2008 34% of men and 35% of women aged 20 or over in the world were overweight. The prevalence of obesity among men doubled from 5% in 1980 to 10% in 2008, while among women it increased from 8% in 1980 to 14% in 2008. Overall, the prevalence of obesity in women was higher compared to men.

Malik et al. (2012) estimate that the prevalence of obesity worldwide has nearly doubled from 1980 to 2008, and the biggest rise is amongst women who were living in Central Latin America, North America, North Africa and the Middle East. The increase in the prevalence of obesity among women in Western Europe was less than 10% over a period of 28 years, while South Asia has the lowest prevalence of obesity among women. However, Cheng et al. (2011) reported that the prevalence of obesity has also increased in most countries in Asia from 2005 to 2010.

Figure 2.1 shows that the UK was listed as one of the top ten countries with the highest prevalence of adult obesity (25%), with the second highest rate of obesity in Europe after Hungary, and 6% more than the average prevalence for adult obesity among the Organisation for Economic Co-operation and Development (OECD) countries (HSCIC 2016) . Out of the South Asian countries, only India was featured on the OECD list; however, the prevalence of adult obesity here was relatively low (5%).

Figure 2.1: Prevalence of Obesity in OECD Countries

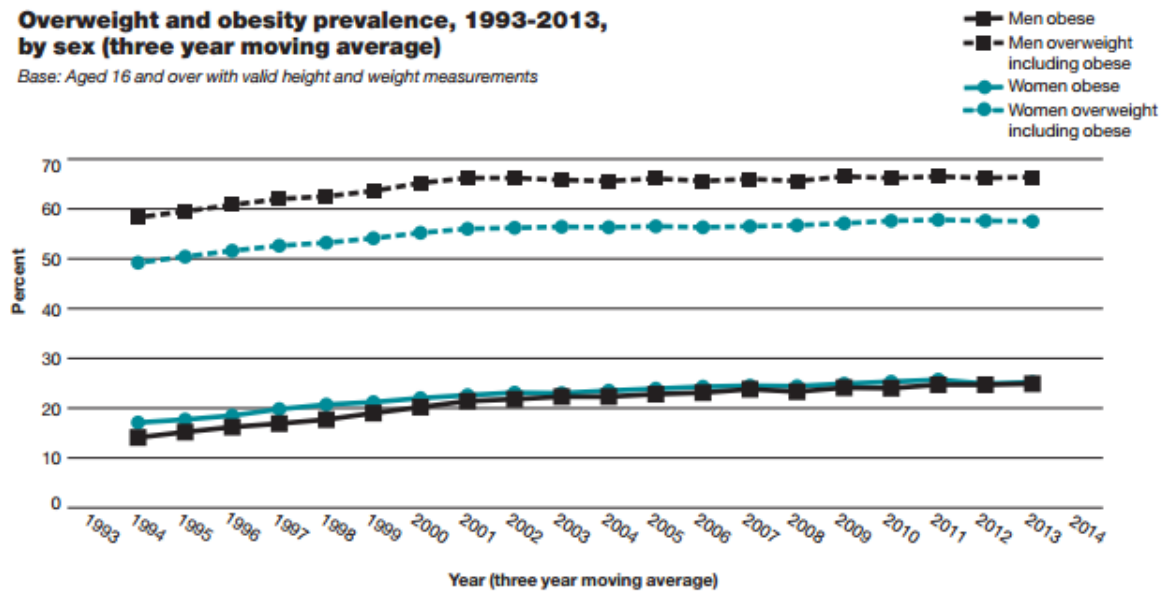


Source: HSCIC (2016)

2.3.2 United Kingdom

A report from the Health Survey for England showed that the prevalence of obesity among men in England increased from 13.2% in 1993 to 24.3% in 2014, and for women from 16.4% in 1993 to 26.8% in 2014 (HSE, 2014) (**Figure 2.2**). Since 1995, the total number of overweight men and women amounted to more than half of the population (HSE, 2014).

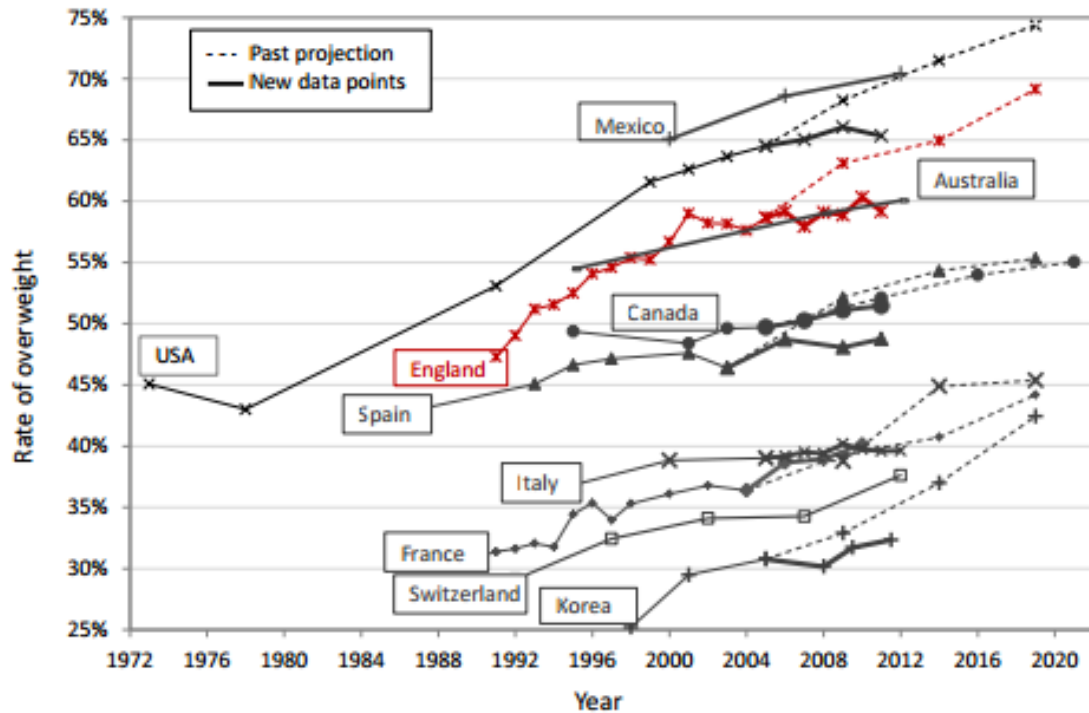
Figure 2.2: Prevalence of obesity among adults aged 16+



Source: HSE (2014)

According to the projections of the Organisation for Economic Co-operation and Development (OECD), the number of overweight adults in England will increase by 1.4% per year until 2020 (Figure 2.3) (OECD, 2014). Moreover, Public Health England (2016) predicted that 60% of adult men and 50% of adult women in England will be obese by 2050.

Figure 2.3: Trends in the prevalence of overweight and obesity in adults, projections and recent estimates, selected OECD countries



Source: OECD estimates based on national health surveys (2014).

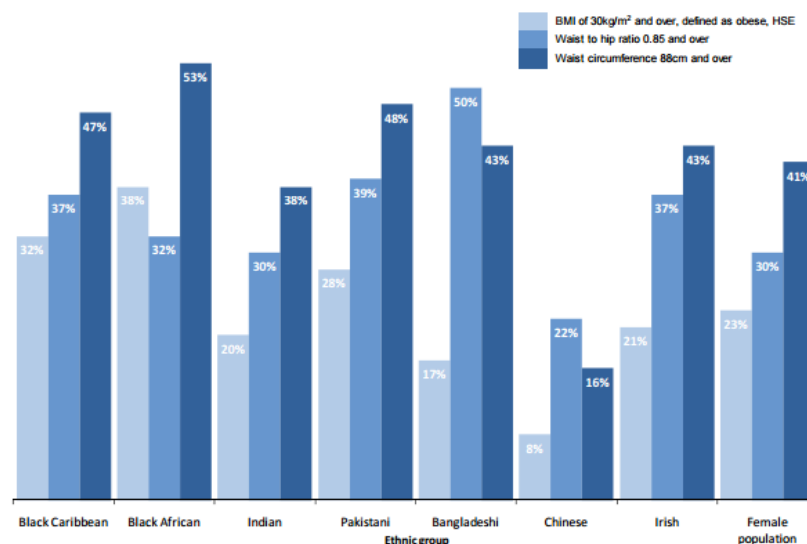
2.3.3 South Asian Population in the UK

Asian or Asian British is the second largest group after Whites in the UK and represents approximately 7.5% of the total population. They originate mainly from India (606,000 UK Born and 807,000 non-UK born), Pakistan (631,000 UK Born and 493,000 non-UK born) and Bangladesh (232,000 UK Born and 215,000 non-UK born) (Census, 2011). The Indian population has increased by 36.3%, Pakistani has increased by 57.3% and a 59.2% increased among Bangladeshi since 2001 when compared to 2011(Cencus, 2011).

Minority ethnic groups including Indians, Pakistani and Bangladeshi are more likely to report ill health than the White British population (Sproston, 2006), except for the Chinese, who often report better health (Sproston, 2006).

The National Obesity Observatory (2011) combined the findings from the Health Survey Unit (2004) and the Health Survey for England (2005) to compare the prevalence of obesity in women between each ethnic minority group and the general population. Figure 2.4 shows that Black African, Black Caribbean, and Pakistani women had a higher prevalence of obesity compared to the general population. The prevalence of obesity for Bangladeshi women was much lower than the overall female population; however, overall, obese Bangladeshi women had the highest waist to hip ratio - over 0.85 – in comparison to other groups. Figure 2.4 also shows that the waist-to-hip ratio (>0.85) and Waist Circumference (≥ 88 cm) of Pakistani and Bangladeshi women was higher than that of the general female population.

Figure 2.4: Prevalence of obesity ($\text{BMI} \geq 30\text{kg/m}^2$) among women in the UK categorised by ethnic group



Reference: NOO, 2011

Using the Obesity BMI Classification of 30kg/m², Smith et al. (2012) did a comparison of obesity between the first and second generation adult South Asian population (Indian, Pakistani and Bangladeshi), on the one hand, and the White reference population, on the other (Table 2.4). From the first generation South Asian population, Indian and Bangladeshi were found less likely to be obese when compared to the White reference group, with an OR of 0.75 (CI 95% 0.58-0.97), and an OR of 0.62 (CI 95% 0.44-0.89), respectively. By contrast, first generation Pakistani adults were 24% more likely to be obese (OR 1.24 (CI 95% 1.00–1.54) when compared to the White reference group. However, in the second generation there is no significant difference between Indian, Pakistani and Bangladeshi adults when compared to the White reference group (Smith et al. 2012).

Table 2.4 : ORs (95% confidence interval) for being obese vs. over/ underweight/ normal in first and second generation ethnic minority groups when compared with the White reference population, adjusted for age and sex

	N	% Obese	OR (95%) for being obese vs white reference
White Reference	16 889	19.1	1
Indian			
First generation	747	15.9	0.75 (0.58-0.97)*
Second generation	632	17.2	0.94 (0.73-1.20)
Pakistani			
First generation	732	21.6	1.24 (1.00-1.54)*
Second generation	836	15.7	1.06 (0.84-1.35)
Bangladeshi			
First generation	595	10.8	0.62 (0.44-0.89)*
Second generation	585	9.2	0.70 (0.48-1.03)

*Weighted percentages given; significant (*P < 0.05)*
Source: Smith et al. (2012)

2.4 DEFINITION OF MATERNAL OBESITY

In 1990, The Institute of Medicine (IOM), United States classified maternal overweight as pre-pregnancy BMI 26-29kg/m² and maternal obesity as pre-pregnancy BMI over 29 kg/m² (IOM,1990). IOM revised the recommendation in 2009 and classified the overweight and obesity cut-off points to make them consistent with the current WHO BMI classification (Table 2.1), including the weight gain recommendation based on pre-pregnancy BMI for pregnant women (IOM, 2009). In this thesis, the classification for overweight and obese pregnant women is based on the pre-pregnancy BMI consistent with WHO classification in Table 2.1. However, among the South Asian ethnic groups, women were classified according to the Asian cut-offs for BMI given in Table 2.2 as well.

2.5 PREVALENCE OF MATERNAL OBESITY

2.5.1 Global

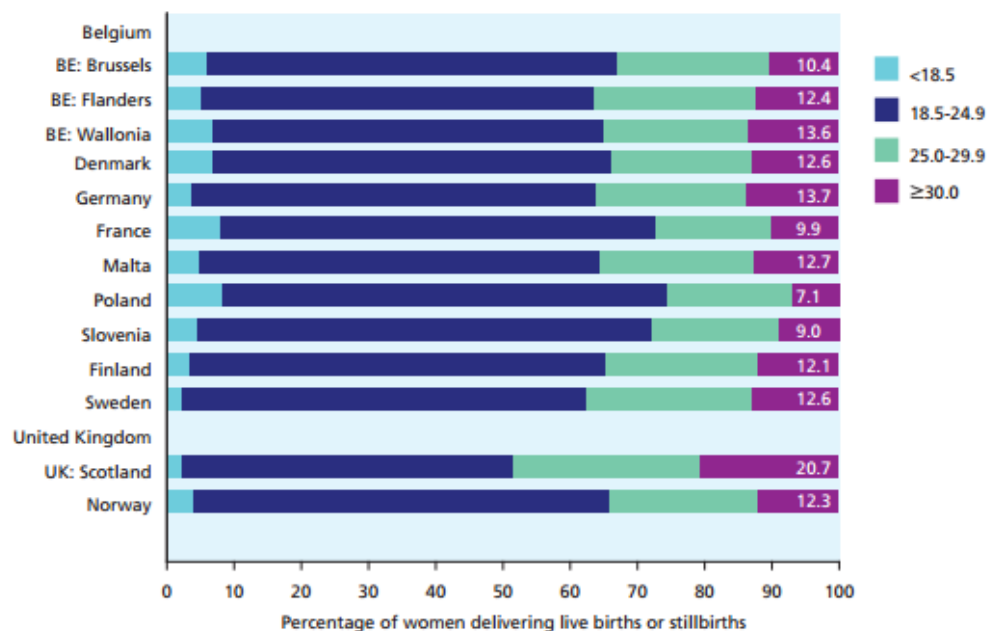
The prevalence of overweight and obesity is also increasing in the pregnant population (Heslehurst et al., 2010). A study in the USA showed the prevalence of maternal obesity with BMI classification based on the BMI at the first prenatal visit (obese as BMI > 29 kg/m²),demonstrating that it had increased to more than double from 16.3% in 1990 to 36.4% in 1999 (Lu et al., 2001).

Another nationally represented health examination survey in the US obtained from the National Health and Nutrition Examination Survey (NHANES), showed the increasing

prevalence of obesity among women from 35.5% (95% CI, 33.2%-37.7%) in 2007-2008 (Flegal et al., 2010) to 40.4% (95% CI, 37.6%-43.3%) in 2013-2014 (Flegal et al, 2016).

Based on the latest European Perinatal Health Report (2010), Scotland (UK) had the highest prevalence of pre-pregnancy obesity (20.7 %) and it was the only country that had a prevalence of more than 20% (Figure 2.5). Poland showed the lowest level for pre-pregnancy obesity rates (7.1%), followed by Slovenia (9.0%) and France (9.9%). The majority of other European countries had rates between 10 and 20% (EURO-PERISTAT Project, 2010). A later study on the Irish population found that the trend for maternal obesity among 42,362 pregnant women between 2009 and 2013 was maintained at 16.8% (McKeating et al., 2015).

Figure 2.5: Distribution of maternal pre-pregnancy BMI in 2010



Source: EURO-PERISTAT Project 2010

2.5.2 United Kingdom

National statistics for maternal obesity are not collected routinely in the UK, unlike those for childhood obesity, which are collected via the National Childhood Measurement Programme and the Health Survey for England (Mandalia, 2012). The level of obesity of the general adult population is also monitored via the Health Survey for England (Sutton, 2012). The Centre for Maternal and Child Enquiries (CMACE, 2010) carried out an observational study in the UK, the Channel Islands, and the Isle of Man focusing on the babies born between March and April 2009 to 5068 women with maternal obesity (defined as BMI > 35 [Class II and Class III obesity], or weight >100kg at any time during pregnancy). This study showed that the prevalence of obesity during pregnancy defined as a BMI >35 kg/m² was 5%; with 2% of mothers having a BMI >40 kg/m² and 0.2% of mothers having a BMI >50 kg/m² (CMACE, 2010). Unfortunately, CMACE did not collect data on obese Class I women with a BMI range of 30-35 kg/m² (CMACE, 2010).

A large retrospective study in England showed the trend of first trimester obesity increased from 7.6% in 1989 to 15.6% in 2007 (Heslehurst et al., 2010). In 2007, 10.0% of the women were obese Class I (BMI 30.0-34.9 kg/m²), 3.8% had a BMI Class II (35.0-39.9 kg/m²), and 1.8% had a BMI Class III (BMI ≥ 40 kg/m²) (Heslehurst et al., 2010).

2.5.3 The South Asian Population in the UK

Heslehurst et al. (2012) did a national epidemiological study of 502, 474 births in England, 1995 to 2007 compared the prevalence of obese pregnant women using Asian specific BMI criteria (for Asians) and general BMI criteria (for others). Results show that South Asian women have a higher prevalence of first trimester obesity (OR 1.72, 95% CI 1.66-1.79) when compared with White women. The percentage of South Asian pregnant women who were obese also increased two-fold, from 10.6% using the general BMI obesity criteria, to 20.5% when using the WHO Asian-specific obesity criteria (Heslehurst et al., 2012). This is the first national maternal obesity dataset to have been analyzed using the WHO Asian-specific BMI criteria within the UK (Heslehurst, et al 2012), and it highlights the large difference that is noted when using the Asian-specific cut-off points. From 1995 to 2007, the prevalence of obesity was consistently higher among the Bangladeshi (OR 2.19, 95% CI 2.08-2.31), Indian (OR 1.15, 95% CI 1.06-1.24) and Pakistani (OR 1.49, 95% CI 1.39-1.60) populations (South Asian ethnic subgroups) than among white women as reference (Heslehurst et al., 2012).

2.6 SOCIO-DEMOGRAPHIC DIFFERENCES IN THE UK

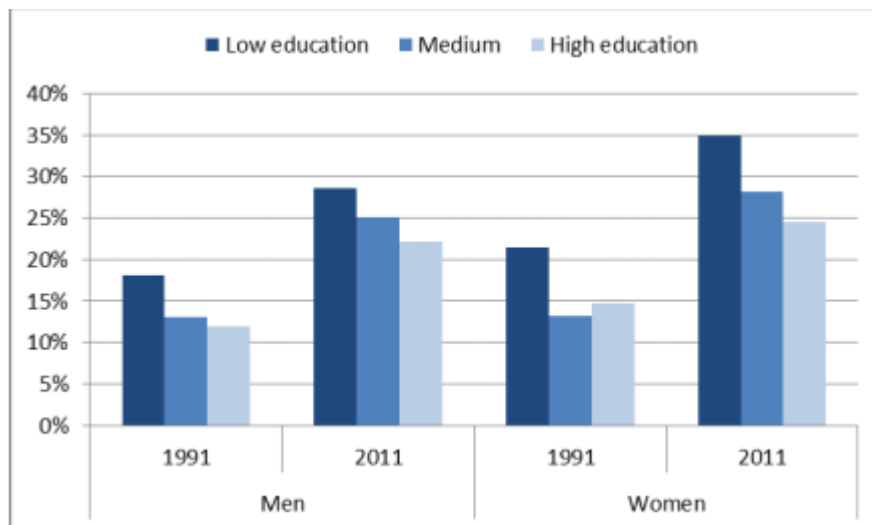
A national epidemiological study of 502,474 births in UK between 1995 and 2007, recruited from 34 maternity units in England concluded that existing maternal obesity guidelines may increase inequalities between ethnic groups (Heslehurst et al., 2010).

Heslehurst et al. (2010) identified that obese women were twice as likely to be living in areas of deprivation (OR 2.2, 95% CI 2.1-2.3). The association was increased with growing levels of obesity, with women with extreme obese classification (BMI > 50 kg/m²) almost five times as likely to be living in an area of deprivation (OR 4.7, 95% CI 3.2-6.9) (Heslehurst et al., 2010).

According to Heslehurst et al. (2010), super morbidly maternal obesity (BMI > 50 kg/m²) was reported as being significantly associated with increasing maternal age in England (OR 1.07, 95% CI 1.05-1.09). Smith et al. (2011) reported that in relation to inequalities, the main barriers preventing obese pregnant women from engaging with the current health service included financial problems, environmental factors, transport, housing, ethnicity and language barriers.

The Organisation for Economic Co-operation and Development (OECD), reported in 2014 that women with a low education status are 1.6 times more likely to be obese than highly educated women. According to Figure 2.6, the prevalence of obesity in both men and women has increased in all education-level groups; however, the highest prevalence of obesity was noted among the low-education group both in 1991 and in 2011 (OECD, 2014).

Figure 2.6: Prevalence of obesity by education level in 1991 and 2011, men and women, England



Source: OECD estimates based on the Health Survey for England (OECD, 2014)

The older generation of South Asian immigrants may have less understanding of the health and the social care system in the UK compared to the younger generation (Atkinson et al. 2001). The younger generation has better command of English, leading to effective communication and better understanding. The ability to speak English declines with increasing age and is much lower amongst those born outside the UK (Szczepura et al., 2005).

2.7 IMPACT OF MATERNAL OBESITY ON MATERNAL HEALTH (PRE-PREGNANCY)

2.7.1 Diabetes Mellitus

Diabetes Mellitus is a chronic condition related to the inability of the body to use glucose efficiently, which causes blood glucose to rise above normal levels (Diabetes UK, 2011). In the UK, around 2.9 million people have been diagnosed with Type 1 Diabetes Mellitus (T1DM) or Type 2 Diabetes Mellitus (T2DM) (Diabetes UK, 2012a). However, T2DM is the disease most commonly associated with obesity (Diabetes UK, 2012a). Patients who were suffering from T2DM were 13 times more likely to be obese (DoH, 2011a).

NICE (2012) reported that the prevalence of Diabetes Mellitus varies between ethnic minority groups and the White British population. The chances of developing T2DM in some ethnic minority groups were up to six times greater than those of the general population (Sproston & Mindell, 2006). Barnett et al (2006) reported that the prevalence of having Diabetes Mellitus among the South Asian population is around 20%, which is much higher when compared to the prevalence for Caucasians (3-4%).

Chronic diabetes also increased the risk of giving birth to low birth weight babies, especially among Asian women (OR 2.28, 95% CI 1.42-3.68), followed by Hispanic women (OR 1.69, 95% CI 1.21-2.35), and White women (OR 1.59, 95% CI 1.01-2.50 (Rosenberg et al., 2005).). However, there was a limitation in this study: it did not measure the BMI because the data on height were unavailable.

The health status of ethnic minority groups, as a whole, is reported to be lower than that of the White British population (POST, 2007). South Asian populations have been found to suffer from an elevated risk of hypertension and Type 2 Diabetes, even if their BMI is low (Razak et al., 2007). The research carried out by Rosenberg et al. (2005) in the USA examined associations between obesity, diabetes, and adverse pregnancy outcomes. Their findings indicated that Asian women, when compared with women from other ethnic groups, have a relatively higher proportion of chronic diabetes (0.4%) (Rosenberg et al., 2005).

Women who have Diabetes Mellitus pre-pregnancy face greater health risks than other women (Atrash et al., 2006). Women with diabetes who planned their pregnancies had significantly higher education, higher income, private insurance, were Caucasian, and were less likely to be smoking, compared with women with diabetes who did not plan their pregnancy (Holling et al., 1998). Spence et al (2010) explored the attitudes and knowledge of women with diabetes relating to pre-pregnancy care and found that they are really motivated, positive, supportive and interested in receiving information related to planning pregnancy, and other health information related to their condition.

2.7.2 Hypertension

According to the National Institute of Health and Care Excellence (NICE), people suffering from hypertension can be classified into three stages; Stage 1: with blood pressure of 140/90 mmHg or higher, Stage 2: blood pressure of 160/100 mmHg or higher and Severe: 180/110mmHg or higher (NICE, 2013). Correlations between hypertension, obesity and poor pregnancies have been well-known for years (Aagaard-Tillery et al., 2006; Ananth et al., 2007; Berg et al., 2009). The recent systematic review and meta-analysis on chronic hypertension and pregnancy outcomes concluded that chronic hypertension increased the risk of adverse pregnancy outcomes when compared to the general population (Bramham et al., 2014). Women who had chronic hypertension had high pooled incidence of pre-eclampsia (25.9%, 95% CI 21.0-31.5%), Caesarean section (41.4%, 95% CI 35.5-47.7%), preterm delivery <37 weeks gestation (28.1%, 95% CI 22.6-34.4%), birth weight <2500g (16.9%, 95% CI 13.1-21.5%), neonatal unit admission (20.5%, 95% CI 15.7-26.4%) and perinatal death (4.0%, 95% CI 2.9-5.4%) (Bramham et al., 2014).

2.8 IMPACT OF MATERNAL OBESITY ON OBSTETRIC OUTCOMES

Obesity during pregnancy is a high risk obstetric condition with considerable immediate and long term health consequences (Heslehurst et al., 2008). The Centre for Maternal and Child Enquiries' (CMACE) and The American Congress of Obstetricians and Gynecologists' (ACOG) summaries indicated that obese pregnant women had a greater risk of severe morbidity including miscarriage, cardiac disease, pre-eclampsia, gestational diabetes, thromboembolism, post-caesarean wound infection, postpartum haemorrhage and low breastfeeding rate (CMACE, 2010& ACOG, 2005).

A study in the UK found that overweight and obese women had a higher risk of gestational diabetes, hypertensive disorders of pregnancy and caesarean section (Scott-Pillai et al., 2013). A more recent systematic review also concluded that obese pregnant women had a higher risk of developing gestational diabetes, gestational hypertension, pre-eclampsia, depression, instrumental and caesarean birth, and surgical site infection when compared to healthy BMI range women (Marchi et al., 2015).

2.8.1 Gestational Diabetes Mellitus (GDM)

GDM is defined as “*any degree of glucose intolerance with onset or first recognition during pregnancy*” (Kjos & Buchanan, 1999). Based on a systematic review with a meta-analysis of 70 population based studies, obese pregnant women were more likely to have

GDM (OR 3.76 (95% CI 3.31-4.28) when compared to healthy weight women (Torloni et al., 2009). The risk of GDM increased with the growing severity of the BMI. The odds of having GDM for obese pregnant women were OR 3.01 (95% CI 2.34-3.87) for obese class I and OR 5.55 (95% CI 4.27-7.27) for obese class II and above compared to healthy BMI pregnant women (Torloni et al., 2009). Another review also estimated a greater risk of developing gestational diabetes among obese pregnant women. Pregnant women who were obese had three times as high a risk (unadjusted OR 3.05 (95% CI 3.05–4.21) as women of healthy weight, while severely obese pregnant women had an almost nine times higher risk (unadjusted OR 8.56, 95% CI 5.07–16.04) to develop gestational diabetes when compared to healthy weight pregnant women (Chu et al, 2007).

Savitz et al (2008) studied the pattern of gestational diabetes and ethnicity in New York City from birth records and hospital discharge summaries from 1995-2003 (n=951,920). Women who were born in South Asian countries had the most elevated risk for gestational diabetes, including women from Bangladesh (aRR 7.1, 95% CI 6.8–7.3), Pakistan (aRR 4.6, 95% CI 4.3–4.8), and India (aRR 3.7, 95% CI 3.5–3.9). In the UK, the prevalence of GDM for South Asian pregnant women was 9.2%; however, they were account for 25.6% for having pregnancies with diabetes related disease (NHS Maternity Statistics, 2013). South Asian women were also found to be at a higher risk of developing GDM when compared to US Caucasian and Australian descent women (Yuen & Wong, 2015).

Hunsberger et al (2010) reported that, by comparison to other ethnicities, South Asian women had a higher risk of developing GDM whether or not their BMI level was greater or less than 26 kg/m². This is because the women in this group have more central or visceral fat, which is also the best known risk factor for developing cardiovascular diseases and

insulin resistance (Pi-Sunyer, 2004). Recent systematic reviews show the positive effects of dieting and physical activity on reducing GDM (Morisset et al., 2010 & Skouteris et al. 2014).

2.8.2 Hypertensive disease in pregnancy

A report from the National High Blood Pressure Education Program Working Group on high blood pressure in pregnancy in 2000 classified hypertensive disorders during pregnancy into four categories: chronic hypertension, pre-eclampsia, pre-eclampsia superimposed on chronic hypertension, and gestational hypertension also known as Pregnancy-Induced Hypertension (PIH) (Report of the National High Blood Pressure Education Program Working Group, 2000). However, in 2008 the Society of Obstetricians and Gynecologists of Canada (SOGC) simplified the classification into two categories: pre-existing or gestational hypertension, with the added option of pre-eclampsia (Magee et al, 2008). Gestational hypertension is defined as displaying blood pressure levels higher than 140 x 90 mmHg, or an increase of 30 and 15 mmHg in the systolic and diastolic pressures, respectively, during the later stage of the pregnancy (>20 weeks of gestation) (Davey & MacGillivray, 1998).

A cohort study in the UK conducted on a group of 1.1 million women aged 50-64 invited from routine breast cancer screening programmes of the National Health Service (NHS) in England and Scotland in 1996 until 2001 showed that having hypertensive disease during

pregnancy is associated with an increased risk of coronary heart disease and stroke [coronary heart disease: RR 1.29 (95% CI 1.27-1.31), cerebrovascular disease: RR 1.23 (95% CI 1.20-1.27), ischaemic stroke: RR 1.29 (95% CI 1.23-1.35), and Haemorrhagic stroke: RR 1.14 (95% CI 1.07-1.21)] at first vascular disease event than pregnant women without a hypertensive disease history (Canoy et al., 2016).

Increasing the BMI level increases the chances of developing hypertensive disease during pregnancy. Overweight pregnant women were 74% more likely to have hypertensive disease during pregnancy (OR 1.74 (95% CI 1.45-2.15)), with obese class I and II pregnant women having three times the odds (OR 3.00 (95% CI 2.40-3.74)), while severely obese pregnant women or Obese Class III women have almost five times the risk (OR 4.87 (95% CI 3.27-7.24)) than pregnant women with a normal BMI (Callaway et al, 2007 & Chu et al, 2008). A study conducted in the US from 1991 to 1999 showed that pregnancy-induced hypertension caused 15.7% of maternal deaths (Chang et al., 2003).

Wang et al. (2013) reviewed the association between maternal obesity and pre-eclampsia and found that obese pregnant women displayed a greater risk of developing pre-eclampsia during pregnancy with elevated pooled risk ratios (RRs 2.68, 95% CI 2.40–3.00) for obese pregnant women (BMI 30–34.9 kg/m²) and for severe obesity (≥ 35 kg/m²) (RRs 3.43, 95% CI 2.59–4.55) than women with a normal BMI. Another systematic review also shows a three to ten times larger risk of developing pre-eclampsia and a 4.5 to 8.7 times larger risk of developing gestational hypertension among obese pregnant women than women with a normal BMI (Salihu et al., 2012). Some factors may increase the risk of developing gestational hypertension and pre-eclampsia, and Salihu et al. (2012) believe that an unhealthy diet and a lack of physical exercise are two of the possible factors.

2.8.3 Caesarian Section

The association between obesity during pregnancy and the necessity of a caesarean section is statistically significant (Heslehurst et al., 2008 & Poobalan et al., 2009). Obese pregnant women display twice the risk of having a caesarean section, with an odds ratio of between 2.01 (95% CI 1.87–2.15) (Chu et. al, 2007) and 2.36 (95% CI 2.15–2.59) (Molyneaux et al, 2007) than women of healthy weight. An increased BMI level will expand the risk of undergoing a caesarean section with odds ratios of 2.05 (95% CI 1.86–2.27) and 2.89 (95% CI 2.28–3.79) for obese pregnant women (BMI >29.0-39.9 kg/m²) and severely obese pregnant women (BMI >35 to >40 kg/m²), respectively. The latest systematic review of the relationship between international migration and caesarean section found that 69% of the studies show different caesarean rates amongst migrants and non-migrants. The odds of migrant South Asian women having caesarean sections were 28% larger (OR 1.28 (95% CI 1.22-1.35)) than those of the local population in Australia, Canada, Finland, Italy, Norway and Switzerland (Merry et al., 2013).

The mechanism for a higher caesarian section rate in women who are obese is likely to be multifaceted. Being obese may interfere with the ability of a woman to deliver vaginally, due to increased pelvic fat and reduced myometrial contractility, impairing the ability of the uterus to contract in labour (Zhang et al 2007). Maternal obesity is also associated with an increased risk of large for gestational age newborns (macrosomia baby) and preterm birth and these factors also increase the likelihood of caesarean section (Lutsive et al, 2015).

However, it could not be denied that caesarean section is a life-saving surgical due certain complication during delivery including obstructed labor, placenta praevia, breech, cephalo-pelvic disproportion, transverse and others (Kirchergast & Hartmann, 2017). Thus, it is an important procedure for reducing maternal and newborn mortality (Molina et al, 2016). Based on cross-sectional, ecological study estimating annual cesarean delivery rates from data collected during 2005 to 2012 from 54 WHO member states in 2012, cesarean delivery rate estimates were inversely correlated with maternal and neonatal mortality rate up to 19.1 per 100 live births (95% CI, 16.3 to 21.9) and 19.4 per 100 live births (95% CI, 18.6 to 20.3) (Molina et al, 2015).

2.8.4 Summary

Table 2.5 gives a summary of the studies exploring the association of obesity and GDM, hypertensive disease during pregnancy and caesarian section.

Table 2.5: Obstetric outcomes for obese pregnant women versus pregnant women with a normal BMI

Obstetric Outcomes	Study	Year of Study	Results: OR/RR(95% CI)
Gestational diabetes mellitus	Maternal obesity and risk of gestational diabetes mellitus (Chu et al, 2007)	1980 - 2006	BMI ≥ 30 (Obese) : OR 3.56 (95% CI 3.05 to 4.21) BMI ≥ 35 (severely obese): OR 8.56 (5.07 to 16.04)
	Pre-pregnancy BMI and the risk of gestational diabetes: a systematic review of the literature with meta-analysis (Torloni et al, 2009)	1977-2007	BMI ≥ 30 (obese): OR 3.01 (95% CI 2.34 to 3.87) BMI ≥ 35 (severely obese): OR 5.55 (95% CI 4.27 to 7.21)

Obstetric Outcomes	Study	Year of Study	Results: OR/RR(95% CI)
			For every 1 kg/m ² increase in BMI, the prevalence of GDM increased by 0.92% (95% CI 0.73 to 1.10).
Hypertensive disease during pregnancy	Does maternal obesity cause preeclampsia? A systematic review of the evidence (Salihu, 2012)	1992-2011	Narrative synthesis: BMI ≥30 (Obese): 4.5–8.7 times more likely to develop gestational hypertension BMI ≥30 (Severely Obese): 3–10 times more likely to have pre-eclampsia
	Maternal adiposity as an independent risk factor for pre-eclampsia: a meta-analysis of prospective cohort studies (Wang et al, 2013)	1958 -2009	Pre-eclampsia, pooled adjusted RRs: BMI ≥30 (obese): RR 2.68 (CI 95% 2.40 to 3.00) BMI ≥35 (severely obese): RR 3.43 (CI 95% 2.59 to 4.55)
Caesarean Section	Maternal obesity and risk of cesarean delivery: a meta-analysis (Chu, 2007)	1980-2005	BMI ≥30 (obese): OR 2.05 (CI 95% 1.86–2.27) BMI ≥35 (severely obese): OR 2.89 (CI 95% 2.28–3.79)
	The impact of maternal BMI status on pregnancy outcomes with immediate short-term obstetric resource implications: a meta-analysis (Heslehurst et al, 2008)	1990-2007	BMI ≥30 (obese): OR 2.01 (CI 95% 1.87–2.15) BMI ≥35 (Severely Obese): OR 1.43 (CI 95% 1.35–1.52)
	Obesity as an independent risk factor for elective and emergency caesarean delivery in nulliparous women – systematic review and meta-analysis of cohort studies (Poobalan et al., 2009)	1996-2007	BMI ≥30 (obese): OR 2.26 (CI 95% 2.04–2.51) BMI ≥35 (severely obese): OR 3.38 (CI 95% 2.49–4.57)

2.9 IMPACT OF MATERNAL OBESITY ON FOETAL/ CHILD OUTCOMES

The latest systematic review on maternal obesity and child health outcomes by Marchi et al. (2015) shows a greater risk of preterm birth, macrosomia, congenital anomalies, foetal defects, and neonatal intensive care admissions among obese pregnant women than among women with a normal BMI. However, in my quantitative research, I focused on three foetal outcomes associated with maternal obesity: macrosomia, low birth weight, and Neonatal Intensive Care Use (NICU), and therefore these will be reviewed in greater detail first.

2.9.1 Macrosomia

Different definitions of macrosomia are given across the specialist literature. However, the most common definitions are: a birth weight of more than 4,000g (Schrauwers & Dekker, 2009), of more than 4,500gm (Abenhaim et al., 2007), and a birth weight greater than the 90th percentile (Sebire et al., 2001). Macrosomia not only increases the risks posed to the newborn baby, such as harm from birth injury, perinatal death, and shoulder dystocia, but also the risks posed to the mother, including perineal trauma, caesarean delivery, achorioamnionitis, or postpartum haemorrhage (Stotland et al., 2004). The explanation for the higher risk of macrosomia babies is likely to be related to increased insulin resistance in obese pregnant women, resulting in higher fetal glucose and insulin levels leading to fetal overgrowth (Gaudet et al 2014).

An extensive study of 287,213 pregnant women from London found a significantly increased mean birth weight among obese women than among women with a normal BMI (Sebire et al., 2001). Obese pregnant women had an OR of 2.36 (99% CI 2.23 - 2.50) for a birthweight above 4000 grammes (macrosomia) compared to pregnant women with a normal BMI range (Sebire et al., 2001). The latest research by Kirchengast & Hartmann (2017) analysed data of 3451 live births at the Viennese University Hospital, Austria between 1995-2000, found that the relative risk to give birth to a macrosomia newborn was significantly increased among overweight (OR 1.46, CI 1.24-1.72), obese (OR 1.76, CI 1.40-2.19) as well as morbidly obese mothers (OR 1.51, CI 0.57-3.99) when compared to healthy weight mothers.

In a recent review, pre-pregnancy obesity was found to have a positive link with the delivery of babies with macrosomia. Pre-pregnancy obese women had twice the risk of having large-for-gestational-age (above the 90th centile) (OR 2.08, 95% CI 1.95–2.23) and high birth weight (>4,000g) (OR 2.00, 95% CI 1.84–2.18) and three times the chance of delivering a baby with macrosomia (4,500gm) (OR 3.23, 95% CI 2.39–4.37) than women with a normal pre-pregnancy BMI (Yu et al., 2013).

A study among 116,976 singleton macrosomic live birth founded that macrosomic infants of obese mothers were at elevated risk for chronic hypertension (OR 6.78, 95% CI 5.82–7.88), insulin-dependent diabetes mellitus, (OR 2.60, 95% CI 2.34–2.88, other types of diabetes mellitus (OR 2.83, 95% CI 2.65–3.02), preeclampsia (OR 2.49, 95% CI 2.33–2.67), hyaline membrane disease (OR 2.14, 95% CI 1.73–2.66), extended assisted ventilation (OR 1.71, 95% CI 1.44–2.04), birth injury (OR 1.58, 95% CI 1.37–1.84) and

meconium aspiration syndrome (OR 1.42, 95% CI 1.09–1.87) when compared with none obese mother (BMI < 30kg/m²) (Salihu et al, 2010).

2.9.2 Low Birth Weight

Being obese before getting pregnant had a negative correlation with having a baby with a low birth weight. Yu et al. (2013) reported that obese pregnant women had a 19% lower risk of having a low birth weight baby (below the 10th centile) (OR 0.81, 95% CI 0.80–0.83) than women with a normal pre-pregnancy BMI. Heslehurst et al. (2008) delineated similar findings in their review, which reports an OR of 0.81 (95% CI 0.78–0.91) of delivering a baby with low birth weight among obese pregnant women than women with a normal BMI.

2.9.3 Neonatal intensive care use (NICU)

The babies of obese or severely obese women needed neonatal intensive care more than the babies of women with a normal BMI range. A systematic review by Heslehurst et al. (2008) reported that, compared to the babies of women with a normal pre-pregnancy BMI, the babies of obese women were at a 38% higher risk (OR 1.38, CI 95% 1.16–1.64), and those of severely obese women had a 33% increased chance (OR 1.33, CI 95% 1.18–1.51) to be admitted into NICU.

A retrospective cohort research among 1736 mothers found that increasing NICU admission among obese pregnant women with comorbidities including hypertensive disease and gestational diabetes mellitus. Increasing maternal BMI during pregnancy also increased the risk of NICU admission in near and full-term infants (Suk et al, 2016). Infants who are macrosomia have increased risk of clavicle fractures, shoulder dystocia, and brachial plexus injury, thus increased the rate of NICU (Kc et al, 2015).

2.9.4 Stillbirth

The infants of obese pregnant women have nearly twice as high a chance of dying in their first year of life than those of pregnant women with a healthy weight, according to large population studies conducted in the UK (Sebire et al, 2001) and the US (Baeten et al, 2001). In the study by Gardosi et al (2013), the risk of stillbirth was found to be significantly higher for the first generation of non-UK born women (RR 1.6, 95% CI 1.3-2.1) than for UK-born women, and the risk of still birth increased when the pre-pregnancy Body Mass Index increased. When looking at ethnic origin, the number of still births is higher for first-generation non-UK-born Pakistani women and non-UK-born Indian women (first generation), than for second-generation UK-born Pakistani and Indian women (Gardosi et al, 2013).

2.9.5 Preterm and Late Delivery

In contrast to other pregnancy complications, obese pregnant women have significantly lower rates of spontaneous preterm delivery (6.2%) than healthy weight pregnant women (11.2%) (Hendler et al, 2005), although the risk increases with certain medical complications (Cedergren, 2004). Furthermore, obese pregnant women are more likely to deliver later than expected (later than the 42 calculated weeks' gestation) (O' Brien et al, 2003, Johnson et al, 1992).

2.9.6 Health in Childhood

Maternal obesity displays a definite link to an increased risk of chronic health problems in children, including cardiovascular disease, Type 2 Diabetes, cancer (Eriksson et al., 2014), childhood asthma (Forno et al., 2014, Harpsoe et al., 2013), and an increased risk for the child to develop obesity later in life (Gillman et al., 2003). The risk of having obese children was almost three times higher for obese women (pre-pregnancy BMI >30kg/m²) than for mothers with a normal (OR 3.06, CI 95% 2.68–3.49) (Yu et al., 2013).

A cohort study involving 1,263,358 Swedish children born in 1992 and in 2004 found that children and young adults aged 0 to 18 had an increased risk of 25% (OR 1.25 (95% CI 1.13-1.38)) of developing Type 1 Diabetes if their mother was obese and of Nordic origin, and an OR of 1.67 (95% CI 1.13-2.49) for children with mothers of non-Nordic origin (Hussen et al, 2015).

2.9.7 Summary

Table 2.6 gives a summary of the studies exploring the association of obesity with foetal outcomes.

Table 2.6: Foetal outcomes of obese pregnant women versus pregnant women with a normal BMI

Foetal Outcomes	Study	Year of Study	Results: OR/RR(95% CI)
Macrosomia	Pre-pregnancy body mass index in relation to infant birth weight and offspring overweight/obesity: a systematic review and meta-analysis (Yu et al., 2013)	1970-2012	<u>Large for gestational age, LGA (above the 90th percentile) :</u> BMI ≥ 30 (obese): OR 2.08 (CI 95% 1.95–2.23) <u>HBW (>4,000 g)</u> BMI ≥ 30 (Obese): OR 2.00 (CI 95% 1.84–2.18) <u>Macrosomia (>4,500 g)</u> BMI ≥ 30 (Obese): OR 3.23 (CI 95% 2.39–4.37)
	The impact of maternal BMI status on pregnancy outcomes with immediate short-term obstetric resource implications: a meta-analysis (Heslehurst et al, 2008)	1990-2007	High birth weight (undefined): BMI ≥ 30 (Obese): OR 2.36 (CI 95% 2.29–2.42)
Low Birth Weight	The impact of maternal BMI status on pregnancy outcomes with immediate short-term obstetric resource implications: a meta-analysis (Heslehurst et al, 2008)	1990-2007	BMI ≥ 30 (obese): OR 0.81 (95% CI 0.78–0.91) BMI ≥ 35 (severely obese): OR 1.11 (95% CI 0.93–1.34)
	Overweight and obesity in mothers and risk of preterm birth and low birth weight infants: systematic review and meta-analyses (McDonald et al., 2010)	1950-2009	BMI ≥ 30 (obese): OR 0.63 (95% CI 0.34–1.19) BMI ≥ 35 (severely obese): OR 0.81 (95% CI 0.42–1.53)

Foetal Outcomes	Study	Year of Study	Results: OR/RR(95% CI)
	Pre-pregnancy body mass index in relation to infant birth weight and offspring overweight/obesity: a systematic review and meta-analysis (Yu et al., 2013)	1970-2012	LBW (<2,500 g): BMI ≥ 30 (obese): OR 0.81 (95% CI 0.80–0.83)
NICU	The impact of maternal BMI status on pregnancy outcomes with immediate short-term obstetric resource implications: a meta-analysis (Heslehurst et al., 2008)	1990-2007	Neonatal intensive care use: BMI ≥ 30 (obese): OR 1.38 (CI 95% 1.16–1.64) BMI ≥ 35 (severely obese): OR 1.33 (CI 95% 1.18–1.51)

2.10 POLICIES AND GUIDANCE ON OBESITY IN PREGNANCY

2.10.1 The National Institute for Health and Care Excellence (NICE), UK

In 2010, NICE published its guidelines on weight management before, during and after pregnancy (NICE, 2010). This is the first and most specific guide on managing weight problems for obese pregnant women. This guide highlights the importance for overweight and obese women to lose weight before pregnancy, follow a healthy diet, and keep physically active during and after pregnancy (NICE, 2010). Table 2.7 describes other NICE guidelines related to pregnant women and obesity.

Table 2.7: NICE Guidance Related to Pregnant Women and Obesity (2006-2015)

Year	NICE Guidelines	Outlines
2006	Obesity Prevention	First national guidelines on the prevention of overweight and obesity in adults and children in England and Wales
2007	Behaviour Change	Commissioning, planning, delivering and evaluating initiatives to support behaviour change at an individual, community and population level; also tackles weight problems
2008	Antenatal Care	Updates and replaces NICE clinical guideline 6, 'Antenatal care: routine care for healthy pregnant women' (published October 2003). This guideline offers best practice advice on the care of pregnant women.
2008	Maternal and Child Nutrition	Guidance to improve the nutrition of pregnant and breastfeeding mothers, and children in low-income households. In particular, this guide addresses

Year	NICE Guidelines	Outlines
		disparities in the nutrition of low-income and other disadvantaged groups versus the general population.
2010	Weight Management Before, During and After Pregnancy	This set of guidelines covers weight management before, during and after pregnancy. The guide complements but does not replace NICE guidance on: obesity, maternal and child nutrition, antenatal care, postnatal care, physical activity, behavioural change, antenatal and postnatal mental health and diabetes in pregnancy.
2013	BMI: preventing ill health and premature death in black, Asian and other minority ethnic groups	This guide assesses how body mass index (BMI) and waist circumference among adults from black, Asian and other ethnic minority groups in the UK links to the risk of developing a range of non-communicable diseases.
2014	Overweight and obese adults: lifestyle weight management	Weight management services for adults who are overweight or obese: covers weight management programmes, courses, clubs or groups that aim to change someone's behaviour to practice a healthy lifestyle.
2015	Diabetes in pregnancy: management from preconception to the postnatal period	This guideline covers managing diabetes and its complications in women who are planning a pregnancy or are already pregnant. It aims to improve the diagnosis of gestational diabetes and help women with diabetes to self-manage their blood glucose levels before and during pregnancy.

2.10.2 The Centre for Maternal and Child Enquiries (CMACE) and the Royal College of Obstetricians and Gynaecologists (RCOG), UK

In 2010, the CMACE and RCOG jointly published their guidelines on the management of women with obesity in pregnancy. The guidelines provide detailed recommendations for obese women on topics including health before conception, as well as during and after pregnancy (CMACE & RCOG, 2010).

Box 2.1: Components in the CMACE/ RCOG Joint Guidelines: Management of Women with Obesity in Pregnancy

1. **Pre-pregnancy care** – Services in Primary Care including Advice on weight and lifestyle should be given during family planning consultations, and weight, body mass index and waist circumference and recommendation on nutritional supplements
2. **Provision of antenatal care** - Management of women with obesity in pregnancy should be integrated into all antenatal clinics, with clear policies and guidelines for care available.
3. **Measuring weight, height and BMI** - Using appropriate equipment, and their body mass index calculated at the antenatal booking visit
4. **Information-giving during pregnancy** - Provide with accurate and accessible information about the risks associated with obesity in pregnancy and how they may be minimized.
5. **Risk assessment during pregnancy** - Pregnant women with a booking BMI ≥ 40 should have an antenatal consultation with an obstetric anaesthetist and have a documented assessment in the third trimester of pregnancy by an appropriately qualified professional
6. **Thromboprophylaxis** - Women with a booking BMI ≥ 30 should be assessed at their first antenatal visit and throughout pregnancy for the risk of thromboembolism
7. **Maternal surveillance and screening** - An appropriate size of arm cuff should be used for blood pressure measurement and obese pregnant women should be screened for gestational diabetes and pre-eclampsia
8. **Planning labour and delivery** - Should have an informed discussion antenatally about possible intrapartum complications associated with a high BMI, and management strategies considered
9. **Care during child birth**
10. **Postnatal care and follow up after pregnancy**
11. **Local guidelines**
12. **Facilities and equipment**
13. **Education of health professionals** - All health professionals involved in the care of pregnant women should receive education about maternal nutrition and its impact on maternal, fetal and child health and appropriate training

Ref: CMACE/RCOG (2010)

2.11 RECOMMENDATIONS AND POLICIES RELATED TO HEALTHY LIFESTYLE FOR PREGNANT WOMEN

2.11.1 Preconception Health

Improving women's health status pre-pregnancy will improve reproductive health outcomes (CDC, 2014). Preconception care is important not only to produce a healthy generation but also to ensure the health of pregnant mothers and their families. Until 2010 there were no qualitative studies carried out in the UK related to diet, physical activity and weight management among women who were planning to become pregnant, and detailing the views of health professionals related to this issue (NICE, 2010).

In 2010 NICE produced the guidelines on weight management before, during and after pregnancy, although there was a very limited discussion or dissemination of information related to preconception weight management (NICE, 2010). A systematic review on preconception care for improving perinatal outcomes outlines that taking vitamin supplements containing folic acid daily before pregnancy reduces the risk of the baby developing neural tube defects by two thirds (Atrash et al., 2006). Weight loss before pregnancy also reduces the risk of the baby developing neural tube defects, of the mother having gestational diabetes, of preterm delivery, as well as pregnancy-induced hypertension, caesarean section, and thromboembolic disease (Atrash et al., 2006).

2.11.2 Healthy Eating

(a) Policy

NICE recommends that women of childbearing age and pregnant women should eat a variety of foods, including a daily intake of five servings of fruit and vegetables and a serving of oily fish once per week (NICE, 2008). Folic acid supplementation (400 µg daily) is recommended during the first trimester of pregnancy, but also prior to pregnancy (NICE, 2008). NICE also recommends vitamin D supplementation (10 µg daily) for all pregnant women throughout the pregnancy (NICE, 2008). Although NICE suggests a low-fat diet, it does not provide specific recommendations for calorie restrictions for weight loss or maintenance (NICE, 2008). The NICE guidelines on weight management before, during, and after pregnancy listed the following dietary changes required to achieve and maintain a healthy weight (NICE 2010, p 6-7):

Box 2.2: Advice to Pregnant Women from NICE on Healthy Diet

1. *Base meals on starchy foods such as potatoes, bread, rice, and pasta, choosing wholegrain where possible*
2. *Eat plenty of fibre-rich foods – such as oats, beans, peas, lentils, grains, seeds, fruits and vegetables, as well as wholegrain bread and brown rice and pasta*
3. *Eat at least five portions of a variety of fruits and vegetable each day, in place of foods higher in fats and calories*
4. *Eat a low-fat diet and avoid increasing your fat and calorie intake.*
5. *Eat as little as possible of:*
 - *Fried foods*
 - *Drinks and confectionery high in added sugars*
 - *Other food and drinks high in fat and sugar (such as some take-away and fast foods)*
6. *Eat breakfast.*
7. *Watch the portion size of meals and snacks, and how often you are eating.*

Reference: NICE, 2010 (Page 6-7).

(b) Impact of diet on South Asians

There is some evidence that dietary habits change due to migration. Leung & Stanner (2012) reported that people who migrate adopt the new lifestyle, values, and norms of their new country. The behavioural changes include, on the one hand, decreased physical activity, and fruit and vegetable intakes, and on the other hand, increased fat and energy consumption (Llacer et al., 2007; Hawkins et al., 2008; Lawton et al., 2008).

Later generation migrants in the UK also reported adopting British dietary patterns, and increased their intake of fat and reduced their intake of vegetables and fruits in comparison to the first generation (Landmand et al., 2001). Multiple meals, large portion sizes, and snacking between meals may contribute to increased body weight amongst the South Asian population (Landmand et al, 2001). A review of European dietary habits with a focus on ethnic minority groups in Europe has found a similar trend of mixed diet practices emerging in second and third generations due to their adoption of a more Western lifestyle (Gilbert et al, 2008). Furthermore, the longer migrants stay in the UK, the stronger their association with and adoption of a Western lifestyle (Landmard & Cruickshank, 2001).

The traditional South Asian diet normally comprises rice or chappatis, pulses, fruits, and vegetables. The National Diet and Nutrition Survey (NDNS, 2004) and the Health Survey for England in 2004 (HSCIC, 2005) report that ethnic minority groups, including South Asians, are more likely to follow the recommendation of eating five portions of fruits and

vegetables per day when compared to the general population. By contrast, reports from 2005-2006 by Family Food Surveys (FFS) showed a different trend of lower consumption of fruit and vegetables amongst South Asians than among the general population (Hoare et al., 2004; National Statistics 2007). This may be due to the under-representation of ethnic minority groups in this study. However, South Asians' diets are also found to be high in fat, especially saturated fat, when compared to the diets of the general population (Wyke & Landmman, 1997; Church et al., 2006).

South Asian women were also found to understand the importance of consuming low-fat and fiber-rich foods, and keen on modifying their traditional recipes to suit a healthier diet (Bush, et al., 1997; Leung & Stanner, 2011). However, modifying the cooking methods to a healthier cooking style was not acceptable because of the changes in taste from the original recipes (Chowdhury et al., 2000).

2.11.3 Exercise/ Physical Activity

(a) Policy

Maintaining the level of physical activity as recommended before pregnancy is critical to sustaining the health status, and can reduce the incidence of comorbidities during pregnancy (NICE, 2010). More physical exercise before pregnancy reduces the risk of developing Gestational Diabetes Mellitus and pre-eclampsia (Sorensen, 2003). Regular physical activity can decrease the risk of hypertensive disorders during early pregnancy (Fortner, 2011). Physical exercise is also an important factor in reducing the chances of caesarean delivery (Melzer, 2010), and decreases anxiety and depression in the postpartum period (Koltyn, 1997). Women who exercise regularly before and during pregnancy also have a reduced chance of developing heartburn, frequent nausea, round ligament pain, and leg cramps throughout their pregnancy (Sternfeld, 1995). Although there are many benefits associated with exercise, particularly during pregnancy, convincing women of childbearing age to exercise before and during pregnancy is difficult even in a sedentary population (Morbidity and Mortality Weekly Report, 2003).

NICE recommends encouraging moderate physical activity during and after pregnancy (NICE, 2010). If a woman has a low level of activity prior to pregnancy, the recommendation is for her to start with low intensity exercises, then increase their duration according to the level of tolerance (NICE, 2010). However, for a pregnant woman who has a high level of activity prior to pregnancy, higher-intensity exercising is encouraged (NICE,

2010). NICE 2010 (pp. 7 & 11) suggested the following practical advice specific for pregnant women (Box 2.2):

Box 2.3: Advice to Pregnant Women from NICE about Physical Activity

- 1. Make activities such as walking, cycling, swimming, aerobics and gardening part of everyday life and build activity into daily life – by taking the stairs instead of the lift or taking a walk at lunchtime.*
- 2. Walk, cycle or use another mode of transport involving physical activity*
- 3. Recreational exercise such as swimming or brisk walking and strength conditioning exercise is safe and beneficial. The aim of recreational exercise is to stay fit, rather than to reach peak fitness.*
- 4. If women have not exercised routinely they should begin with no more than 15 minutes of continuous exercise, three times per week, increasing gradually to daily 30 minutes sessions*
- 5. If women exercised regularly before pregnancy, they should be able to continue with no adverse effects.*

Reference: NICE 2010 (p 7 & p11)

A report from the Center for Disease Control and Prevention in Atlanta found that out of 205,140 US adults, only 45.4% followed recommendations to exercise regularly five or more days per week for 30 minutes, practicing moderate-intensity activities (Morbidity and Mortality Weekly Report, 2003). According to the Health Survey for England from 2012, 61% of adults (56% of women and 66% of men) followed the recommendation of engaging in at least 150 minutes of moderate physical activity or 75 minutes of vigorous activity per week, or the equivalent of these (Scholess & Mindell, 2013). This data indicates the difficulty in convincing the general adult population to exercise regularly as recommended; motivating pregnant women, especially those who are obese, to exercise daily could be an

even bigger challenge. However, Smith et al. (2011) indicated that pregnancy was also considered the best time to implement behavioural changes and engage with the health service. Pregnant women will usually try their best and be motivated to achieve the best outcome (Smith et al., 2011).

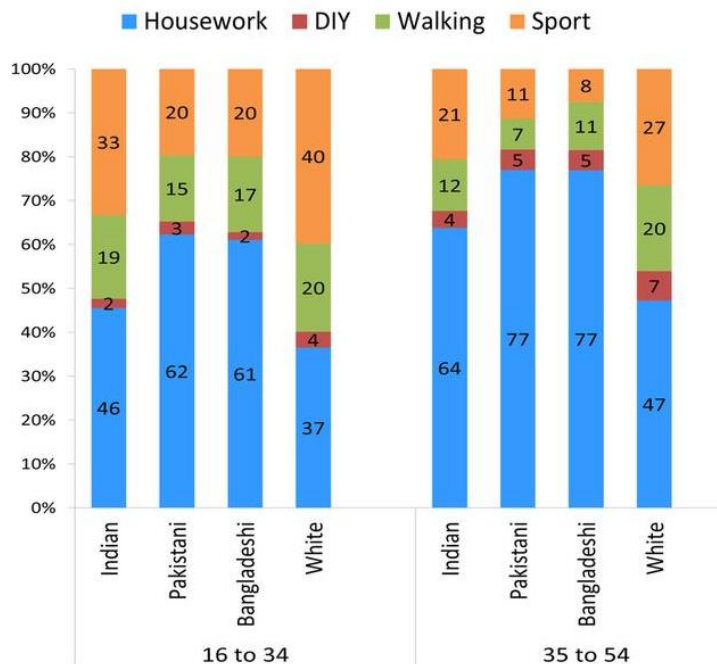
(b) Physical Activity in the Context of the South Asian Population in UK

Since 2004, there have been only three reviews on physical activity among South Asians in the UK. The first review was published by Fischbacher et al. (2004), and in looking at the problem of physical activity in the context of the UK-based South Asian population, all South Asian groups (Indian, Pakistani and Bangladeshi) exercised less than the general population. The second review was published by Babakus & Thompson in 2012. It considered the issue of physical activity and South Asian women at an international level, and concluded that South Asians did not reach the level of physical activity that was recommended for them. The recent systematic review by Bathnagar et al. (2015) looked at the differences in the levels of physical activity between first and second-generation South Asians living in UK. This study found that second-generation South Asians are more physically active than first-generation South Asians; both groups are less physically active than the White British population.

Bathnagar et al. (2016) published a report on the levels of physical activity of South Asians in England with data based on self-reported physical activity from the Health Survey for

England from 1999 and 2004. Among women aged 16 to 34, the proportion of White British involved in Sport is significantly higher compared to that of the South Asian groups, and double than that of Pakistani and Bangladeshi women. For Pakistani and Bangladeshi women aged 35-54, most of the physical activity consisted of housework (77%), compared to 47% in the White British group. By contrast, the rate of walking, DIY activities, and sports was higher for White British women than for South Asian women. Indian women reported engaging in sports-related activities twice as much as Pakistani and Bangladeshi women, and Pakistani women were the group that reportedly engaged the least in walking. Figure 2.7 details the percentage of engaging in each physical activity for women of the South Asian ethnic group versus White British women.

Figure 2.7 : Percentage that each physical activity domain contributes to total physical activity by ethnic group and age group, Health Survey for England 1999 & 2004 (Bhatnagar et al., 2015)



2.11.4 Weight management

In order to improve women's lifestyle – including their dietary trends and levels of physical activity - before, during and after pregnancy, it is necessary to understand their current practice, attitude, behaviours, and beliefs (Flynn et al., 1999; NICE, 2010). During pregnancy, obese women reported changing to a more positive lifestyle behaviour than when they were not pregnant (Smith & Lavender, 2011). Therefore, pregnancy is a crucial time to provide the best information and intervention regarding body weight, diet, and physical activity not only during pregnancy but targeting postnatal care as well (NICE, 2008; Smith & Lavender, 2011).

(a) Policy

Even when they have a weight problem, pregnant women are not advised to lose weight during pregnancy (NICE, 2010). Instead, NICE guidelines encourage women who are obese (BMI of 30 kg/m² or more at booking) to lose weight after giving birth and before their next pregnancy (NICE, 2010). In seventeen selected studies included in the current UK guideline for maternal obesity (NICE, 2010), there is no recommendation for appropriate gestational weight gain (GWG) for obese women in the UK (Johnson et al., 2013).

In contrast, The US Institute of Medicine (IOM) has issued guidelines that specify that women who are obese during pregnancy should gain between 5 and 9 kg of weight through the pregnancy (0.5 – 2 kg in the first trimester, 0.22 kg/ week in the second and third trimesters) versus 11 – 15kg for healthy weight pregnant women (IOM, 2009). However, a cross-sectional study in Southern India assessed 1462 pregnant women attending a tertiary care center and concluded that the IOM guidelines were not appropriate to monitor the gestational weight gain among the Southern Indian population (Radhakrishnan et al., 2014). The result showed that excess weight gain was not associated with birth outcomes. However, pregnant women who gain less than the recommended weight increased their risk of preterm deliveries (<37 weeks) (OR 3.58; CI 95% 1.75-7.32) (Radhakrishnan et al., 2014).

Box 2.4: Actions for health professionals on weight management for pregnant women suggested by NICE

1. *Health professionals should understand the importance of achieving a healthy weight before pregnancy*
2. *Health professionals should encourage and advise obese women (BMI >30kg/m²) to reduce weight before becoming pregnant. They should explain that losing 5-10% of their weight (realistic target) would have significant health benefits. Further weight loss to achieve a BMI within the healthy range. Losing weight to within this range may be difficult, and women will need to be motivated and supported.*
3. *Health professionals should encourage women to check their weight and waist measurement periodically or, as a simple alternative, check the fit of their clothes.*
4. *Health professionals should offer a weight-loss support programme involving diet and physical activity.*
5. *Health professionals should offer specific dietary advice in the preparation of pregnancy, including the need to take daily folic acid supplements. This includes professionals working in pre-conception clinics, fertility clinics, sexual and reproductive health services and children centres*

Reference: NICE, 2010 (page 57).

(b) Pregnant women's views on services

Johnson et al. (2013) carried out a systematic review of the qualitative evidence from 17 primary studies in the UK of weight management during pregnancy, gathering the views and experiences of pregnant women and health professionals. The major issue that this systematic review found was that pregnant women have problems accessing the right information regarding their health and weight management. Furthermore, the report concluded that focusing on giving the right information on healthy lifestyle (physical activity and healthy diet) is more useful than focusing on weight management, which is less stigmatizing and less sensitive (Johnson et al., 2013). One of the reasons for the pregnant women's lack of knowledge was the unavailability of information (Smith et al., 2012), but there may be other factors involved.

Brown & Avery (2012) carried out a mixed-methods study amongst pregnant women in the UK to explore what information and advice had been given to them in a healthcare setting. Pregnant women received summary information regarding weight gain, diet, and exercise, but not specifically on the issue of weight management. Pregnant women opined that they needed more detailed and personalised advice relating to weight gain or weight management (Brown & Avery, 2012). Due to the lack of advice and support on the part of health professionals, pregnant women take their own initiative and seek related sources of help. However, they risk receiving un-regulated information (Brown & Avery, 2012). Some of the pregnant women also feel anxious about their condition (Brown & Avery, 2012).

(c) Health professionals' views

Weight management for obese pregnant women is not an easy task in a primary care setting due to the limited time for consultation, lack of training among the staff, shortage of staff, language barriers, culture-specific behaviour and obese patients' reluctance to practice healthy lifestyle (Maryon-Davis, 2005). However, according to the current evidence, the gap can be narrowed down by improving one-to-one support and interventions, improved specific guidelines, smarter searching tools, quality incentives, more facilities and specialists, closer working between the health professionals, and closer working with the patient and voluntary worker group (Maryon-Davis, 2005).

Schmied et al. (2010) carried out a qualitative study in Australia among health professionals (the majority were midwives) to explore the views of their experience of working with obese childbearing women to understand their role and barriers in supporting women who are obese. Some of the health professionals were frustrated and not confident with the service they gave to the patients (Schmied et al., 2010). They felt that working with obese women was very challenging due to their body size, having difficulties in communicating effectively and providing appropriate care, as there were inadequate services and facilities to manage specific problems (Schmied et al., 2010). Midwives working in the antenatal clinics were also found to be unprepared to talk about 'body weight' with obese pregnant women in Australia (Davis et al., 2014). To address the weight

problems of pregnant women, it is crucial to improve the skills and confidence of the staff and implement continuous service innovations (Davis et al., 2011).

Smith et al. (2010) undertook a qualitative study on community-based service provision for the prevention and management of maternal obesity. Surprisingly, the findings showed a lack of knowledge and understanding of service users or providers about weight management during pregnancy in areas including physical activity, weight gain requirement in pregnancy, safely advising women to restrict calories and to exercise (Smith et al., 2010). This may be related to the non-specific recommendation from the guidelines such as NICE (NICE, 2010). There were similar results from a qualitative study of 30 health professionals from North West England concerning the care of obese pregnant women (Smith et al., 2012). There was a lack of knowledge and information found amongst both health professionals and pregnant women (Smith et al., 2012). The service providers were reported to be unsure about what interventions and suggestions they needed to give to the obese pregnant women.

Midwives or other health professionals need specialised knowledge to deliver the correct information on physical activity and nutrition to pregnant women and make appropriate referrals since there is evidence of a lack of knowledge among the health professionals (Johnson et al., 2013).

2.12 GAPS IN RESEARCH

The current literature on the combined impact of maternal obesity, being South Asian in the UK and pregnancy outcomes is minimal. Johnson et al. (2012) carried out a systematic review on weight management during pregnancy. Among the seventeen selected studies, there is no single paper focusing on the weight management of South Asian pregnant women. Heslehurst (2011) compiled 20 national reports and guidelines related to maternal obesity in the UK since 2003. However, all the reports and guidance were not specific to ethnicity and were targeted at general maternal obesity.

Most reviews focus on weight management for pregnant women and were not targeted specifically to the South Asian population but to all pregnant women. According to the current literature, Asian populations have a higher chance of having obesity-related illness than the Caucasian population (Unwin, 1997). There is evidence that dietary patterns have changed due to migration, with second-generation migrants reporting adopting more aspects of the British diet than the first generation (Landmand et al., 2001), although this is not specifically in pregnant women. The recent systematic reviews of physical activity among South Asian population in the UK found that levels of physical activity were lower in all South Asian groups than in the White British group (Bathnagar et al., 2015).

There is a lack of research in the literature on the factors that influence engagement or lack of engagement with community-based service provision for South Asian obese pregnant

women. There is also a lack of research on knowledge and practice of South Asian pregnant women in relation to physical activity and healthy diet and healthcare provider.

This PhD thesis addresses this gap, firstly by identifying the prevalence of maternal obesity among South Asian pregnant women and examining the association between maternal obesity and adverse pregnancy outcomes. Secondly, with the qualitative research, I have explored the understanding and practices of weight management by means of interviews with obese pregnant woman and with health professionals.

The reported dietary and physical activity patterns of obese pregnant women have been explored in order to understand their behaviour related to engaging in a healthy lifestyle during pregnancy, and the differences between the first generation of South Asian pregnant women, the later generation of South Asian women, and European women. The health professionals' views on obese pregnant women's food consumption and physical activity are included to understand the differences in the lifestyle, the associated factors, and the service provision between the first and later generations of South Asian pregnant women and European women from the health professionals' perspectives.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter explains the methodology of this research. In this case a mixed-methods research design was chosen. It is common amongst researchers to adopt a mixed-methods design to gain a better understanding of the research problem. The use of both qualitative and quantitative methods allows them to complement each other, resulting in a stronger analysis by gathering the advantages of both types of data and analysis (Green and Caracelli, 2013).

3.2 MIXED-METHODS RESEARCH

3.2.1 Definition of Mixed-Methods Research

Mixed-methods research has been defined as a combination of at least two methods from both qualitative and quantitative research (Greene et al, 1989). Ten years later this shifted to mixing methods in all phases of the research process (Tashakkori & Teddlie, 1998). In 2007, Creswell & Plano Clark defined mixed-methods research as:

“A research design with philosophical assumptions as well as methods of inquiry. As a methodology, it involves philosophical assumptions that guide the direction of the collection and analysis and the mixture of qualitative and quantitative approaches in many phases of (the) research process. As a method, it focuses on collecting, analyzing and mixing both quantitative and qualitative data in a single study or series of studies. Its central premise is that the use of quantitative and qualitative approaches, in combination, provides a better understanding of research problems than either research alone.” (Creswell & Plano Clark, 2007, p. 5)

3.2.2 Strength and Weaknesses of Mixed-Method Research

Mixed-methods research has both strength and weaknesses. The reason I chose to adopt mixed-methods research is that it can handle a wider range of research questions and can present a more robust conclusion. Mixed-methods research also increases the generalizability of the findings compared to one type of research design (Cronholm, & Hjalmarsson, 2011). However, even some of the mixed-methods research weaknesses can become challenging for a single researcher, especially when the two designs are concurrently timed so that a single researcher needs to learn about and conduct multiple methods at the same time (Cronholm, & Hjalmarsson, 2011). This, however, is an opportunity for the researcher to improve their skills in both qualitative and quantitative research. Table 3.1 details the strength and weaknesses of mixed-methods research.

Table 3.1 Strength and Weaknesses of Mixed-Methods Research

Strengths	Weaknesses
<ul style="list-style-type: none"> ▪ <i>Words, pictures, and narrative can be used to add meaning to numbers.</i> ▪ <i>Numbers can be used to add precision to words, pictures, and narrative.</i> ▪ <i>Can provide quantitative and qualitative research strengths</i> ▪ <i>The researcher can generate and test a grounded theory.</i> ▪ <i>Can answer a broader and more complete range of research questions because the researcher is not confined to a single method or approach.</i> ▪ <i>The specific mixed research designs discussed in this article have specific strengths and weaknesses that should be considered</i> ▪ <i>The researcher can use the strengths of an additional method to overcome the weaknesses of another method.</i> ▪ <i>Can provide stronger evidence for a conclusion through convergence and corroboration of findings</i> ▪ <i>Can add insights and understanding that might be missed when only a single method is used.</i> ▪ <i>Can be used to increase the generalizability of the results.</i> ▪ <i>Qualitative and quantitative research used together produce more complete knowledge, which is necessary to inform theory and practice.</i> 	<ul style="list-style-type: none"> ▪ <i>It can be difficult for a single researcher to carry out both qualitative and quantitative research, especially if two or more approaches are expected to be used concurrently; it may require a research team.</i> ▪ <i>The researcher has to learn about multiple methods and approaches and understand how to mix them appropriately.</i> ▪ <i>Methodological purists contend that one should always work within either a qualitative or a quantitative paradigm.</i> ▪ <i>More expensive.</i> ▪ <i>More time consuming.</i> ▪ <i>Some of the details of mixed research remain to be worked out fully by research methodologists (e.g., problems of paradigm mixing, how to qualitatively analyze quantitative data, how to interpret conflicting results)</i>

(Ref : Johnson & Onwuegbuzie, 2004)

3.2.3 Key decisions in Choosing Mixed-methods Design

Creswell & Plano Clark (2011) highlight four key decisions in choosing a mixed methods design (Table 3.2). The decisions concern the different ways of including the quantitative and qualitative strands when conducting the research: posing a question, collecting and analyzing data, and interpreting the results.

Table 3.2: Key decisions in choosing a mixed-methods design

The keys decisions to choose mixed-methods design	Options
Level of interaction between strands	Independent Interactive
Priority of the strands	Equal priority Quantitative priority Qualitative priority
Timing of the strands	Concurrent timing Sequential timing Multiphase timing
Procedures mixing the strands	During interpretation During data analysis During data collection At level of design

Adapted from Creswell & Plano Clark 2011, p63-68

The key decisions are all connected to a research design. Six major designs of mixed-methods research are most commonly used (Creswell & Plano Clark, 2011) as expounded below in Table 3.3.

Table 3.3: Major Mixed Method Types of Design

Design type	Definition	Purpose	Level of interaction	Priority	Timing	Primary point of interface for mixing
Convergent Parallel Design	Concurrent qualitative & quantitative data collection, separate analyses, merging data sets	<ul style="list-style-type: none"> - understand more on topic - validate or corroborate quantitative scales 	Independent	Equal	Concurrent	<ul style="list-style-type: none"> - Interpretation (if independent) - Analysis (if interactive)
Explanatory Sequential Design	Sequentially quantitative to qualitative data collection	<ul style="list-style-type: none"> - explain quantitative result 	Interactive	Quant.	Sequential : quant 1 st	Data collection
Exploratory Sequential Design	Sequentially qual to quant data collection	<ul style="list-style-type: none"> - to test or measure 	Interactive	Qual.	Sequential : qual 1 st	Data collection
Embedded Design	Concurrent or sequential of supporting data with separate analysis and use supporting data before or during major data collection	<ul style="list-style-type: none"> - Explore before experimental trial - Aid understanding of experimental trial - Follow-up explanation after experimental trial 	Interactive	Qual. or Quant.	Either concurrent or sequential	Design level
Transformative Design	Framing the concurrent or sequential collection and analysis of quantitative & qualitative within transformative and theoretical framework	<ul style="list-style-type: none"> - Identify and challenge social injustices 	Interactive	Equal, Quant. or Qual.	Either concurrent or sequential	Design level
Multiphase Design	Combining the concurrent and / or sequential collection of quantitative & qualitative data sets over multiple phases of a programme of study	<ul style="list-style-type: none"> - Implement multiple phases to address a programme objective 	Interactive	Equal	Multiphase level	Design level

Ref: Creswell & Plano Clark, 2011, p70-71 & p73-75

3.3 THE CHOSEN MIXED-METHODS RESEARCH DESIGN: CONVERGENT PARALLEL DESIGN

Based on the key decisions in choosing a mixed-methods research design, the mixed methods design in this thesis is a Convergent Parallel Design. Convergent Parallel Design is the best-known approach of mixed methods research (Creswell & Plano Clark, 2011). This design brings together the differing strengths of quantitative methods (large sample size, trends, generalization) and qualitative methods (small sample size, details, in depth) (Patton, 1990).

I analyzed quantitative secondary data from the Perinatal Institute dataset and at the same time I conducted qualitative interviews among South Asian (first and later generations) and European obese pregnant women attending the antenatal clinic at University Hospital Coventry (part of University Hospitals Coventry and Warwickshire NHS Trust) and the health professionals. Figure 3.1 explains the design of my research (adapted from Creswell & Plano Clark, 2011).

3.3.1 Detail of Convergent Parallel Design

A) Definition

Qualitative and quantitative aspects were analyzed at the same time with equal weight during the research process. The analysis was carried out separately for each strand, and then combined for the overall interpretation of the results (Creswell & Plano Clark, 2011).

B) Purpose

The purpose of convergent design is to understand more about a topic and the research problem. This design is also important for corroboration and validation by comparing or contrasting the findings of both strands (Creswell & Plano 2011).

C) Level of interaction

The chosen research design has an independent level of interaction. Independent interaction occurs when the two strands are separate and the researcher retains as distinct the quantitative and qualitative research questions, data collection, and data analysis (Green 2007) such as occurred in this study.

D) Priority

Morgan (1998) and Creswell (2003) both explained that priority refers to which strand is given more weight and attention by the researcher throughout the data collection and data analysis in the study. Convergent Parallel Design needs equal priority from both quantitative and qualitative research, so both methods have equal importance to address the research problem (Creswell & Plano, 2011). In this research, I have given equal priority to both methods.

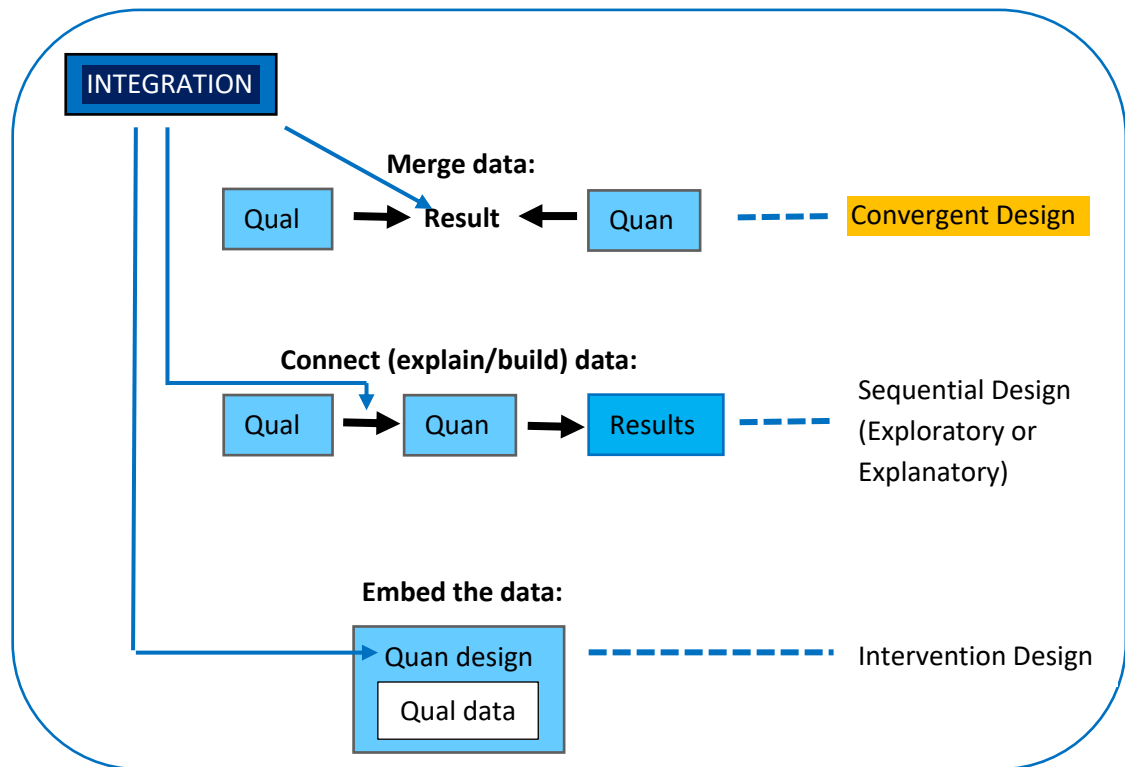
E) Timing

Concurrent timing means the researcher is running both the quantitative and qualitative methods during a single time frame of the research study (Creswell & Plano 2011). I implemented both analyses at the same time before integrating the interpretation of the findings from both strands.

F) Primary point of interface for mixing (Integration)

When the study is independent, the two strands (qualitative and quantitative) are only mixed during the overall discussion and interpretation at the end phase of the research (Green, 2007). Figure 3.1 explains the integration of the results in a convergent design which differs from other designs. This was the case in this study.

Figure 3.1: Types of integration in Mixed Methods Research

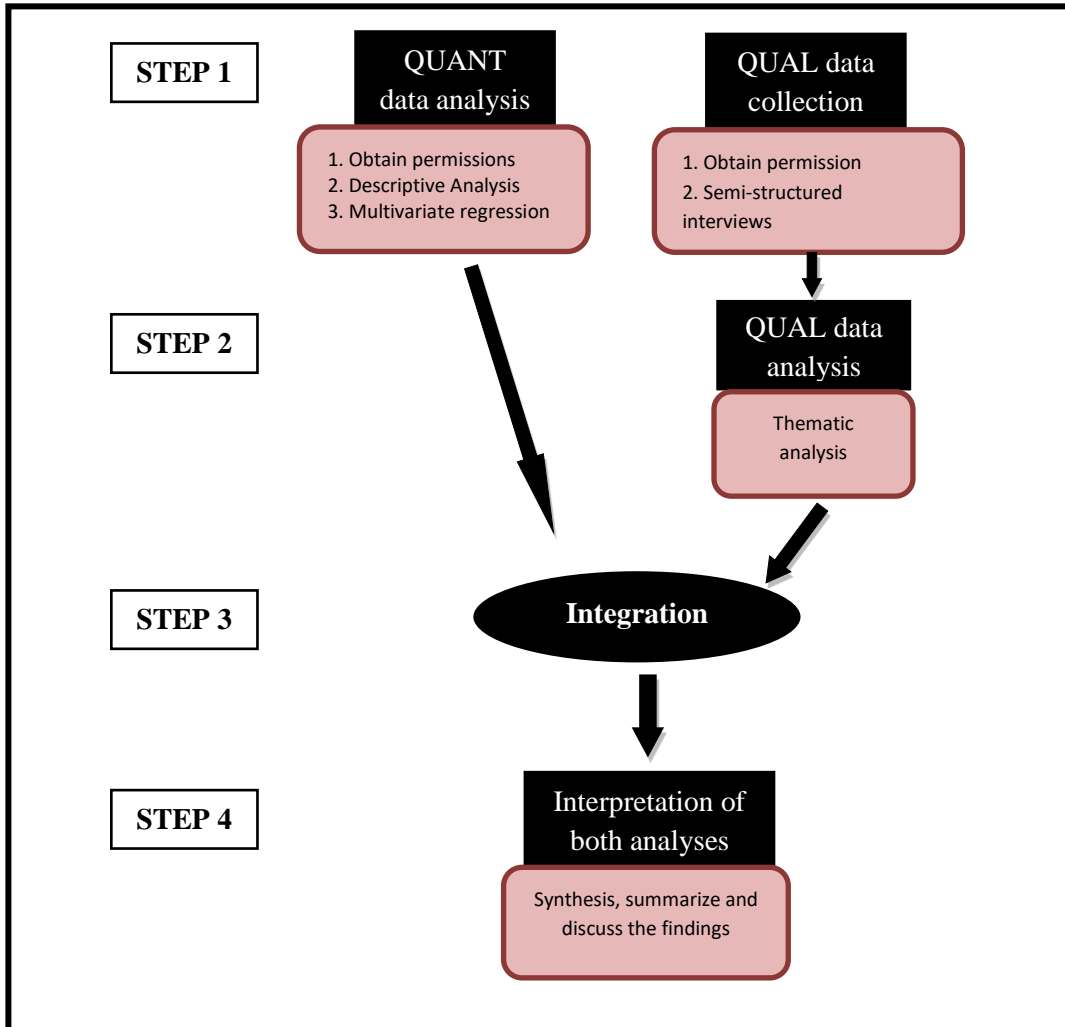


Source : Creswell (2015)

3.3.2 Process of Convergent Parallel Design

There are four steps in the Convergent Parallel Design as explained in Figure 3.2.

Figure 3.2: Process of Convergent Parallel Design in my research
(adapted Creswell & Plano Clark, 2011)



A) STEP 1

In Step 1, I analyzed the quantitative data at the same time as I collected the data for the qualitative strand (Figure 3.2).

Quantitative Strand: Data Analysis

Analysis of the database from the Perinatal Institute has been carried out using appropriate statistical tests and statistical software SPSS version 23. First, descriptive analysis was conducted to check the trends and distribution to explore the data. Odd ratios (unadjusted) were calculated to compare the univariate analysis by ethnicity with European (all pregnant women live in the UK and were born in the European geographical area) as the reference population. Multivariate regression has been carried out to analyze the relationship between BMI, ethnicity and all the pregnancy outcomes. Adjustment has been made for potential confounders such as age and socio-economic status (Index of Multiple Deprivation, education level and employment status). Detailed methods of the quantitative research are explained in Chapter 4.

Qualitative Strand : Qualitative Data Collection (Semi-structured Interviews)

Semi-structured in-depth interviews are one of the most common methods for collecting qualitative data for individuals or groups (DiCicco-bloom & Crabtree, 2006). The individual interview gives a chance to explore and understand views and behaviour (DiCicco-bloom & Crabtree, 2006).

The purpose of conducting semi-structured interviews with obese pregnant women in this research was to explore the views and behaviours of first- and later generation South Asian and European women concerning their health status, food consumption and physical activity during pregnancy. Similarly, the purpose of conducting semi-structured interviews with health professionals was to explore the knowledge, attitude and experience of health professionals related to dietary intake and physical activity of obese pregnant women. Further details of the methods are in Chapter 7.

B) STEP 2: Qualitative Data Analysis

Thematic analysis was used to analyse the qualitative data, being the most appropriate way to code the qualitative study that helps to understand the interpretation of the qualitative data. The sample size has been decided at the beginning of the research (Alhojailan, 2012). Other approaches such as Grounded Theory are very similar to Thematic Analysis in terms of coding process (Alhojailan, 2012). However, Grounded Theory differs in that the data collection and analyses need to be run in parallel (Corbin 1990) and the sampling process is only determined as the data collection develops (Glaser & Strauss 1967, Alhojailan 2012). Therefore, Grounded Theory was considered not appropriate for this research. Further details of thematic analysis are explained in Chapter 7.

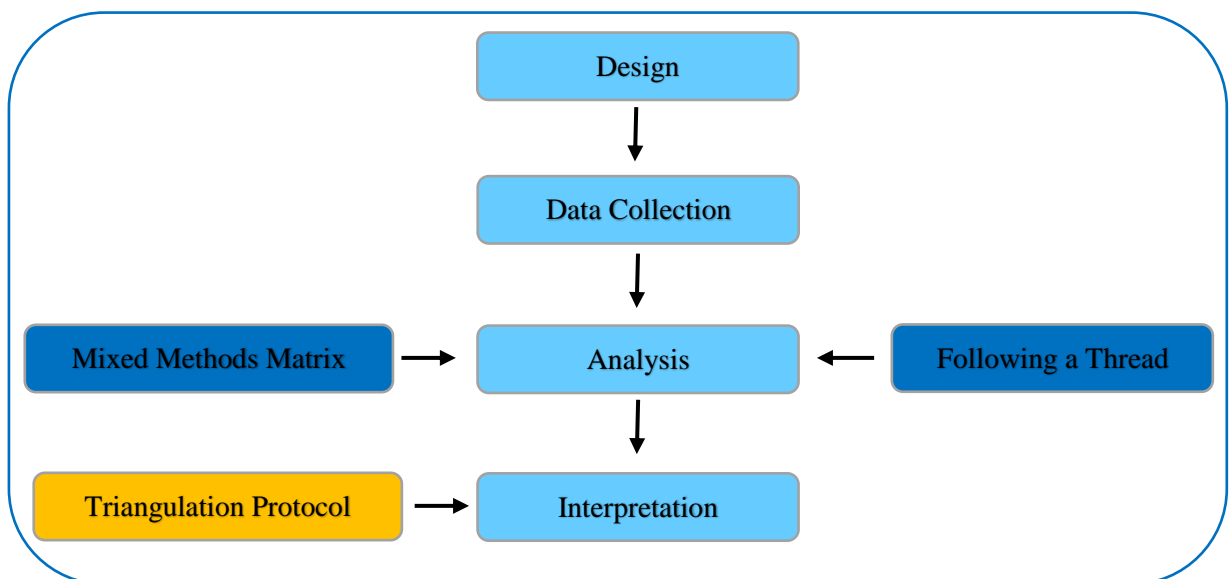
C) STEP 3 : Stage of Integration

Integration is the phase of mixing or merging the two sets of results (qualitative and quantitative) and identifying the differences and similarities (Creswell et al. 2011, Tashakkori and Teddlie 1998; Creswell et al. 2003). In the convergent parallel designs in

this study, the quantitative and qualitative phases are integrated after both sets of data have been analysed separately. I matched the ethnic background for both the quantitative and qualitative data collection and analyses and the samples were from within the same geographical area. The results are integrated before the interpretation phase to develop the conclusions for the entire study.

Triangulation Protocol, Following a Thread and Mixed Methods Matrix are three integration data techniques for mixed methods studies (O’Cathain et al., 2010). The Triangulation protocol was deemed to be the most appropriate for this research because the integration happens while combining the findings (after the analyses) while in the other two techniques (Following a Thread and Mixed Methods Matrix) integration happens during the process of analysis (Alicia et al., 2010).

Figure 3.3 : Point of application for three techniques for integrating data in mixed methods research



Source: Alicia et al., 2010

Campbell and Fiske (1959), who were quantitative psychologists, developed the triangulation techniques and suggested using various tests to measure the same construct with the aim of observing “convergent validity.” There are six steps in using the Triangulation Protocol. These are detailed in Table 3.4.

Table 3.4: Triangulation Protocol

Step	Activity
1 Sorting	Sort findings from each data source or method into similarly categorized segments that address the research question(s) of interest to determine areas of content overlap and divergence
2 Convergence coding	Identify the themes from each data source. Compare the findings to determine the degree of convergence of (a) essence of the meaning and prominence of the themes presented and (b) coverage and specific examples provided in relation to each theme
3 Convergence assessment	Review all compared segments to provide a global assessment of the level of convergence. Document when and where researchers have different perspectives on convergence or dissonance of findings
4 Completeness assessment	Compare the nature and scope of the unique topic areas for each data source or method to enhance the completeness of the united set of findings and identify key differences in scope and/or coverage
5 Researcher comparison	Compare the assessments of convergence or dissonance and completeness of the united set of findings among multiple researchers to : (a) clarify interpretations of the findings and (b) determine the degree of agreement among researchers on triangulated findings. Plan for how disagreements will be handled and how the final decisions on interpretations will be made.
6 Feedback	Feedback of triangulated results to the research team and/or stakeholders for review and clarification.

Source:: Farmer et al (2006), p383

D) STEP 4: Interpretation of findings

The interpretation of both analyses started with integrating the results of both methods during the discussion of the primary findings written in Chapter 8 and Chapter 9. Creswell & Plano (2011) explain that interpretation should summarize and separate the results and discuss both findings, relate to each other and ultimately develop a more robust understanding.

This research sets out to understand the factors associated with maternal obesity among South Asian women using European women as a reference. In the discussion chapter (Chapter 10), I combined the results from the quantitative and qualitative phase to answer the research questions and develop a complete picture of the research. First, I interpreted the results from the quantitative research question before I interpreted the findings from the qualitative research question. This process allowed me to match both findings with qualitative research supporting the quantitative finding and vice versa.

CHAPTER 4

QUANTITATIVE METHODS

4.1 INTRODUCTION

This chapter presents the methods for the statistical analyses carried out for the population based observational study in the West Midlands, comprising secondary data analysis using the Perinatal Institute dataset.

The methods described were used to answer the first research question in Chapter 5 and Chapter 6: to explore the prevalence of maternal obesity and complications associated with it among the South Asian versus the European reference control population in the West Midlands. Chapter 5 presents the differences in prevalence and the association of maternal obesity with obstetric outcomes, comparing South Asians born in the UK (first generation), South Asians not born in the UK (later generation), taking European women as the reference population. Chapter 6 keeps the same format; however, the data focuses on a comparison between Pakistani, Indian and Bangladeshi women, taking European women as the reference population.

4.2 DESIGN

The design of this research is a population based observational study, performing secondary data analysis using a dataset referring to pregnant women in the West Midlands, as detailed below.

4.2.1 Perinatal Episode Electronic Record Database

The perinatal episode electronic record (PEER) database, which is managed and hosted by the Perinatal Institute, was analysed in this study. This dataset collected data on all pregnant women from 25 maternity units in the West Midlands from 2009 to 2012. Regional data collection commenced on 1st April 2009 as part of NHS West Midlands' investing for Health Maternity/ Perinatal Project. Information is extracted from the Pregnancy Notes and input into the PEER data collection tool by data clerks in Trusts in the West Midlands. The information is collected from the maternity notes after delivery.

Access to the database has been obtained through Professor Jason Gardosi, Director of the Perinatal Institute. A detailed protocol was submitted to the Perinatal Institute and accepted for the data analysis, and it included the research questions and the identification and justification of variables to be analysed. These variables are outlined in section 4.3.

4.2.2 Sample Size

The database has 161,936 pregnancies recorded between 2009 - 2012. 143,286 completed pregnancies (88.7% of the whole database) match the inclusion criteria of European and South Asian (Indian, Pakistani and Bangladeshi) populations for this study. The total number of pregnant women of South Asian ethnicity was 21,142. However, the analysis in Chapter 5 was done using a lower number (19,841) in comparison to Chapter 6 (21,142). This was due to some missing information related to the birth place of a number of South Asian women, seeing that classifying them as UK-born (SA bUK) or non-UK-born (SA nbUK) was required for the analysis done in Chapter 5.

The distribution of ethnic origin which gives the sample size used in the analysis done for the first research questions is shown in Table 4.1.

Table 4.1: Ethnic Breakdown of Pregnant Women in the Perinatal Episode Electronic Database in the West Midlands, 2009-2012

Ethnic Group	Frequency (n)	Percentage (%)
Chapter 5		
European	122,144	86.0
SA bUK	9,179	6.5
SA nbUK	10,662	7.5
Chapter 6		
European	122,144	85.2
Pakistani	11,262	7.9
Indian	7,483	5.2
Bangladeshi	2,397	1.7

C) Setting

The data was collected from 25 NHS hospitals from across the West Midlands region of England. The 25 hospitals within the region are: Alexandra, Bridgenorth, Burton, Birmingham Women's Hospital - Birth Centre, Birmingham Women's Hospital - acute, City, George Elliot, Good Hope, Heartlands, Hereford, Lichfield, Ludlow, New Cross, Oswestry, Royal Shrewsbury, Russell's Hall, Sandwell, Solihull, Stafford, University Hospital of North Staffordshire (UHNS), Walsall Manor, University Hospital of Coventry and Warwickshire (UHCW), Warwick, Worcester and Wrekin.

4.3 THE DATA ITEMS IN THE DATABASE

24 data items from the West Midlands Maternity Core Dataset of the PEER (Version 1.9 – 04.11.2010; NHS Perinatal Institute for Maternal and Child Health, 2010) were used in the analysis. The data items are all collectable from the standardized maternity record (Perinatal Institute, 2018) which are already used in over half of all pregnancies in England.

Each data item was identified as key to answering the research questions and to establishing the background of the study. The identification of, and justification for each of the variables used in the analysis, as well as how they were coded, are outlined below.

4.3.1 Body Mass Index

The Body Mass Index (BMI) was used to classify the pregnant women as obese, overweight, normal BMI, or underweight. The BMI (kg/m^2) was calculated using the

weight and height of the pregnant women as given by the data obtained during their first antenatal check-up (booking) (Table 4.2).

Two BMI cutoff points were used in this study to classify overweight and obesity in the South Asian pregnant women for the general population and Asian-specific BMI criteria, as decided previously (Tables 2.1 & 2.2 in Chapter 2). For the European reference group I used the BMI criteria for the general population only (Table 2.1 in Chapter 2).

Table 4.2: Data Items for Body Mass Index

Purpose	No	Data Item	Field/ Option	Used in this study
BMI	57	Maternal height at completed assessment	i. cm ii. undocumented	(A) BMI Classifications (General Population) i. underweight ii. normal iii. overweight iv. obese v. obese Class I vi. obese Class II vii. obese Class III (B) BMI Classifications (South Asian) i. underweight ii. normal iii. overweight iv. obese
	58	Maternal weight at completed assessment	i. kg ii. undocumented	

4.3.2 Demographic Characteristics

Table 4.3 documents the demographic variables used from the database, and also how they were recoded for use in the analysis. Additional details are only given where needed, in order to explain the variables further.

Table 4.3: Data Items for Demographics Characteristics

Purpose	No	Data Item	Field/ Option	Used in this study
Ethnicity	8	Ethnic Origin	i. Africa : (North/Sub Sahara/Other) ii. Asia : (India/ Pakistan/ Bangladesh /China /Far east / Southeast /Other /Undocumented) iii. Caribbean iv. Europe : (Britain /Ireland /Eastern /Northern /Western /Southern/ Other/ Undocumented) v. Middle East vi. Mixed – African- European vii. Mixed-Asian- European viii. Mixed-Caribbean- European ix. Mixed-Other x. Mixed- Undocumented xi. Other-Free text xii. Declined to answer	i. European : (Britain/ Ireland/ Eastern/ Northern/ Western/ Southern) ii. South Asian : (Indian/ Pakistani/ Bangladeshi) iii. Indian iv. Bangladeshi v. Pakistani
Place of	9	Was the	i. No	i. Born in UK

Purpose	No	Data Item	Field/ Option	Used in this study
birth		woman born in UK	ii. Yes iii. Undocumented	ii. Not born in UK
Age	4	Maternal Date of Birth	i. Dd/mm/yyyy ii. Undocumented	The dataset that I received has calculated the age of the mothers. I recoded the data into : i. < 18 years old ii. 18-35 years old iii. < 35 years old iv. more than 35 years old v. 3-year age bands (starting age 15)
Parity	46	If yes: a) Previous pregnancies reaching 24 weeks gestation or more	i. Number ii. Undocumented	I recoded the parity into : i. 0 ii. 1 iii. 2 iv. 3 or more
Marital Status	15	Marital Status	i. Single ii. Married/ Civil partnership iii. Divorced/ civil partnership dissolved iv. Widowed v. Separated vi. Undocumented	i. Single ii. Married/Civil Partnership iii. Divorced/ Widowed / Separated

Notes: Undocumented - recorded as missing

(a) Ethnicity and Place of Birth

Ethnic origin was assessed by midwives through interviews asking where the pregnant woman's family originates from. The pregnant women were coded into twelve categories

according to their ethnic group (Table 4.3). However, only two categories were used in the analyses, and these are the European and the Asian groups. I used the European category as per the original database, however I recoded the Asian group into South Asian, Indian, Pakistani and Bangladeshi. All other ethnic groups from Asian countries were excluded from the analysis.

The place of birth determined whether the pregnant women were born in the UK or not. This data item was used to classify the South Asian pregnant women as first generation (not born in the UK; SA nbUK) or later generation (born in the UK; SA bUK). However, there were only 662 (0.5% of total population) Bangladeshi women who were classified as later generation, and thus due to the small numbers it was not feasible to explore the association between maternal obesity and obstetric outcomes for this ethnic group. Furthermore, Gardosi et al (2013), using the same database, did not divide the separate South Asian (Bangladeshi, Indian, Pakistani) groups into first and later generation for the same reason.

Since the numbers in each category became smaller after splitting the South Asian ethnic group, in the second part of the analysis I decided not to continue exploring the different risks of maternal obesity among the Indian, Pakistani and Bangladeshi sub-groups taking into consideration whether or not they were born in the UK. This decision was taken prior to commencing the analysis.

For the reference group in this research I looked at the combined UK-born and non-UK-born European population. This was the reference group used for comparison during the analysis for both parts of the quantitative research.

(b) Age

In the analysis, age was used as a continuous variable, and was also recoded into categories: age < 18, 18-35 years old, and more than 35 years old for the descriptive analysis. When exploring the association between age and obstetric outcomes I recoded into two categories only: age 35 and below, and age over 35. I also recoded age into 3 year age bands (ages 15 to 42) when exploring the distribution of age and its association with obstetric outcomes.

4.3.3 Socio-Economic Characteristics

Table 4.4 documents the various information related to the socio-economic status of the pregnant women that was available in the dataset.

Table 4.4: Data Items for Socio-Economic Characteristics

Purpose	No	Data Item	Field/ Option	Used in this study
Employment status	20	Employment status of mother at booking	i. Full-time employed ii. Part-time employed iii. Employed undocumented iv. Looking after home/ family v. Student vi. Permanently sick/ disabled vii. Unemployed viii. Retired ix. Undocumented	Recorded into three categories: i. Work Full Time ii. Work Part Time iii. Not Working (Combined Looking after home/ family, Student, Permanently sick/ disabled, Unemployed and Retired)
Partner Employed	17	If yes, are they employed	i. No ii. Yes	i. No ii. Yes

Purpose	No	Data Item	Field/ Option	Used in this study
			iii. Undocumented	
Education Level	14	Highest educational level of pregnant women	i. No qualification ii. GSCE/ O Level iii. A Level iv. First Degree v. Higher degree (PgD, MSc, MPhil, PhD) vi. NVQ Level 1/2/3/4/5 vii. Other Qualifications (City& Guilds, RCA/OCR, BTE/EdExcel) viii. Professional Qualifications ix. Undocumented	Recoded into four categories: i. No qualifications ii. GCSE/ O Level/ A Level (Combined GSCE/ O Level/ A Level/ NVQ level 1/2/3/4/5) iii. First Degree/ Higher (Combined First degree, Higher degree (PgD, MSc, MPhil, PhD), Professional qualifications) iv. Other qualifications
Housing Status	21	Housing tenure at booking	i. Owns ii. Rents iii. With family/ friends iv. UKBA/NASS v. No fixed abode vi. Care services	Recoded into three categories: i. Owns ii. Rents iii. Others (Combined With family/friends, UKBA/NASS, No fixed abode, Care services)
Index multiple Deprivation (IMD)	5	Postcode of mother at booking	IMD Centile in the database coded as : i. IMD 1-3 (lowest) ii. IMD 4 iii. IMD 5 (highest)	i. IMD 1-3 (lowest) ii. IMD 4 iii. IMD 5 (highest)

Notes: Undocumented - recorded as missing

(a) Index of Multiple Deprivation (IMD)

I used the original coding in the database for IMD. The classification of IMD has been calculated by the Perinatal Institute staff based on the postcode given by the mother at booking using the standard format from the Office for National Statistics (Payne & Abel, 2012).

4.3.4 Characteristics of Women at Booking

Table 4.5 details two variables of health characteristics at booking taken from the database, and then how they were recoded for use in the analysis.

Table 4.5: Data Items for Health Characteristics

Purpose	No	Data Item	Field/ Option	Used in this study
Smoking status	27	Was the woman smoking at booking?	i. No ii. Yes iii. Undocumented	i. No ii. Yes
Late Booking	54	Date of first appointment with midwife/GP.	i. dd/mm/yyyy ii. Undocumented	i. No ii. Yes (first appointment ≥ 13 weeks of pregnancy defined as “Late for booking”)

Notes: Undocumented - recorded as missing

4.3.5 Pre-Existing Disease

Pre-existing diseases were recoded in the database (Table 4.6).

Table 4.6: Data Items for Pre-Existing Disease

Purpose	No	Data Item	Field/ Option	Used in this study
Previous Medical Problems	40	Were there any previous medical problems identified during the pregnancy?	i. No ii. Yes iii. Undocumented	i. No ii. Yes
Diabetes	41	If yes: a) Diabetes c) Hypertension	i. No ii. Yes iii. Undocumented	Diabetes: i. No ii. Yes
Hypertension				Hypertension: i. No ii. Yes

Notes: Undocumented - recorded as missing

4.3.6 Pregnancy outcomes

a) Pregnancy-Related Complication

The database recorded three pregnancy related complications, with a focus on hypertensive disease and gestational diabetes (Table 4.7).

Table 4.7: Data items for pregnancy-related complications

Purpose	No	Data Item	Field/ Option	Used in this study
i) Pregnancy-related complication	80	Did the women have any pregnancy-related complications during the pregnancy?	i. No ii. Yes iii. Undocumented	i. No ii. Yes
ii) Hypertensive disease during pregnancy and Gestational Diabetes	81	If yes: a) Antepartum haemorrhage b) Hypertensive disease i. Pregnancy induced hypertension ii. Pre-eclampsia iii. HELLP c) Gestational diabetes	i. No ii. Yes iii. Undocumented (for each disease)	i. No ii. Yes (for each disease)

Notes: Undocumented - recorded as missing

(b) Final mode of birth

The ‘final mode of birth’ field will help identify whether obesity is a risk factor for caesarean section and instrumental delivery among the South Asian population compared to the European population in the West Midlands. I used the same coding that was available in the database. For women who had a caesarean section, the grade of the section was also available (Table 4.8).

Table 4.8: Data items Final Mode of birth

Purpose	No	Data Item	Field/ Option	Used in this study
Final mode of birth	91	Final mode of birth	i. Spontaneous cephalic vaginal ii. Ventouse iii. Forceps iv. Vaginal Breach v. Caesarean Section vi. Undocumented	i. Spontaneous cephalic vaginal ii. Ventouse iii. Forceps iv. Vaginal Breach v. Caesarean Section
ii) Type of Caesarean	92	If caesarean section, what grade	i. Emergency ii. Urgent iii. Scheduled iv. Elective v. Undocumented	i. Emergency ii. Urgent iii. Scheduled iv. Elective

Notes: Undocumented - recorded as missing

4.3.7 Birth Outcome

Table 4.9 details the birth outcomes. The database has calculated the centile of birth weight which has been classified into 3 categories: < 10th centile (Intrauterine Growth Restriction; IUGR), 10-90th centile and >90th centile (Macrosomia). Congenital anomaly and pre-term delivery are not the main part of the birth outcomes in my analysis. However, this

information has been used during logistic regression analysis for the adjustment of potential confounders.

Table 4.9: Data items for birth outcome

Purpose	No	Data Item	Field/ Option	Used in this study
Birth weight	100	Birth weight	g (gram)	i. (gram) ii. Birthweight centile iii. Macrosomia iv. IUGR
Neonatal Intensive Care Unit (NICU)	108	Destination of discharge	i. Health visitor ii. Neonatal unit iii. Died iv. Undocumented	Recode Neonatal Unit to NICU i. No ii. Yes
Congenital anomaly	97	Was there a congenital anomaly at birth	i. No ii. Yes iii. Suspected iv. Undocumented	i. No ii. Yes
Pre-term Delivery	87	Date and time of delivery	i. Dd/mm/yyyy ii. hh:mm	This data has been used to calculate the weeks of gestation. i. No (born 37 weeks or after 37 weeks completed weeks of gestation) ii. Yes (born before 37 completed weeks of gestation)

Notes: Undocumented - recorded as missing

4.4 STATISTICAL ANALYSIS

The analysis was carried out using EXCEL and the statistical software SPSS version 23.

a) Recoding and understanding the data

At the beginning of data analysis, I explored the dataset, choosing relevant variables and recoding the necessary variables such as BMI, ethnicity and age, as described above. The database had been cleaned previously, and used for other analysis.

b) Descriptive Analysis

Descriptive analysis was conducted to check the trends and distributions in order to explore the data.

i) Analysis of the socio-demographic characteristics of European, SA bUK and SA nbUK (Chapter 5) and Indian, Pakistani, Bangladeshi (Chapter 6) women taking into account age, maternal weight, maternal height, BMI, birth weight, parity, marital status, employment status, partner's employment status, education level, housing status, Index of Multiple Deprivation, late booking and smoking status.

ii) Analysis of the prevalence of maternal obesity (%) of European, SA bUK and SA nbUK (Chapter 5) and Indian, Pakistani, Bangladeshi (Chapter 6) pregnant women.

c) Difference of Proportion through Z-Test

I analysed the different distribution of ethnic groups by age and BMI for each obstetric outcome using a Z-test.

d) Mann-Whitney U-Test

I analysed the difference in the median of BMIs between ethnic groups for the whole sample and by obstetric outcomes using a Mann-Whitney U-Test.

e) Odds Ratio Calculation

I calculated the OR (unadjusted) using Microsoft Excel for:

- i. OR for being obese for SA, SAbUK, SA nbUK, Indian, Pakistani, Bangladeshi compared to the European population as the reference group.
- ii. OR of the socio-demographic characteristics of obese and overweight women compared to normal BMI pregnant women
- iii. OR of having a pre-existing disease (diabetes, pre-existing hypertension and mental health) for obese and overweight women compared to pregnant women with a normal BMI
- iv. OR of obstetric outcomes (GDM, Hypertensive Disease during pregnancy, Final Mode of Birth, Type of caesarean, Birth weight Centile, NICU) for obese and overweight pregnant women compared to normal BMI pregnant women

f) Logistic Regression

Logistic regression was carried out to analyse the relationship between BMI, ethnicity and all the pregnancy outcomes.

- i. Logistic regression was needed to predict obstetric outcomes by BMI (obese, overweight and underweight) within each ethnic group (with normal BMI as

reference) for GDM, Hypertensive Disease during pregnancy, Caesarean Section, IUGR, Macrosomia and NICU.

- ii. Logistic regression was used to predict obstetric outcomes by BMI (obese, overweight and underweight) for the whole sample (European normal BMI as reference) for GDM, Hypertensive Disease during pregnancy, Caesarean Section, IUGR, Macrosomia and NICU.

Adjustments were made for potential confounders such as Marital Status, Working Status, Index of Multiple Deprivation, Housing Status, Smoking Status, Late Booking, Congenital Anomaly and Premature Birth. Thus adjusted odds ratios are presented.

4.5 ETHICAL ISSUES

The database is owned and managed by the Perinatal Institute, which complies with data protection requirements. The data is anonymised, with no risk of identification of individuals.

Access to the database is controlled in that the database can only be accessed (by a student) on the premises of the Perinatal Institute and not copied. I adhered to the Perinatal Institute's requirements.

CHAPTER 5

RESULTS OF QUANTITATIVE STUDY

SOUTH ASIAN FIRST GENERATION VERSUS SOUTH ASIAN LATER GENERATION VERSUS EUROPEAN AS REFERENCE

5.1 OVERVIEW

This chapter presents the findings from the quantitative data analysis of 141,985 pregnant women (Table 4.1) from the West Midlands Maternity Core Dataset. This chapter addresses the first research question by examining the prevalence of maternal obesity over the 4 year period from 2009 – 2012 and by examining the antenatal and foetal complications associated with maternal obesity among the first generation compared to later generation South Asians versus European reference population in the West Midlands obstetric population.

5.2 SOCIO-DEMOGRAPHIC CHARACTERISTICS

Table 5.1 (do statistical test) shows the socio-demographic characteristics of the pregnant women, and also indicates the breadth of the variables in the database for later analysis.

The Index of Multiple Deprivation shows that the South Asian pregnant women were more

deprived than the European population. 76.5% of South Asian pregnant women who were not born in the UK were not working compared to 50% of South Asian's who were born in the UK and 36.9% of European women. The percentage of Europeans who were pregnant below 18 years old were quite high (4.4%) compared to South Asian not born in the UK (0.2%) and born in the UK (1.0%).

Table 5.1 : Socio-demographic characteristics of the pregnancy cohort in the West Midlands Database (2009-2012), Perinatal Institute

Detail	European	South Asian	
		SA nbUK	SA bUK
Age, mean (years)	28.1	29.1	29.0
Maternal weight, mean (kg)	70.7	62.4	65.4
Maternal height, mean (cm)	164.7	158.5	160.1
BMI , mean (kg/m2)	26.1	24.9	25.4
Birth weight, mean (g)	3349.9	3132.2	3090.1
Age, (%)			
Total (Missing), n	122144 (117)	10661 (1)	9179 (0)
< 18 years	4.4	0.2	1.0
18 – 35 years , %	82.7	89.1	89.0
> 35 years	12.9	10.7	10.0
Parity, (%)			
Total (Missing), n	120374 (1770)	10607 (55)	9129 (50)
0	44.8	29.8	37.0
1	33.7	31.9	32.4
2	13.4	20.6	17.7
3 or more	8.1	17.7	12.9
Marital Status, (%)			
Total (Missing), n	114977 (7167)	10504 (158)	9100 (79)
Single	58.7	2.1	9.7
Married/Civil Partnership	40.3	97.1	89.6
Separated/ Divorced/ Widowed	1.0	0.8	0.7

Detail	European	South Asian	
		SA nbUK	SA bUK
Employment Status, (%)			
Total (Missing), n	115020 (7124)	10137 (525)	8738 (441)
Working Full Time	38.8	14.2	33.0
Working Part Time	22.0	9.3	17.0
Not Working	39.2	76.5	50.0
Partner Employed, (%)			
Total (Missing), n	102249 (19895)	9406 (1256)	7978 (1201)
Working	85.6	87.1	87.1
Not working	14.4	12.9	12.9
Education Level, (%)			
Total (Missing), n	43731 (78413)	3536 (7126)	3591 (5588)
No Qualification	5.7	13.9	4.1
GCSE/ O Level/ A Level	36.5	27.1	30.5
First Degree/ Higher Education	57.8	59.0	65.4
Housing Status, (%)			
Total (Missing), n	106380 (15764)	9660 (1002)	8392 (787)
Own	43.3	43.8	52.2
Rent	39.3	25.8	16.9
Others	17.4	30.4	30.9
Index Multiple Deprivations, (%)			
Total (Missing), n	115330 (6814)	10544 (118)	9094 (85)
1-3: Least deprived	47.0	15.7	24.5
4	21.4	16.4	19.1
5 : Most Deprived	31.6	67.9	56.4
Late Booking (> 13 weeks), (%)			
Total (Missing), n	117708 (4436)	10349 (313)	8935 (244)
Yes	12.4	21.1	14.4
No	87.6	78.9	85.6

5.3 PREVALENCE OF MATERNAL OBESITY

5.3.1 Completeness of BMI data

As BMI is the main variable that I am interested in, I examined the completeness of the data for this variable. Table 5.2 indicates that for each population sub-group at least 98% of the pregnant women had weight and height recorded at booking, indicating completeness of this variable was high and did not vary across sub-groups.

Table 5.2: Number of BMI recorded at booking and percentage (%) for European and South Asian

		Total Population	No. of BMI recorded at Booking	%
European	All	122 144	120 481	98.6
	Born UK	108 626	109 861	98.9
	Not Born UK	7 748	7 850	98.7
South Asian	All	21 142	20 833	98.5
	Born UK	9179	9091	99.0
	Not Born UK	10 662	10 549	98.9

5.3.2 Population Distribution

Based on Figure 5.1, the distributions of BMI for the pregnant women look similar between European, South Asian not born in the UK (SA nbUK) and South Asian born in the UK (SA bUK). However, when I did a statistical test (Difference of Proportion Z Test) for pregnant women who had a BMI more than 30 kg/m² (Figure 5.2), there were some significant differences for the distribution between BMI 33-43 kg/m². The prevalence of obesity for European women was slightly higher compared to South Asian women, with South Asian women who were born in UK (SA bUK) sitting in the middle between European and South Asian who are not born in UK (SA nbUK) women.

Figure 5.1: Population Distribution by BMI (kg/m²)

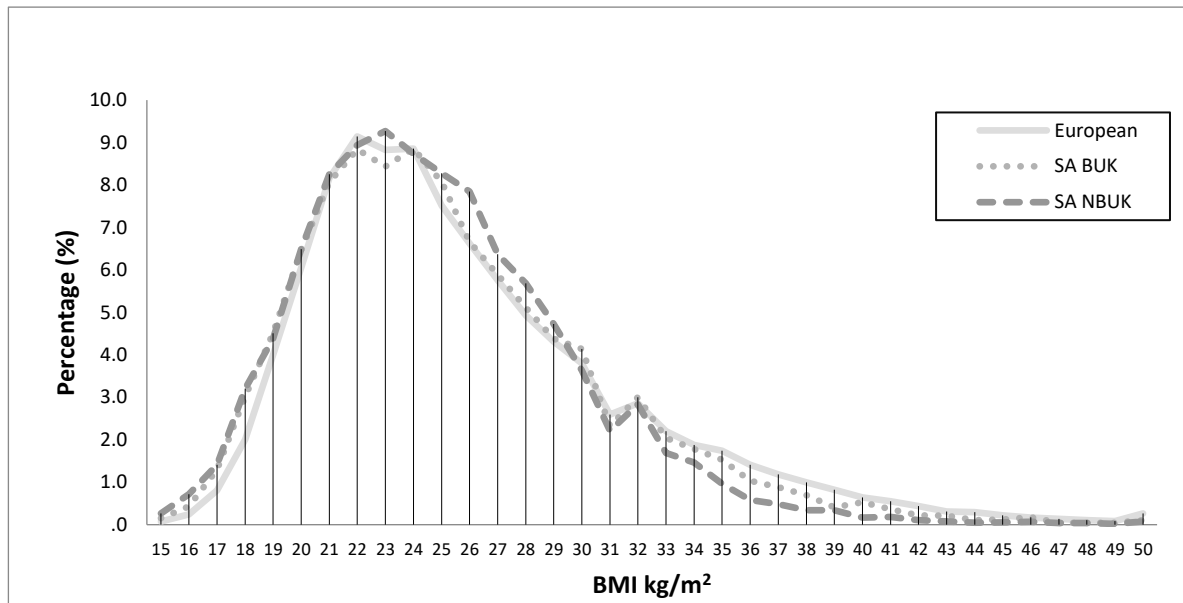
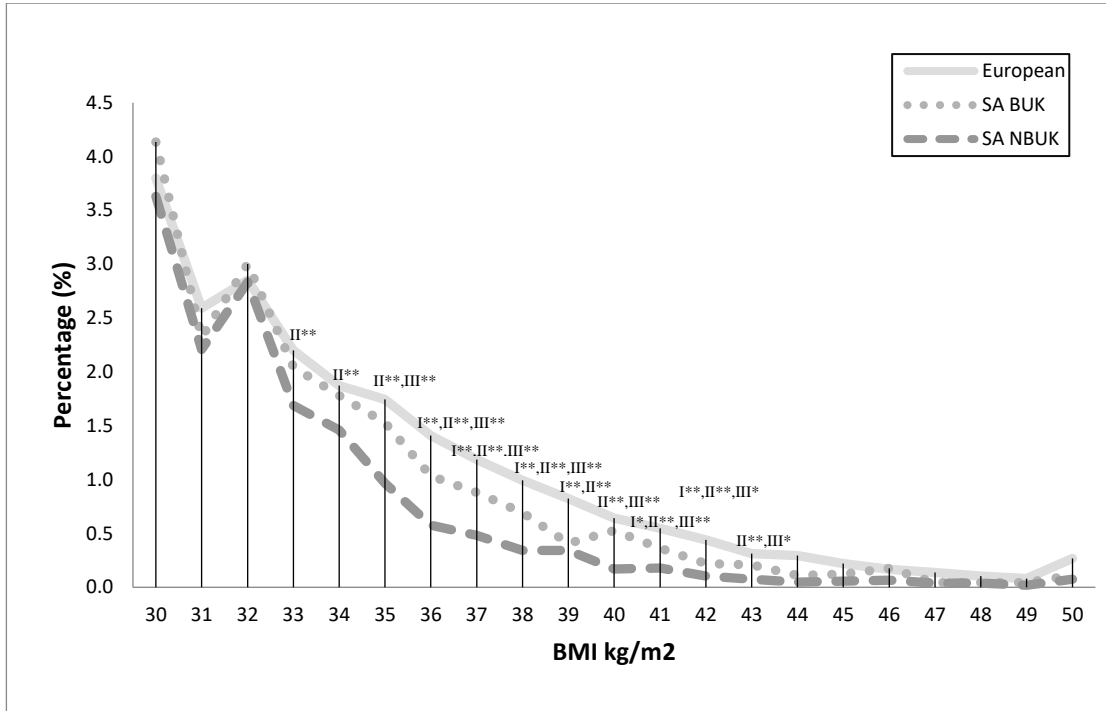


Figure 5.2 : Population Distribution for BMI > 30kg/m²



Different of Proportion (Z) Test:

I=Sig. diff between EU & SA bUK, I*= p<0.05, I**=p<0.01

II=Sig. diff between EU & SA nbUK, II*= p<0.05, II**=p<0.01

III=Sig. diff between SA bUK & SA nbUK, III*= p<0.05, III**=p<0.01

5.3.3 Maternal Obesity by Ethnic Group

Table 5.3 presents the bivariate analysis of obesity by ethnic group. This indicates that the prevalence of obesity ($\text{BMI} \geq 30 \text{ kg/m}^2$) for South Asian pregnant women was lower among the South Asian pregnant women not born in the UK (11.6%, OR = 0.60 (95% CI 0.57-0.64)) and also lower for South Asian pregnant women born in UK (15.5%, OR = 0.82 (95% CI 0.77-0.87)), in comparison with the European reference population (18.6%).

However, when using the Asian Specific BMI cut off points to indicate obesity ($\text{BMI} > 27.5 \text{ kg/m}^2$) for the South Asian population, the prevalence of obesity was higher in South Asian not born in UK (25.5%, OR = 1.92 (95% CI 1.83-2.02)) and also higher for the South Asian born in UK (29.3%, OR = 2.24 (95% CI 2.13-2.37)), in comparison with the European reference population (18.6%) ($\text{BMI} \geq 30 \text{ kg/m}^2$) (Table 5.5).

Table 5.4 examines the odds of being obese for the South Asian population who were not born in the UK (1st generation) as the reference population versus those who were born in the UK (later generation). This indicates that South Asian pregnant women who were born in the UK were 36% more likely to be obese compared with those not born in the UK. The risk also increased between UK born and non UK born with the increase in the level of obesity classified by BMI. For example, those of South Asian origin who were born in the UK had two fold increased chance of having Class III Obesity ($\text{BMI} > 40 \text{ kg/m}^2$) compared with those not born in the UK [nb UK: 0.7% vs b UK: 1.4%, OR 2.10 (95% CI 1.57-2.80)].

Table 5.3: Odds Ratios (95% confidence interval) for being obese, obese class I, obese class II, obese class III among overall South Asian, Indian, Pakistani and Bangladeshi when compared to European as the reference population.

	<u>Obese (BMI > 30)</u>			<u>Obese Class I (BMI 30-34.99)</u>			<u>Obese Class II (BMI 35-39.99)</u>			<u>Obese Class III (BMI >40)</u>		
	N	%	OR (95% CI) for being obese	N	%	OR (95% CI) for being obese	N	%	OR (95% CI) for being obese	N	%	OR (95% CI) for being obese
European References	22760	18.6	1	13571	11.1	1	6092	5	1	3097	2.5	1
South Asian												
Not Born UK	1242	11.6	0.60 (0.57-0.64)*	966	9.1	0.79 (0.73-0.84)*	202	1.9	0.37 (0.32-0.42)*	74	0.7	0.26 (0.21-0.33)*
Born UK	1424	15.5	0.82 (0.77-0.87)*	971	10.6	0.94 (0.87-1.01)	322	3.5	0.69 (0.62-0.78)*	133	1.4	0.55 (0.46-0.66)*

Weighted percentage given; significant (*p<0.05), WHO BMI General Classification used

Table 5.4: Odds Ratios (95% confidence interval) for being obese, obese class I, obese class II, obese class III among Born UK vs. Not Born in UK as the reference population for the South Asian Population only

	<u>Obese (BMI > 30)</u>			<u>Obese Class I (BMI 30-34.99)</u>			<u>Obese Class II (BMI 35-39.99)</u>			<u>Obese Class III (BMI >40)</u>		
	N	%	OR (95%) for being obese	N	%	OR (95%) for being obese	N	%	OR (95%) for being obese	N	%	OR (95%) for being obese
South Asian												
Not Born UK (ref)	1242	11.6	1	966	9.1	1	202	1.9	1	74	0.7	1
Born UK	1424	15.5	1.36 (1.25-1.48)*	971	10.6	1.19 (1.08-1.31)*	322	3.5	1.89 (1.58-2.26)*	133	1.4	2.10 (1.57-2.80)*

Weighted percentage given; significant (*p<0.05), WHO BMI General Classification used

Table 5.5 : Odds Ratios (95% confidence interval) for being obese in South Asians not born in the UK and those born in the UK (New BMI Cut off points for Asian, BMI Obese 27.5+ kg/m²) when compared with European (BMI Obese 30+ kg/m²) as the reference population.

	N	% Obese	OR (95% CI) for being obese (BMI 27.5+) vs. European reference (BMI 30+)
European (Reference)	22760	18.6	1
South Asian			
Not Born UK	2724	25.5	1.92 (1.83-2.02)*
Born UK	2663	29.3	2.24 (2.13-2.37)*

*Weighted percentage given; significant (*p<0.05), WHO BMI Asian Specific Classification used*

5.4 ASSOCIATION OF SOCIO-DEMOGRAPHIC FACTORS WITH MATERNAL OBESITY BY ETHNICITY

5.4.1 European

Table 5.6 presents the Odd Ratios for socio-demographic characteristics of European pregnant women comparing obesity, overweight and normal BMI using WHO General BMI classification.

Factors significantly associated with obesity in European women were older maternal age (age more than 35 years old (OR =1.17 (95% CI 1.12-1.22)), marital status of separate/ divorced/ widowed (OR=1.37 (95% CI 1.19-1.58)), not working (OR=1.25 (95% CI 1.21-1.29)), partner not working (OR=1.29 (95% CI 1.24-1.35)), and renting as opposed to owner occupied housing (OR=1.63 (95% CI 1.58-1.69)). The risk of having obesity was also associated with increasing parity [(Parity 1: OR 1.41 (95% CI 1.36-1.46); (Parity 2: OR 1.79 (95%CI 1.71-1.87); (Parity 3 or more: OR 2.39 (95% CI 2.27-2.52)] and increasing deprivation quintile [(IMD 4: OR 1.44 (95%CI 1.38-1.50); IMD 5: OR 1.72 (95% CI 1.66-1.78)].

Obese European women were also 63% significantly more likely to renting house OR 1.63 (95% CI 1.58-1.69) however 9% less likely to come late at booking OR 0.91 (0.87-0.96) when compared to healthy weight women. Findings also indicated there was no association between weight status and smoking among European women.

Table 5.6 : Odd Ratios socio-demographic characteristics of European pregnant women

European	Normal n (%) (Reference:1)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
Age							
< 35 (ref)	52, 111 (88.1)	27,113 (85.0)	1		22,035 (86.3)	1	
≥ 35	7,066 (11.9)	4,796 (15.0)	1.30	1.25-1.36	3,500 (13.7)	1.17	1.12-1.22
Total, n	59,177	31,909			25,535		
Missing, n	36	30			28		
Parity							
0 (ref)	28,641 (48.9)	13,335 (42.2)	1		9,373 (37.2)	1	
1	19,253 (32.9)	10,964 (34.7)	1.22	1.19-1.26	8,878 (35.2)	1.41	1.36-1.46
2	6,938 (11.9)	4,536 (14.4)	1.40	1.35-1.47	4,054 (16.1)	1.79	1.71-1.87
≥ 3	3,689 (6.3)	2,734 (8.7)	1.59	1.51-1.68	2,887 (11.5)	2.39	2.27-2.52
Total, n	58,521	31,569			25,192		
Missing, n	692	370			371		
Marital Status							
Single	32,769 (58.5)	17,035 (56.5)	0.92	0.90-0.95	14,223 (59.2)	1.04	1.00-1.07
Married/ Civil Partner (ref)	22,704 (40.5)	12,776 (40.0)	1		9,508 (39.6)	1	
Separate/ Divorced/ Widowed	532 (1.0)	337 (1.1)	1.13	0.98-1.29	306 (1.3)	1.37	1.19-1.58
Total, n	56,005	30,148			24,037		
Missing, n	3,208	1,791			1,526		
Employment Status							
Work Full Time (ref)	22,463 (40.0)	12,161 (40.2)	1		8,671 (36.2)	1	
Work Part Time	12,491 (22.2)	6,970 (23.0)	1.03	0.99-1.07	5,094 (21.3)	1.06	1.01-1.10
Not Working	21,188 (37.7)	11,108 (36.7)	0.97	0.94-1.00	10,200 (42.6)	1.25	1.21-1.29
Total, n	56,142	30,239			23,965		
Missing, n	3,071	1,700			1,598		
Partner Employed							
Working (ref)	43,248 (86.5)	23,603 (87.2)	1		17,649 (83.1)	1	
Not	6,769	3,455	0.94	0.90-0.98	3,577	1.29	1.24-1.35

European	Normal n (%) (Reference:1)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
Working	(13.5)	(12.8)			(16.9)		
Total, n	50,017	27,058			21,226		
Missing, n	9,196	4,881			4,337		
Index Multiple Deprivation (quintile)							
1 – 3 (ref)	28,401 (50.6)	14,469 (47.9)	1		9,407 (39.0)	1	
4	11,515 (20.5)	6,613 (21.9)	1.13	1.09-1.17	5,494 (22.8)	1.44	1.38-1.50
5	16,187 (28.9)	9,117 (30.2)	1.11	1.07-1.14	9,196 (38.2)	1.72	1.66-1.78
Total, n	56,103	30,199			24,097		
Missing, n	3,110	1,740			1,466		
Housing Status							
Own (ref)	23,682 (45.7)	12,982 (46.3)	1		8,311 (37.2)	1	
Rent	18,529 (35.7)	10,776 (38.5)	1.06	1.03-1.10	10,631 (47.6)	1.63	1.58-1.69
Others	9,620 (18.6)	4,267 (15.2)	0.81	0.78-0.84	3,373 (15.1)	1.00	0.95-1.05
Total, n	51,831	28,025			22,315		
Missing, n	7382	3914			3248		
Late Booking							
No (ref)	50,181 (87.4)	27,122 (87.8)	1		21,864 (88.4)	1	
Yes	7,203 (12.6)	3,755 (12.2)	0.96	0.92-1.01	2,865 (11.6)	0.91	0.87-0.96
Total, n	30,877	30,877			24,729		
Missing, n	1,062	1,062			834		
Smoking							
No (ref)	45,581 (77.7)	24,702 (78.2)	1		19,505 (77.2)	1	
Yes	13,096 (22.3)	6,905 (21.8)	0.97	0.94-1.01	5,764 (22.8)	1.03	0.99-1.07
Total, n	58,677	31,607			25,269		
Missing, n	536	332			294		

NB. WHO General Classification for BMI used

5.4.2 South Asian Born in UK (SA bUK)

Table 5.7 shows the Odd Ratios for socio-demographic characteristics of South Asian pregnant women who were born in the UK comparing obesity, overweight and normal BMI using Asian Specific BMI cut off points.

Factors significantly associated with obesity in South Asian women who were born in the UK were age more than 35 years old (OR =1.79 (95% CI 1.49-2.15)), not working (OR=1.43 (95% CI 1.27-1.62)), partner not working (OR=1.19 (95% CI 1.01-1.41)), and renting as opposed to owner occupied housing (OR=1.24 (95% CI 1.06-1.44)). The risk of having obesity was also associated with increasing parity [(Parity 1: OR 1.66 (95% CI 1.46-1.89); (Parity 2: OR 2.31 (95%CI 1.98-2.70); (Parity 3 or more: OR 4.09 (95% CI 3.41-4.90))] and increasing deprivation quintile [(IMD 4: OR 1.49 (95%CI 1.26-1.76); IMD 5: OR 1.98 (95% CI 1.74-2.26)].

South Asian obese women who were born in the UK were 24% significantly more likely to renting house OR 1.24 (95% CI 1.06-1.44) compared to healthy weight women. However findings indicated there was no association between weight status with late booking and smoking status.

Table 5.7 : Odd Ratios socio-demographic characteristics of South Asian born in UK (SA bUK) pregnant women

SA bUK	Normal n (%) (Reference:1)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
Age							
< 35 (ref)	2,728 (92.8)	2,682 (88.1)	1		2,339 (87.8)	1	
≥ 35	211 (7.2)	361 (11.9)	1.74	1.46-2.08	324 (12.2)	1.79	1.49-2.15
Total, n	2,939	3,043			2,663		
Missing, n	-	-			-		
Parity							
0 (ref)	1,315 (44.9)	1,096 (36.2)	1		721 (27.2)	1	
1	944 (32.2)	984 (32.5)	1.25	1.11-1.41	861 (32.5)	1.66	1.46-1.89
2	441 (15.1)	546 (18.0)	1.49	1.28-1.72	559 (21.1)	2.31	1.98-2.70
≥ 3	228 (7.8)	400 (13.2)	2.10	1.76-2.52	511 (19.3)	4.09	3.41-4.90
Total, n	2,928	3,026			2,652		
Missing, n	11	17			11		
Marital Status							
Single	298 (10.2)	299 (9.9)	0.97	0.82-1.15	209 (7.9)	0.76	0.63-0.91
Married/ Civil Partner (ref)	2,601 (89.2)	2,692 (89.2)	1		2,416 (91.4)	1	
Separate/ Divorced/ Widowed	18 (0.6)	26 (0.9)	1.40	0.76-2.55	17 (0.6)	1.02	0.52-1.98
Total, n	2,917	3,017			2,642		
Missing, n	22	26			21		
Employment Status							
Work Full Time (ref)	987 (35.4)	993 (34.2)	1		740 (29.1)	1	
Work Part Time	520 (18.6)	472 (16.3)	0.90	0.77-1.05	427 (16.8)	1.10	0.93-1.28
Not Working	1,283 (46.0)	1,435 (49.5)	1.11	0.99-1.25	1,377 (54.1)	1.43	1.27-1.62
Total, n	2,790	2,900			2,544		
Missing, n	149	143			119		
Partner Employed							
Working (ref)	2,251 (88.1)	2,306 (87.4)	1		2,021 (86.1)	1	
Not Working	305	331	1.06	0.90-1.25	327	1.19	1.01-1.41

SA bUK	Normal n (%) (Reference:1)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
	(11.9)	(12.6)			(13.9)		
Total, n	2,556	2,637			2,348		
Missing, n	383	406			315		
Index Multiple Deprivation							
1 – 3 (ref)	834 (28.7)	799 (26.4)	1		470 (17.9)	1	
4	575 (19.7)	582 (19.3)	1.06	0.91-1.23	482 (18.3)	1.49	1.26-1.76
5	1505 (51.6)	1,637 (54.2)	1.14	1.01-1.28	1,682 (63.9)	1.98	1.74-2.26
Total, n	2,914	3,018			2,634		
Missing, n	25	25			29		
Housing Status							
Own (ref)	1328 (49.5)	1513 (54.3)	1		1,332 (54.7)	1	
Rent	398 (14.8)	435 (15.6)	0.96	0.82-1.12	495 (20.3)	1.24	1.06-1.44
Others	956 (35.7)	840 (30.1)	0.77	0.69-0.87	609 (25.0)	0.64	0.56-0.72
Total, n	2,682	2,788			2,436		
Missing, n	257	255			227		
Late Booking							
No (ref)	2,479 (86.1)	2,567 (86.4)	1		2,177 (84.4)	1	
Yes	399 (13.9)	405 (13.6)	0.98	0.84-1.14	403 (15.6)	1.15	0.99-1.34
Total, n	2,878	2,972			2,580		
Missing, n	61	71			83		
Smoking							
No (ref)	2,798 (95.8)	2,899 (96.1)	1		2,535 (95.7)	1	
Yes	123 (4.2)	119 (3.9)	0.93	0.72-1.21	114 (4.3)	1.02	0.79-1.33
Total, n	2,921	3,018			2,649		
Missing, n	18	25			14		

NB. WHO Asian Classification for BMI used

5.4.3 South Asian Not Born in UK (SA nbUK)

Table 5.8 gives the calculation of Odd Ratios for socio-demographic characteristics among South Asian pregnant women who were not born in the UK comparing obesity, overweight and normal BMI using the WHO Asian specific BMI classification.

Factors significantly associated with obesity in South Asian women who were not born in the UK were age more than 35 years old (OR =3.54 (95% CI 2.98-4.20)), not working (OR=1.23 (95% CI 1.05-1.43)) and partner not working (OR=1.41 (95% CI 1.21-1.65)). The risk of having obesity was also associated with increasing parity [(Parity 1: OR 1.89 (95% CI 1.65-2.17); (Parity 2: OR 2.86 (95%CI 2.45-3.32); (Parity 3 or more: 6.65 (95% CI 5.65-7.83)] and increasing deprivation quintile [(IMD 4: OR 1.34 (95%CI 1.11-1.62); IMD 5: OR 1.98 (95% CI 1.70-2.30)].

South Asian obese women who were not born in the UK were 24% significantly less likely to come late at booking OR 0.49 (95% CI 0.43-0.58) compared to healthy weight women. Findings also indicated they were 24% more likely to be smoking OR 1.24 (95% CI 1.09-1.40).

Table 5.8 : Odd Ratios Socio-demographic characteristics of SA not born in UK (SA nbUK) pregnant women

SA nbUK	Normal n (%) (Reference:1)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
Age							
< 35 (ref)	3,251 (94.2)	3,355 (88.8)	1		2,233 (81.9)	1	
≥ 35	202 (5.8)	425 (11.2)	2.04	1.71-2.43	491 (18.0)	3.54	2.98-4.20
Total, n	3,453	3,780			2,724		
Missing, n	-	-			-		
Parity							
0 (ref)	1,349 (39.3)	1,014 (26.9)	1		486 (17.9)	1	
1	1,127 (32.8)	1,275 (33.7)	1.51	1.34-1.69	768 (28.3)	1.89	1.65-2.17
2	617 (18.0)	819 (21.7)	1.77	1.55-2.02	635 (23.4)	2.86	2.45-3.32
≥ 3	343 (10.0)	659 (17.5)	2.56	2.19-2.98	822 (30.3)	6.65	5.65-7.83
Total, n	3,436	3,767			2,711		
Missing, n	17	14			13		
Marital Status							
Single	73 (2.1)	77 (2.1)	0.96	0.66-1.33	53 (2.0)	0.92	0.64-1.31
Married/ Civil Partner (ref)	3,296 (97.0)	3,624 (97.2)	1		2,607 (97.2)	1	
Separate/ Divorced/ Widowed	30 (0.9)	29 (0.8)	0.88	0.53-1.47	22 (0.8)	0.93	0.53-1.61
Total, n	3,399	3730			2,682		
Missing, n	54	51			42		
Employment Status							
Work Full Time (ref)	467 (14.2)	592 (16.4)	1		310 (12.0)	1	
Work Part Time	308 (9.4)	361 (10.0)	0.92	0.76-1.12	219 (8.5)	1.07	0.86-1.34
Not Working	2,516 (76.5)	2,662 (73.6)	0.83	0.73-0.95	2,051 (79.5)	1.23	1.05-1.43
Total, n	3,291	3,615			2,580		
Missing, n	162	166			144		
Partner Employed							
Working (ref)	2,720 (88.6)	2,904 (87.4)	1		2,028 (84.6)	1	
Not	351	418	1.12	0.96-1.30	370	1.41	1.21-1.65

SA nbUK	Normal n (%) (Reference:1)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
Working	(11.4)	(12.6)			(15.4)		
Total, n	3,071	3,322			2,398		
Missing, n	382	459			326		
Index Multiple Deprivation							
1 – 3 (ref)	633 (18.5)	638 (17.0)	1		297 (11.0)	1	
4	604 (16.7)	626 (16.7)	1.03	0.88-1.20	380 (14.1)	1.34	1.11-1.62
5	2,173 (66.2)	2,479 (66.2)	1.13	1.00-1.28	2,020 (74.9)	1.98	1.70-2.30
Total, n	3,410	3,743			2,697		
Missing, n	43	38			27		
Housing Status							
Own (ref)	1,220 (38.9)	1,588 (46.2)	1		1,207 (49.0)	1	
Rent	754 (24.1)	898 (26.1)	0.91	0.81-1.03	698 (28.3)	0.94	0.82-1.07
Others	1,160 (37.0)	954 (25.2)	0.63	0.53-0.73	560 (22.7)	0.48	0.44-0.57
Total, n	3,134	3,440			2,465		
Missing, n	319	341			259		
Late Booking							
No (ref)	2,704 (80.2)	2,902 (79.1)	1		2,027 (76.6)	1	
Yes	667 (19.8)	765 (20.9)	1.07	0.95-1.20	619 (23.4)	0.49	0.43-0.55
Total, n	3,371	3,667			2,646		
Missing, n	82	114			78		
Smoking							
No (ref)	3,408 (99.2)	3,746 (99.4)	1		2,680 (99.0)	1	
Yes	26 (0.8)	22 (0.6)	0.77	0.44-1.36	28 (1.0)	1.24	1.09-1.40
Total, n	3,434	3,768			2,708		
Missing, n	19	13			16		

NB. WHO Asian Classification for BMI used

5.4.4 Summary

Being an older mother (more than 35 years old) was significantly associated with obesity in each population group, although the elevated risk was most marked in the South Asian women who were not born in the UK (OR =3.54 (95% CI 2.98-4.20)).

The same trend was shown for the odd ratios of obese pregnant women who were classified as parity 3 or more, with the South Asian women who were not born in the UK having the highest increased risk of obesity (OR =6.65 (95% CI 5.65-7.83)). This is compared to South Asian women born in the UK (OR =4.09 (95% CI 3.41-4.09)) and European (OR =2.39 (95% CI 2.27-2.52)) when compare to normal BMI group.

Obese pregnant women were found to have higher risk of being unemployed when compared to normal BMI pregnant women especially among South Asian born in UK (OR =1.43 (95% CI 1.27-1.62)) followed by European (OR =1.25 (95% CI 1.21-1.29) and South Asian not born in UK (OR =1.23 (95% 1.05-1.43)) when compared to normal BMI women. However when calculated the odds ratios of the partner employment status, SA not born in UK (OR =1.41 (95% CI 1.21-1.65)) having the highest risk having unemployed partner followed by European (OR =1.29 (95% CI 1.24-1.35)) and the least was South Asian born in UK (OR =1.19 (95% CI 1.01-1.41)) when compared to the reference group.

Overall, obese pregnant women were twice as likely to live in the most deprived areas compared to the normal BMI group. The trend seems similar between South Asian women who were born in the UK (OR =1.98 (95% CI 1.74-2.26)), South Asian women not born in the UK (OR =1.98 (95% CI 1.70-2.30)) and European pregnant women (OR =1.72 (95% CI 1.66-1.78)) when compared to normal BMI women.

5.5 ASSOCIATION OF PRE-EXISTING DISEASE WITH MATERNAL OBESITY BY ETHNICITY

5.5.1 European

Table 5.9 shows the Odds Ratios for pre-existing disease comparing obesity, overweight and normal BMI using WHO General BMI cut off points among European pregnant women. Compared with the normal BMI group, European pregnant women who were obese had higher risk of pre-existing diabetes (Obese: 1.2%, Normal BMI: 0.4%, OR=2.63 (95% CI 2.22-3.11)); and were 3.5 times more likely to have pre-existing hypertension (Obese: 5%, Normal BMI: 1.5%, OR=3.51 (95% CI 3.21-3.83)). Increasing BMI level showed a positive correlation with developing pre-existing diseases among European women.

Table 5.9: Odds Ratio of pre-existing disease among European comparing obese, overweight with normal BMI pregnant women as reference

European	Normal n (%) (Reference: 1)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
Diabetes							
No (ref)	57,678 (99.6%)	30,980 (99.4)	1		24,496 (98.8%)	1	
Yes	257 (0.4%)	197 (0.6)	1.43	1.18-1.72	287 (1.2%)	2.63	2.22-3.11
Total, n	57,935	31,939			24,783		
Missing, n	1,278	762			780		
Pre-existing Hypertension							
No (ref)	57,149 (98.5%)	30,416 (97.3)	1		23,654 (95.0%)	1	
Yes	851 (1.5%)	844 (2.7)	1.86	1.69-2.05	1,235 (5.0%)	3.51	3.21-3.83
Total , n	58,000	31 266			24,889		
Missing, n	1,213	679			674		

NB. WHO General Classification for BMI used

5.5.2 South Asian Born in UK (SA bUK)

Table 5.10 shows the Odd Ratios for pre-existing disease comparing obesity, overweight and normal BMI using Asian specific BMI cut off points among South Asian pregnant women born in the UK (later generation). South Asian women who were born in the UK who were obese had higher risk of pre-existing diabetes (Obese: 2.3%, Normal BMI: 0.2%, OR=9.65 (95% CI 3.80-18.24)); and were four times more likely to have pre-existing hypertension (Obese: 3.8%, Normal BMI: 1.0%, OR=4.02 (95% CI 2.64-6.14)) when compared with the normal BMI group. Increasing BMI level showed a positive correlation with having pre-existing diseases among South Asian women who were born in the UK.

Table 5.10: Odd Ratio of pre-existing disease among South Asian born in UK comparing obese, overweight with normal BMI pregnant women as reference

SA bUK	Normal n (%) (Reference:1)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
Diabetes							
No (ref)	2,907 (99.8)	2,991 (99.1)	1		2,583 (97.7)	1	
Yes	7 (0.2)	26 (0.9)	3.61	1.56-8.33	60 (2.3)	9.65	3.80-18.24
Total, n	2,914	3,017			2,643		
Missing, n	25	26			20		
Pre-existing Hypertension							
No (ref)	2,891 (99.0)	2,978 (98.8)	1		2,540 (96.2)	1	
Yes	28 (1.0)	36 (1.2)	1.25	0.76 - 2.05	99 (3.8)	4.02	2.64-6.14
Total , n	2,919	3,014			2,639		
Missing, n	20	29			24		

NB. WHO Asian Classification for BMI used

5.5.3 South Asian Not Born in UK (SA nbUK)

Table 5.11 shows the Odd Ratios for pre-existing disease comparing obesity, overweight and normal BMI using Asian Specific BMI cut off points among South Asian pregnant women who were not born in the UK (later generation). Compared with the normal BMI group, pregnant women who were obese had almost 9 times risk of pre-existing diabetes (Obese: 2.8%, Normal BMI: 0.3%, OR=8.80 (95% CI 4.66-16.61)); and were 4 times more likely to have pre-existing hypertension (Obese: 3.8%, Normal BMI: 0.9%, OR=4.29 (95% CI 2.86-6.43)). Increasing BMI level showed a positive correlation with having pre-existing diseases among South Asian pregnant women who were not born in the UK.

Table 5.11 : Odds Ratio of pre-existing diseases among South Asian not born in UK comparing obese, overweight with normal BMI pregnant women as reference

SA nbUK	Normal n (%) (Reference:1)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
Diabetes							
No (ref)	3412 (99.7)	3700 (98.7)	1		2609 (97.2)	1	
Yes	11 (0.3)	49 (1.3)	4.11	2.13-7.91	74 (2.8)	8.80	4.66-16.61
Total, n	3423	3749			2683		
Missing, n	11	32			41		
Pre-existing Hypertension							
No (ref)	3,395 (99.1)	3,672 (97.9)	1		2,579 (96.2)	1	
Yes	31 (0.9)	77 (2.0)	2.30	1.51-3.49	101 (3.8)	4.29	2.86-6.43
Total, n	3,426	3,749			2,680		
Missing, n	27	32			44		

NB. WHO Asian Classification for BMI used

5.5.4 Summary

Compared to normal BMI women as the reference, the odds of having pre-existing diabetes mellitus was high among South Asian obese women either born in the UK or not. Obesity increased the chance 9.7 times of having pre-existing diabetes mellitus for South Asian women who were born in the UK, OR=9.65 (95% CI 3.80-18.26) and 8.8 times more risk among South Asian women who were not born in the UK, OR=8.80 (95% CI 4.66-16.6)), compared to women with normal BMI. The odds ratio of the risk of having pre-existing diabetes among European women was OR=2.63 (95% CI 2.22-3.11) compared to the reference group.

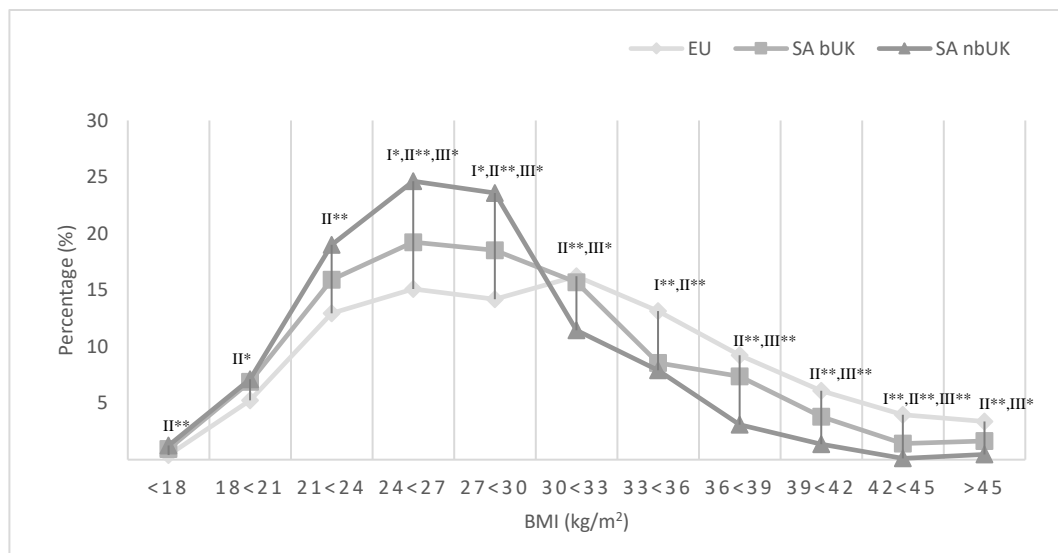
Overall, the obese pregnant women have 3 to 4 fold increased chance of having pre-existing hypertension among all three ethnic groups. This was similar between South Asian women who were not born in the UK (OR=4.29 (95% CI 2.86-6.43)) and South Asian women born in UK (OR=4.02 (95% CI 2.64-6.14)), followed by European (OR=3.51 (95% CI 3.21-3.83)) when compare to normal BMI pregnant women.

5.6 GESTATIONAL DIABETES MELLITUS (GDM)

5.6.1 Distribution of Gestational Diabetes Mellitus (GDM) by BMI

Figure 5.3 shows the prevalence of Gestational Diabetes Mellitus of pregnant women by BMI. There is significantly different especially between European and South Asian not born in UK (SA nbUK) pregnant women for each BMI range. The prevalence of Gestational Diabetes Mellitus cases among South Asian not born in UK (SA nbUK) was significantly higher among pregnant women who had BMI below than 30kg/m^2 , however for BMI more than 30kg/m^2 the prevalence of Gestational Diabetes Mellitus was significantly higher among the European when compared to the South Asian not born in UK (SA nbUK). The prevalence of developing Gestational Diabetes Mellitus among South Asian born in UK (SA bUK) was between those other two groups.

Figure 5.3: Distribution of Gestational Diabetes Mellitus Cases by BMI



Different of Proportion (Z) Test:

I=Sig. diff between EU & SA bUK, I*= $p<0.05$, I**= $p<0.01$,

II=Sig. diff between EU & SA nbUK, II*= $p<0.05$, II**= $p<0.01$

III=Sig. diff between SA bUK & SA nbUK, III*= $p<0.05$, III**= $p<0.01$

5.6.2 Association of Gestational Diabetes Mellitus (GDM) with Maternal Obesity by Ethnicity

Table 5.12 shows the Odd Ratios for obstetric outcome comparing obese, overweight and normal BMI using WHO General BMI Classification (a) among European pregnant women and WHO Asian Specific BMI Classification (b) for South Asian population.

After excluding women who had been diagnosed with diabetes mellitus before pregnancy, surprisingly, the odds of having gestational diabetes was 5.5 times higher when compared to normal BMI pregnant women among European obese women (Obese:5.7%, Normal BMI 1.1%, OR=5.55 (95% CI 5.04-6.11) followed by South Asian born in UK ((Obese 8.7%, Normal BMI: 2.4%, OR=3.89 (95% CI 2.96-5.12)). However, the prevalence of having Gestational Diabetes Mellitus was highest among South Asian women not born in the UK (Obese: 14.4%, Normal BMI: 4.7%, OR=3.38 (95% CI 2.79-4.10)).

Table 5.12: Odd Ratios of having gestational diabetes comparing obese, overweight and normal BMI pregnant women as reference

Gestational Diabetes	Normal n (%) (Reference:1)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
European							
No (ref)	56,729 (98.9)	30,178 (97.9)	1		23,037 (94.3)	1	
Yes	616 (1.1)	638 (2.1)	1.95	1.74-2.18	1,386 (5.7)	5.55	5.04-6.11
Total, n	57,345	30,816			24,423		
Missing, n	1,868	1,123			1140		
SA bUK							
No (ref)	2,804 (97.6)	2,865 (96.0)	1		2,370 (91.3)	1	
Yes	69 (2.4)	118 (4.0)	1.67	1.24-2.26	227 (8.7)	3.89	2.96-5.12
Total, n	2,873	2,983			2,597		
Missing, n	66	60			66		
SA nbUK							
No (ref)	3,195 (95.3)	3,356 (91.3)	1		2,266 (85.6)	1	
Yes	159 (4.7)	318 (8.7)	1.90	1.56-2.32	381 (14.4)	3.38	2.79-4.10
Total, n	3,354	3,674			2,647		
Missing, n	99	107			77		

NB. WHO General Classification used for the European group.

WHO Asian Classification for BMI used for the South Asian groups.

5.6.3 Logistic Regression Test of Maternal Obesity and Gestational Diabetes Mellitus

Table 5.13 gives the results from a logistic regression test to analyse the effects of ethnicity and Body Mass Index on the likelihood that pregnant women have gestational diabetes within the same ethnic group using two BMI Classification which is (a) WHO General BMI Classification and (b) WHO Asian Specific BMI Classification. These calculations excluded women who had been diagnosed as having diabetes mellitus before pregnancy. Based on the Adjusted Odds Ratio in Table 5.13, increasing BMI was associated with increased chances to have gestational diabetes among European, South Asian born in UK and South Asian not born in UK pregnant women, as shown previously with bivariate analysis as well.

When using WHO General BMI Classification (a), European pregnant women who were obese had 5 times the risk of having gestational diabetes during pregnancy (Obese: 5.4%, Normal BMI: 1.0%, AOR = 5.31, (95% CI 4.70-6.01)). South Asian women born in the UK had almost 3.5 times the risk (Obese: 9.9%, Normal BMI: 2.9%, AOR= 3.47 (95% CI 2.60-4.63)) to exhibit gestational diabetes and South Asian women not born in the UK had twice the risk (Obese : AOR=2.54 (95% CI 1.97-3.26)) when compared to women who have normal BMI at booking in the same ethnic group. Similar associations were found using the WHO Asian cut-off values for BMI to classify overweight and obesity. Having an underweight BMI seems to be a protective factor on developing GDM during pregnancy in the South Asian pregnant women.

Table 5.13: Logistic Regression Predicting of Gestational Diabetes on Ethnicity and Body Mass Index (BMI) (normal BMI women as reference)

BMI Status	<u>European^a</u>		<u>SA bUK^a</u>		<u>SA bUK^b</u>		<u>SA nbUK^a</u>		<u>SA nbUK^b</u>	
	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)
Underweight	23 (0.6)	0.66 (0.37-1.18)	7 (1.6)	0.74 (0.32-1.71)	7 (1.6)	0.83 (0.35-1.94)	15 (2.5)	0.32 (0.14-0.72)	15 (2.5)	0.38 (0.16-0.87)
Normal (ref)	616 (1.0)	1	130 (2.9)	1	69 (2.3)	1	293 (5.5)	1	159 (4.6)	1
Overweight	638 (2.0)	1.91 (1.66-2.20)	122 (4.9)	1.76 (1.31-2.36)	118 (3.9)	1.52 (1.08-2.13)	352 (10.9)	1.80 (1.46-2.23)	318 (8.4)	1.71 (1.33-2.22)
Obese	1386 (5.4)	5.31 (4.70-6.01)	162 (9.9)	3.47 (2.60-4.63)	227 (8.5)	3.30 (2.41-4.51)	213 (15.1)	2.54 (1.97-3.26)	381 (14.0)	2.82 (2.18-3.64)

^a WHO General BMI Classification

^b WHO Asian Specific BMI Classification

* Adjusted for Marital Status, Working Status, Partner working status, Index Multiple Deprivation, Housing Status, Smoking Status, Late Booking, Hypertensive Disease during pregnancy, Low Birthweight, Macrosomia and Premature birth

Table 5.14 gives the result from the logistic regression test to analyse the effects of ethnicity and Body Mass Index on the likelihood that pregnant women have gestational diabetes using WHO General BMI Classification for all groups. Increasing BMI category was associated with an increased chance to have Gestational Diabetes among European, South Asian born in UK and South Asian not born in UK pregnant women, compared to the reference population of European pregnant women with a normal BMI.

The risk of obese South Asian women who were not born in the UK of developing gestational diabetes was almost 17 times (OR=16.95 (95% CI 14.36-10.21)); 10 times among obese South Asian women born in the UK (OR=10.40 (95% CI 8.68-12.46)) and 5.5 times among the European obese group (OR=5.54 (95% CI 5.03-6.10) when compared to normal BMI European pregnant women as the reference population. South Asian women not born in the UK had the highest chance of developing GDM at any level of BMI.

The results from the logistic regression test in Table 5.15 were similar to the results in Table 5.14 after using the WHO Asian Specific BMI Classification for the South Asian groups. At any level of BMI, South Asians who were either born in the UK or not, had higher risk of developing GDM when compared to normal BMI European pregnant women as the reference group. Among underweight South Asian pregnant women who were not born in the UK, the risk of developing GDM was almost 2.5 times higher when compared to normal BMI European women, OR 2.48 (95% CI 1.48-4.17). The calculations in both

tables (5.14 & 5.15) excluded women who had been diagnosed with having diabetes mellitus before pregnancy and using European normal BMI group as reference.

Table 5.14: Logistic Regression Predicting of Gestational Diabetes Mellitus on Ethnicity and Body Mass Index using WHO General BMI Classification (normal BMI European women as reference)

Ethnicity & BMI	n	%	AOR	95% CI for Odds Ratio		p
				Lower	Upper	
<u>European</u>						
Underweight	23	0.6	0.59	0.39	0.89	0.013
Normal (ref)	616	1.0	1	-	-	-
Overweight	638	2.0	1.95	1.74	2.18	<0.001
Obese	1386	5.4	5.54	5.03	6.10	<0.001
<u>SA bUK</u>						
Underweight	7	1.6	1.50	0.71	3.18	0.291
Normal	130	2.9	2.79	2.30	3.37	<0.001
Overweight	122	4.9	4.87	4.00	5.95	<0.001
Obese	162	9.9	10.40	8.68	12.46	<0.001
<u>SA nbUK</u>						
Underweight	15	2.5	2.48	1.48	4.17	0.001
Normal	293	5.5	5.52	4.79	6.36	<0.001
Overweight	352	10.9	11.70	10.21	13.41	<0.001
Obese	213	15.1	16.95	14.36	20.02	<0.001

* Adjusted for Marital Status, Working Status, Partner working status, Index Multiple Deprivation, Housing Status, Smoking Status, Late Booking

Table 5.15: Logistic Regression Predicting of Gestational Diabetes on Ethnicity and Body Mass Index using WHO Asian Specific BMI (normal BMI European women as reference)

Ethnicity & BMI	n	%	AOR	95% CI for Odds Ratio		p
				Lower	Upper	
<u>European</u>						
Underweight	23	0.6	0.59	0.39	0.89	0.013
Normal (ref)	616	1.0	1	-	-	-
Overweight	638	2.0	1.95	1.74	2.18	<0.001
Obese	1386	5.4	5.54	5.03	6.10	<0.001
<u>SA bUK</u>						
Underweight	7	1.6	1.50	0.71	3.18	0.291
Normal	69	2.3	2.27	1.76	2.92	<0.001
Overweight	118	3.9	3.79	3.10	4.64	<0.001
Obese	227	8.5	8.82	7.53	10.33	<0.001
<u>SA nbUK</u>						
Underweight	15	2.5	2.48	1.48	4.17	0.001
Normal	159	4.6	4.58	3.84	5.48	<0.001
Overweight	318	8.4	10.20	8.59	12.11	<0.001
Obese	381	14.0	15.48	13.54	17.71	<0.001

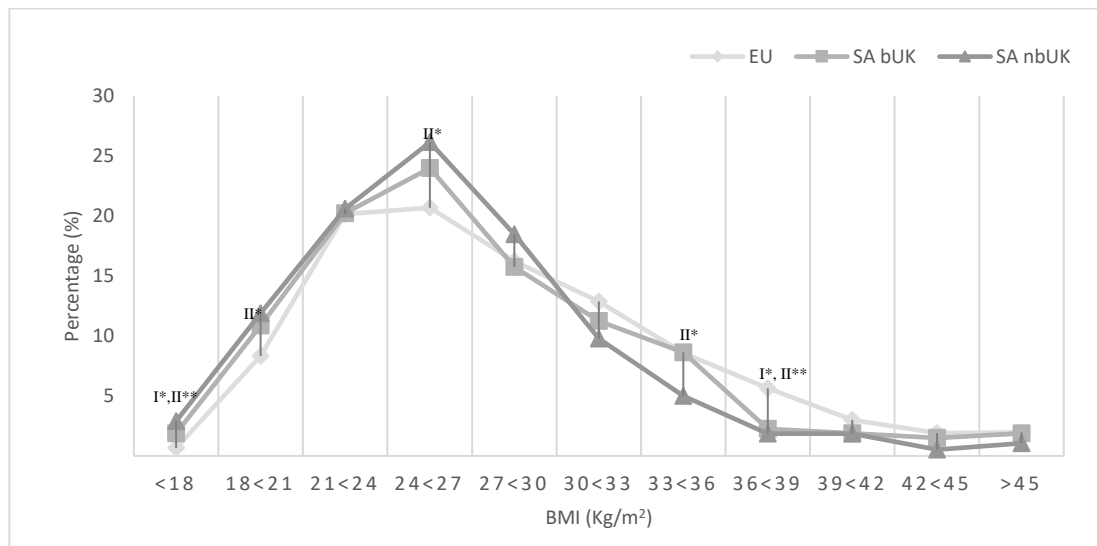
* Adjusted for Marital Status, Working Status, Partner working status, Index Multiple Deprivation, Housing Status, Smoking Status, Late Booking

5.7 HYPERTENSIVE DISEASE DURING PREGNANCY

5.7.1 Distribution of Hypertensive Disease during Pregnancy by BMI

Figure 5.4 shows the proportion of developing hypertensive disease during pregnancy by BMI. The proportion of South Asian not born in UK significantly higher compared to European at BMI range below than 18kg/m², BMI range 18 to <21 kg/m² and BMI range 24 to <27kg/m². In contrast, proportion of developing hypertensive disease during pregnancy significantly higher among European compared to South Asian not born in UK at BMI range 33 to <39 kg/m² and at BMI range 36 to <39 kg/m² when compared to South Asian born in UK. There is no significant different of proportion on developing hypertensive during pregnancy between South Asian born in UK and not born in UK at any range of BMI level.

Figure 5.4: Distribution of Hypertensive Disease during Pregnancy by BMI



Different of Proportion (Z) Test:

I=Sig. diff between EU & SA bUK, I*=p<0.05

II=Sig. diff between EU & SA nbUK, II*=p<0.05, II**= p<0.01

5.7.2 Association of Hypertensive Disease during Pregnancy with Maternal Obesity by Ethnicity

Table 5.16 shows the Odd Ratios for hypertensive disease comparing obese, overweight and normal BMI using WHO General BMI Classification (a) among European pregnant women and WHO Asian Specific BMI Classification (b) for South Asian population. After excluding women who had been diagnosed with hypertension before pregnancy, overall, each group of obese pregnant women has two times the risk of developing hypertensive disease during pregnancy when compared to normal BMI pregnant women: European (Obese: 9.3%, Normal BMI: 4.2%, OR=2.34 (95% CI 2.20-2.48); South Asian born in the UK (Obese: 4.1%, Normal BMI: 2.0%, OR=2.05 (95% CI 1.48-2.84); and South Asian not born in the UK (Obese : 5.1%, Normal BMI: 2.7%, OR=1.94 (95% CI 1.48-2.56)

Table 5.16: Odd Ratios of having Hypertensive Disease during Pregnancy comparing obese, overweight and normal BMI pregnant women as reference

Hypertensive Disease during Pregnancy	Normal n (%) Reference (1)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
European							
No (ref)	55,152 (95.8)	29,036 (93.8)	1		22,282 (90.7)	1	
Yes	2,420 (4.2)	1,935 (6.2)	1.52	1.43-1.62	2,283 (9.3)	2.34	2.20-2.48
Total, n	57,572	30,971			24,565		
Missing, n	1641	968			998		
SA bUK							
No (ref)	2,818 (98.0)	2,879 (96.7)	1		2,460 (95.9)	1	
Yes	58 (2.0)	99 (3.3)	1.67	1.20-2.32	104 (4.1)	2.05	1.48-2.84
Total, n	2,876	2,978			2,564		
Missing, n	63	65			99		

SA nbUK						
No (ref)	3,251 (97.3)	3,481 (96.1)	1		2,433 (94.9)	1
Yes	90 (2.7)	143 (3.9)	1.48	1.14-1.94	131 (5.1)	1.94 1.48-2.56
Total, n	3,341	3,624			2,654	
Missing, n	112	157			160	

NB. WHO General Classification used for the European group.

WHO Asian Classification for BMI used for the South Asian groups.

5.7.3 Logistic Regression Test of Maternal Obesity and Hypertensive Disease during Pregnancy

Table 5.17 gives the results from a logistic regression test to analyse the effects of ethnicity and Body Mass Index on the likelihood of developing hypertensive disease during pregnancy. Based on the adjusted Odds Ratio in Table 5.17, increasing BMI Category was associated with an increased chance of having a hypertensive disease during pregnancy among South Asian women not born in the UK, South Asian women born in the UK and European pregnant women. This calculation excludes women who had been diagnosed with pre-existing hypertensive disease before pregnancy. Hypertensive disease during pregnancy was calculated by combining all pre-eclampsia and pregnancy induce hypertension cases. Using both BMI cut off points, South Asian women not born in the UK who were obese had the highest chance to develop hypertensive disease during pregnancy, using normal BMI as the reference group. When using WHO Asian Specific BMI Classification (b), the risk to develop hypertensive disease increased among South Asian women not born in the UK from AOR=1.80 (95% CI1.26-2.57) to AOR= 2.36 (95% 1.57-3.54 CI), and increased among South Asian women not born in the UK women from AOR=2.56 (95% CI1.73-7.39) to AOR= 2.97(95% 2.05-4.31CI). Among European women, being underweight seems to be a protective factor from developing hypertensive disease from pregnancy.

Table 5.17 : Logistic Regression Predicting Hypertensive disease during pregnancy by Ethnicity and Body Mass Index (BMI) (normal BMI as reference)

BMI Status	<u>European^a</u>		<u>SA bUK^a</u>		<u>SA bUK^b</u>		<u>SA nbUK^a</u>		<u>SA nbUK^b</u>	
	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)
Underweight	90 (2.4)	0.49 (0.35-0.66)	6 (1.3)	0.36 (0.11-1.14)	6 (1.3)	0.51 (0.15-1.65)	15 (2.5)	0.85 (0.42-1.70)	15 (2.5)	1.08 (0.52-2.24)
Normal (ref)	2596 (4.4)	1	109 (2.4)	1	60 (2.0)	1	164 (3.1)	1	92 (2.7)	1
Overweight	2143 (6.7)	1.61 (1.49-1.74)	94 (3.8)	1.36 (0.94-1.97)	108 (3.5)	1.83 (1.22-2.73)	162 (5.0)	1.87 (1.37-2.56)	169 (4.5)	2.02 (1.43-2.87)
Obese	2622 (10.3)	2.43 (2.25-2.62)	87 (3.5)	1.80 (1.26-2.57)	122 (4.6)	2.36 (1.57-3.54)	94 (6.7)	2.56 (1.73-3.79)	159 (5.8)	2.97 (2.05-4.31)

^a WHO General BMI Classification

^b WHO Asian Specific BMI Classification

* Adjusted for Marital Status, Working Status, Partner working status, Index Multiple Deprivation, Housing Status, Smoking Status, Late Booking, GDM, IUGR, Macrosomia and Premature birth

Table 5.18 presents the findings from a logistic regression test to assess the effects of ethnicity and Body Mass Index on hypertensive disease during pregnancy using the WHO General BMI classification (a), using European normal BMI as the reference population. Based on the results in Table 5.18, obese European women had almost 2.5 greater odds chances developing hypertensive disease during pregnancy (Obese: 10.3%, Normal BMI (ref) 4.4%, AOR= 2.34 (95% CI 2.20-2.48)) and 38% more risk among obese South Asian women who were not born in the UK (Obese: 6.7%, Normal BMI (ref) 4.4%, AOR= 1.38 (95% CI 1.09-1.75)) when compared to normal BMI European pregnant women as the reference group. However, there is no significant difference between South Asian women who were born in the UK compared with the European reference group (normal BMI) related to the risk of developing hypertensive disease during pregnancy. Being underweight reduced the risk to develop hypertensive disease among European and South Asian born in UK women. Similar findings were also observed when using the WHO Asian Specific BMI Classification (b) in Table 5.19.

Table 5.18: Logistic Regression Predicting of Hypertensive Disease during pregnancy on Ethnicity and Body Mass Index (using WHO General BMI Classification) (normal BMI European women as reference)

Ethnicity & BMI	n	%	AOR	95% CI for Odds Ratio		p
				Lower	Upper	
<u>European</u>						
Underweight	90	2.4	0.54	0.43	0.67	<0.001
Normal Ref	2596	4.4	1	-	-	-
Overweight	2143	6.7	1.52	1.43	1.62	<0.001
Obese	2622	10.3	2.34	2.20	2.48	<0.001
<u>SA bUK</u>						
Underweight	6	1.3	0.32	0.14	0.71	0.005
Normal	109	2.4	0.54	0.45	0.66	<0.001
Overweight	94	3.8	0.83	0.66	1.03	0.091
Obese	87	5.3	1.11	0.88	1.41	0.380
<u>SA nbUK</u>						
Underweight	15	2.5	0.62	0.37	1.03	0.065
Normal	164	3.1	0.69	0.58	0.81	<0.001
Overweight	162	5.0	1.07	0.90	1.28	0.447
Obese	94	6.7	1.38	1.09	1.75	0.007

* Adjusted for Marital Status, Working Status, Partner working status, Index Multiple Deprivation, Housing Status, Smoking Status, Late Booking

Table 5.19 : Logistic Regression Predicting of Hypertensive Disease on Ethnicity and Body Mass Index using WHO Asian Specific BMI Classification (normal BMI European women as reference)

Ethnicity & BMI	n	%	AOR	95% CI for Odds Ratio		p
				Lower	Upper	
<u>European</u>						
Underweight	90	2.4	0.54	0.43	0.67	<0.001
Normal Ref	2596	4.4	1			
Overweight	2143	6.7	1.52	1.43	1.62	<0.001
Obese	2622	10.3	2.34	2.20	2.48	<0.001
<u>SA bUK</u>						
Underweight	6	1.3	0.32	0.14	0.71	0.005
Normal	60	2.0	0.47	0.36	0.61	<0.001
Overweight	108	3.5	0.78	0.64	0.96	0.019
Obese	122	4.6	0.96	0.79	1.18	0.716
<u>SA nbUK</u>						
Underweight	15	2.5	0.62	0.37	1.03	0.065
Normal	92	2.7	0.63	0.51	0.78	<0.001
Overweight	169	4.5	1.08	0.86	1.35	0.518
Obese	159	5.8	1.23	1.01	1.47	0.026

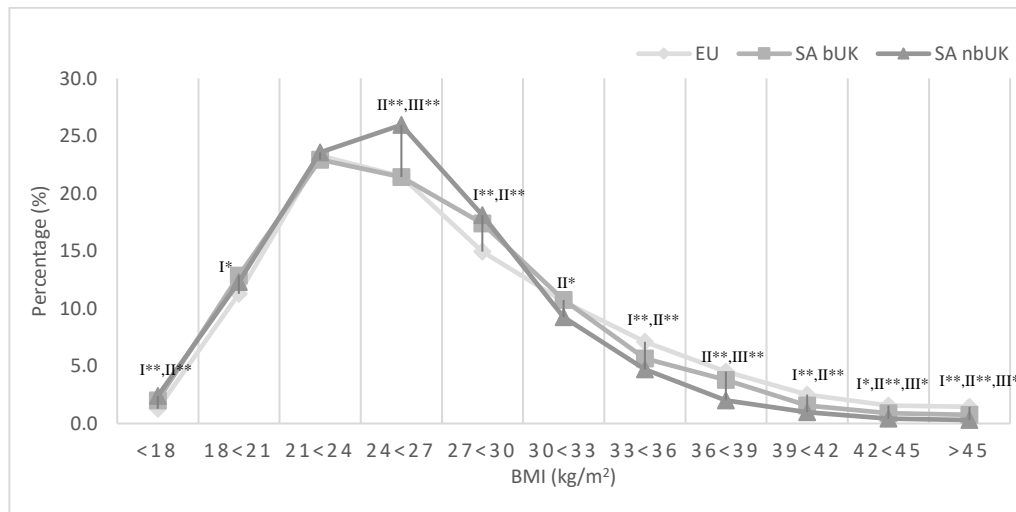
* Adjusted for Marital Status, Working Status, Partner working status, Index Multiple Deprivation, Housing Status, Smoking Status, Late Booking

5.8 CAESAREAN SECTION

5.8.1 Distribution of Caesarean Section by BMI

Figure 5.5 shows the proportion of women having a caesarean section during delivery by BMI. The proportion of European significantly higher compared to South Asian not born in UK for BMI range above 30 kg/m² and significantly higher compared to South Asian born in UK at BMI range 33 to <36 kg/m² and BMI above 39kg/m². South Asian not born in UK women was found had significantly higher proportion having caesarean section during delivery at BMI range <18kg/m² and between 24 to <33kg/m² when compared to European women. There is also differences between South Asian born in UK and not born in UK, which South Asian born in UK has higher proportion on having caesarean section compared to South Asian not born in UK women at BMI range 36 to <39kg/m² and BMI range >42 kg/m².

Figure 5.5 : Distribution of Caesarean Section by BMI



Different of Proportion (Z) Test:

I=Sig. diff between EU & SA bUK, I*=p<0.05, I**= p<0.01

II=Sig. diff between EU & SA nbUK, II*=p<0.05, II**= p<0.01

III=Sig. diff between SA bUK & SA nbUK, III*=p<0.05, III**= p<0.01

5.8.2 Association of Caesarean Section with Maternal Obesity by Ethnicity

Tables 5.20 and 5.21 shows the Odd Ratios for final mode of birth and type of caesarean section comparing obese, overweight and normal BMI using WHO General BMI Classification (a) among European pregnant women and WHO Asian Specific BMI Classification (b) for South Asian populations. Obesity also increased the chance of delivery by caesarian section by approximately 70% for all population groups compared with women with normal BMI: European (OR=1.69 (95% CI 1.63-1.75), South Asian born in the UK (OR=1.74 (95% CI 1.54-1.97), or South Asian not born in the UK (OR=1.68 (95% CI 1.49-1.89). However, there is no significant difference for the type of caesarean section between obese pregnant women compared with the reference group (Table 5.21).

In contrast, the risk of instrumental delivery was decreased with increasing BMI level. Obese European women were 40% less likely to have the Ventouse method (OR=0.60 (95% CI 0.55-0.64), had 19% reduced risk of forceps delivery (OR=0.81 (95% CI 0.76-0.87) and were 15% less likely having Breech delivery (OR=0.85 (95% CI 1.63-1.75). The risk of instrumental delivery was even lower among South Asian obese women when compared to normal BMI women. South Asian obese women who were born in the UK were 52% less likely to have the Ventouse method (OR=0.48 (95% CI 0.37-0.62) and 32% less likely to have a forceps delivery (OR = 0.68; 95% CI 0.49-0.81). Among South Asian women who were not born in the UK, results showed that they were 53% less likely to experience the Ventouse method (OR=0.47 (95% CI 0.36-0.61) and 40% less likely to have forceps used during delivery (OR=0.60 (95% CI 0.45-0.78).

Table 5.20 : Odd Ratios of Final Mode of Birth and comparing obese and overweight with normal BMI pregnant women as reference

Final Mode of Birth	Normal n (%) (Ref = 1)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
European							
Normal vaginal (ref)	38,742 (65.8)	19,989 (63.0)	1		15,114 (59.6)	1	
Ventouse	4,215 (7.2)	1,735 (5.5)	0.80	0.75-0.85	979 (3.9)	0.60	0.55-0.64
Forceps	3,275 (5.6)	1,640 (5.2)	0.97	0.91-1.03	1,037 (4.1)	0.81	0.76-0.87
Breech	273 (0.5)	123 (0.4)	0.87	0.71-1.08	90 (0.4)	0.85	0.67-1.07
Caesarean Section	12,349 (20.9)	8,231 (25.8)	1.29	1.25-1.33	8,130 (32.1)	1.69	1.63-1.75
Total, n	58,854	31,718			25,350		
Missing, n	359	221			213		
SA bUK							
Normal vaginal (ref)	1,938 (66.1)	1,935 (63.8)	1		1,619 (61.0)	1	
Ventouse	203 (6.9)	156 (5.1)	0.71	0.62-0.96	81 (3.1)	0.48	0.37-0.62
Forceps	184 (6.3)	185 (6.1)	1.01	0.81-1.25	97 (3.7)	0.68	0.49-0.81
Breech	16 (0.5)	17 (0.6)	1.06	0.54-2.11	12 (0.5)	0.90	0.42-1.90
Caesarean Section	591 (20.2)	741 (24.4)	1.28	1.13-1.45	844 (31.8)	1.74	1.54-1.97
Total, n	2,932	3,034			2,653		
Missing, n	7	9			10		
SA nbUK							
Normal vaginal (ref)	2,326 (67.5)	2,437 (64.6)	1		1,695 (62.5)	1	
Ventouse	218 (6.3)	180 (4.8)	0.79	0.64-0.97	74 (2.7)	0.47	0.36-0.61
Forceps	182 (5.3)	151 (4.0)	0.79	0.63-0.99	79 (2.9)	0.60	0.45-0.78
Breech	24 (0.7)	5 (0.1)	0.20	0.08-0.52	15 (0.6)	0.86	0.45-1.64
Caesarean Section	694 (20.2)	1,002 (26.5)	1.38	1.23-1.54	849 (31.3)	1.68	1.49-1.89
Total, n	3,444	3,775			2,712		
Missing, n	9	6			12		

NB. WHO General Classification used for the European group.

WHO Asian Classification for BMI used for the South Asian groups.

Table 5.21: Odd Ratios of type caesarian comparing obese and overweight with normal BMI pregnant women as reference

Type of Caesarean	Normal n (%)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
European							
Scheduled (ref)	703 (5.8)	468 (5.8)	1		469 (5.9)	1	
Emergency	4,757 (39.5)	3,014 (37.6)	0.95	0.84-1.08	2,868 (36.1)	0.90	0.80-1.02
Urgent	1,736 (14.4)	1,135 (14.2)	0.98	0.85-1.13	1,067 (13.4)	0.92	0.48-1.46
Elective	4,849 (40.3)	3,397 (42.4)	1.05	0.93-1.19	3,537 (44.5)	1.09	0.75-2.11
Total, n	12,045	23,925			7,941		
Missing, n	47,168	31,939			17,622		
SA bUK							
Scheduled (ref)	29 (5.1)	26 (3.7)	1		38 (4.7)	1	
Emergency	259 (45.1)	323 (45.4)	1.39	0.86-2.42	348 (43.2)	1.03	0.62-1.71
Urgent	93 (16.2)	109 (15.3)	1.31	0.72-2.38	102 (12.7)	0.84	0.48-1.48
Elective	193 (33.6)	253 (35.6)	1.46	0.83-2.56	318 (39.4)	1.26	0.75-2.11
Total, n	2,365	711			806		
Missing, n	2,939	2,332			1,857		
SA nbUK							
Scheduled (ref)	32 (4.8)	42 (4.3)	1		39 (4.8)	1	
Emergency	357 (53.7)	440 (45.4)	0.94	0.58-1.52	363 (44.5)	0.83	0.51-1.36
Urgent	77 (11.6)	101 (10.4)	1.00	0.58-1.73	87 (10.7)	0.93	0.53-1.62
Elective	199 (29.9)	387 (39.9)	1.48	0.91-2.42	326 (40.0)	1.34	0.82-2.22
Total, n	665	970			815		
Missing, n	2,788	2,811			1,909		

NB. WHO General Classification used for the European group.

WHO Asian Classification for BMI used for the South Asian groups.

5.8.3 Logistic Regression Test of Maternal Obesity and Caesarean Section

The risk of having a caesarean section during delivery increased with increasing BMI level for all ethnic groups. The increased risk was quite similar between European women (Obese: 31.8% vs normal BMI: 20.9%, AOR= 1.75 (95% CI 1.68-1.83)), South Asian women born in the UK (Obese: 32.3%, normal BMI: 21.0%, AOR= 1.85 (95% CI 1.59-2.16)) and South Asian women not born in the UK (Obese: 33.0%, Normal BMI: 21.7%, AOR= 1.95 (95% CI 1.65-2.30)) comparing the obese women with the reference group (normal BMI) when using WHO General BMI Classification. A similar trend was found after using the WHO Asian Specific BMI Classification for the South Asian groups.

Table 5.23 presents the finding from a logistic regression test to assess the effects of ethnicity and Body Mass Index on caesarean section using the WHO General BMI classification (a), using European women with a normal BMI as the reference population. Based on the results in Table 5.23, obese pregnant women had a similar risk of having a caesarean section during delivery regardless of ethnic background. Obese European women had 78% more risk (Obese: 31.8%, Normal BMI (ref) 20.9%, AOR= 1.78 (95% CI 1.72-1.84)), South Asian born in the UK had 81% more risk (Obese: 32.3%, Normal BMI (ref) 20.9%, AOR= 1.81 (95% CI 1.63-2.01)) and South Asian women not born in the UK had 86% more risk (Obese: 33.0%, Normal BMI (ref) 20.9%, AOR= 1.86 (95% CI 1.66-2.08)) of having a caesarean section during delivery when compared to the reference group. The results also indicated that being underweight reduced the risk of caesarean section. A similar trend was found when using WHO Asian Specific BMI Classification for the South Asians groups (b), with findings given in Table 5.24.

Table 5.22: Logistic Regression Predicting of Caesarean Section during delivery on Ethnicity and Body Mass Index (BMI) (normal BMI pregnant women as reference)

BMI Status	<u>European^a</u>		<u>SA bUK^a</u>		<u>SA bUK^b</u>		<u>SA nbUK^a</u>		<u>SA nbUK^b</u>	
	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)
Underweight	588 (15.6)	0.80 (0.72-0.90)	74 (16.6)	0.74 (0.55-0.99)	74 (16.6)	0.78 (0.57-1.06)	95 (16.1)	0.73 (0.56-0.96)	95 (16.1)	0.80 (0.61-1.06)
Normal (ref)	12,349 (20.9)	1	950 (21.0)	1	591 (20.1)	1	1,156 (21.7)	1	694 (20.1)	1
Overweight	8,231 (25.8)	1.28 (1.23-1.33)	700 (28.0)	1.36 (1.19-1.56)	741 (24.4)	1.20 (1.04-1.39)	923 (28.7)	1.55 (1.37-1.76)	1,002 (26.5)	1.58 (1.39-1.80)
Obese	8,130 (31.8)	1.75 (1.68-1.83)	526 (32.3)	1.85 (1.59-2.16)	844 (31.7)	1.87 (1.61-2.16)	466 (33.0)	1.95 (1.65-2.30)	849 (31.2)	1.92 (1.66-2.22)

^a WHO General BMI Classification

^b WHO Asian Specific BMI Classification

* Adjusted for Marital status, working status, partner working status, Index Multiple Deprivation, Renting House, Smoking Status, Late Booking

Table 5.23: Logistic Regression Predicting of Caesarean Section during pregnancy on Ethnicity and Body Mass Index using WHO General BMI Classification (normal BMI European women as reference)

Ethnicity & BMI	n	%	AOR	95% CI for Odds Ratio		p
				Lower	Upper	
<u>European</u>						
Underweight	588	15.6	0.70	0.64	0.77	<0.001
Normal (ref)	12349	20.9	1	-	-	-
Overweight	8231	25.8	1.32	1.27	1.36	<0.001
Obese	8130	31.8	1.78	1.72	1.84	<0.001
<u>SA bUK</u>						
Underweight	74	16.6	0.75	0.59	0.97	0.025
Normal	950	21.0	1.01	0.94	1.09	0.838
Overweight	700	28.0	1.47	1.34	1.60	<0.001
Obese	526	32.3	1.81	1.63	2.01	<0.001
<u>SA nbUK</u>						
Underweight	95	16.1	0.72	0.58	0.90	0.004
Normal	1156	21.7	1.05	0.98	1.12	0.196
Overweight	923	28.7	1.53	1.41	1.65	<0.001
Obese	466	33.0	1.86	1.66	2.08	<0.001

* Adjusted for Marital status, working status, partner working status, Index Multiple Deprivation, Renting House, Smoking Status, Late Booking

Table 5.24 : Logistic Regression Predicting of Caesarean Section on Ethnicity and Body Mass Index using WHO Asian Specific BMI Classification (normal BMI European women as reference)

Ethnicity & BMI	n	%	Odds Ratio	95% CI for Odds Ratio		p
				Lower	Upper	
<u>European</u>						
Underweight	588	15.6	0.70	0.64	0.77	<0.001
Normal (ref)	8231	20.9	1.32	1.27	1.36	<0.001
Overweight	12349	25.8	1	-	-	-
Obese	8130	31.8	1.78	1.72	1.84	<0.001
<u>SA bUK</u>						
Underweight	74	16.6	0.75	0.59	0.97	0.025
Normal	591	20.1	0.95	0.87	1.04	0.284
Overweight	741	24.4	1.22	1.12	1.33	<0.001
Obese	844	31.7	1.76	1.62	1.911	<0.001
<u>SA nbUK</u>						
Underweight	95	16.1	0.72	0.58	0.90	0.004
Normal	694	20.1	0.95	0.87	1.04	0.244
Overweight	1002	26.5	1.49	1.35	1.65	<0.001
Obese	849	31.2	1.72	1.58	1.87	<0.001

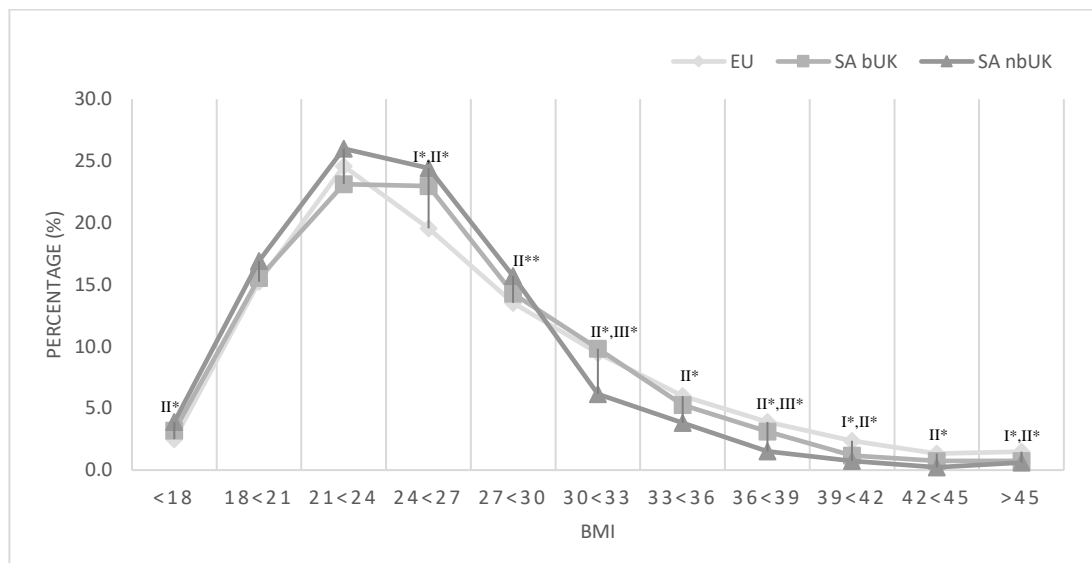
* Adjusted for Marital status, working status, partner working status, Index Multiple Deprivation, Renting House, Smoking Status, Late Booking

5.9 LOW BIRTHWEIGHT

5.9.1 Distribution of Having Low Birthweight Baby by BMI

Figure 5.6 shows the proportion of having low birth weight baby by BMI. The prevalence of European significantly higher compared to South Asian not born in UK for BMI range above 30 kg/m². In contrast, South Asian not born in UK women was found had significantly higher proportion having low birth weight baby at BMI range 24 to <30kg/m² when compared to European women. There is also differences between South Asian born in UK and not born in UK, which South Asian born in UK has higher proportion on having low birth weight bay compared to South Asian not born in UK women at BMI range 30 to <33kg/m² and BMI range 36 to <39kg/m². Detail differences of prevalence having low birthweight baby highlight in Figure 5.6.

Figure 5.6: Distribution of Having Low Birthweight Baby by BMI



Different of Proportion (Z) Test:

I=Sig. diff between EU & SA bUK, I*=p<0.05, I**= p<0.01

II=Sig. diff between EU & SA nbUK, II*=p<0.05, II**= p<0.01

III=Sig. diff between SA bUK & SA nbUK, III*=p<0.05, III**= p<0.01

5.9.2 Association of Low Birthweight with Maternal Obesity by Ethnicity

Table 5.25 shows the Odd Ratios of low birthweight comparing women who were obese and overweight with women with normal BMI as the reference population. I have used the WHO General BMI Classification (a) among European pregnant women and WHO Asian Specific BMI Classification (b) for the South Asian population groups. Obese European women had 32% increased odds of having a low birthweight newborn (Obese 17.6%, Normal BMI: 14.1%, OR 1.32 (95% CI 1.27-1.38) and 35% more risk among South Asian women who were born in the UK (Obese 16.7%, Normal BMI: 13.3%, OR 1.35 (95% CI 1.16-1.56) when compared to normal BMI women. There is no significant difference for obese South Asian women not born in the UK when compared with the reference group (normal BMI).

Table 5.25: Odd Ratios of low birthweight comparing obese, overweight and normal BMI pregnant women as reference

Low Birthweight	Normal n (%)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
European							
10-90 Centile (ref)	46,466 (79.6)	24,596 (79.6)	1		18,832 (74.9)	1	
< 10 Centile	8,249 (14.1)	4,622 (14.7)	1.06	1.02-1.10	4419 (17.6)	1.32	1.27-1.38
Total, n	58,369	31,478			25127		
Missing, n	844	461			436		
SA bUK							
10-90 Centile (ref)	2354 (80.7)	2346 (77.9)	1		1981 (75.1)	1	
< 10 Centile	389 (13.3)	453 (15.1)	1.17	1.01-1.35	441 (16.7)	1.35	1.16-1.56

Total, n	2918	3011			2638		
Missing, n	21	32			25		
SA nbUK							
10-90 Centile (ref)	2753 (80.3)	2912 (77.6)	1		2032 (75.1)	1	
< 10 Centile	428 (12.5)	487 (13.0)	1.08	0.94-1.24	335 (12.4)	1.06	0.91-1.24
Total, n	3428	3754			2704		
Missing, n	25	27			20		

NB. WHO General Classification used for the European group.

WHO Asian Classification for BMI used for the South Asian groups.

5.9.3 Logistic Regression Test of Maternal Obesity and Low Birth Weight

Logistic regression test has been performed to examine the effects of ethnicity and Body Mass Index on the likelihood to deliver low birthweight baby as shown in Table 5.26. Low birthweight was classified as birth weight less than the 10th percentile in this analysis. Based on the adjusted odds ratio from the logistic regression test and using WHO General BMI Classification, it shows that European obese pregnant women had 24% more risk to have low birthweight baby (Obese: 17.3%, Normal BMI: 13.9%. AOR=1.24 (CI 95% 1.18-1.31)) when compared to normal BMI women as the reference group. The risk was similar among South Asian obese pregnant women who were born in the UK (Obese: 17.2%, Normal BMI : 13.8%, AOR=1.22 (CI 95% 1.03-1.45)) but not significantly different among obese South Asian women who were not born in UK compared to the reference group.

Table 5.26: Logistic Regression Predicting of Low Birth Weight during delivery on Ethnicity and Body Mass Index (BMI) (normal BMI pregnant women as reference)

BMI Status	<u>European^a</u>		<u>SA bUK^a</u>		<u>SA bUK^b</u>		<u>SA nbUK^a</u>		<u>SA nbUK^b</u>	
	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)
Underweight	699 (18.6)	1.16 (1.03-1.30)	62 (13.9)	0.94 (0.68-1.31)	62 (13.9)	0.98 (0.70-1.37)	81 (13.7)	1.07 (0.80-1.43)	81 (13.7)	1.01 (0.86-1.20)
Normal (ref)	8,249 (13.9)	1	621 (13.8)	1	389 (13.2)	1	651 (12.2)	1	428 (12.4)	1
Overweight	4,622 (14.5)	1.05 (1.00-1.10)	381 (15.2)	1.07 (0.91-1.25)	453 (14.9)	1.10 (0.93-1.29)	425 (13.2)	1.02 (0.87-1.20)	487 (12.9)	1.05 (0.79-1.40)
Obese	4,419 (17.3)	1.24 (1.18-1.31)	281 (17.2)	1.22 (1.03-1.45)	441 (16.6)	1.16 (1.00-1.34)	174 (12.3)	1.08 (0.81-1.44)	335 (12.3)	0.90 (0.76-1.06)

^a WHO General BMI Classification

^b WHO Asian Specific BMI Classification

* Adjusted for Marital Status, Working Status, Partner working status, Index Multiple Deprivation, Housing Status, Smoking Status, Late Booking

The results in Table 5.27 indicate the effects of ethnicity and Body Mass Index on the odds that pregnant women have a low birth weight baby when using the WHO General BMI classification and European normal BMI as the reference population. The risk of having a low birthweight baby was slightly increased among European (OR= 1.30 (95% CI 1.25-1.35)) and South Asian women who were born in the UK (OR= 1.28 (95% CI 1.13-1.46)) who were obese, albeit not significantly different for South Asian women who were not born in the UK. Underweight European pregnant women had 42% more risk of having a low birthweight baby (OR= 1.42 (95% CI 1.30-1.54 CI)), whereas no significant association was found for the South Asian groups.

Table 5.27: Logistic Regression Predicting of Low Birthweight during pregnancy on Ethnicity and Body Mass Index using WHO General BMI Classification (normal BMI European women as reference)

Ethnicity & BMI	n	%	AOR	95% CI for Odds Ratio		p
				Lower	Upper	
<u>European</u>						
Underweight	699	18.6	1.42	1.30	1.54	0.00
Normal Ref	8249	13.9	1	-	-	-
Overweight	4622	14.5	1.05	1.01	1.08	0.03
Obese	4419	17.3	1.30	1.25	1.35	0.00
<u>SA bUK</u>						
Underweight	62	13.9	0.99	0.76	1.31	0.99
Normal	621	13.8	0.98	0.90	1.07	0.63
Overweight	381	15.2	1.10	0.99	1.23	0.08
Obese	281	17.2	1.28	1.13	1.46	0.00
<u>SA nbUK</u>						
Underweight	81	13.7	0.97	0.77	1.23	0.81
Normal	651	12.2	0.85	0.78	0.93	0.00
Overweight	425	13.2	0.93	0.84	1.04	0.20
Obese	174	12.3	0.86	0.73	1.01	0.07

* Adjusted for Marital Status, Working Status, Partner working status, Index Multiple Deprivation, Housing Status, Smoking Status, Late Booking

The results from the logistic regression test in Table 5.28 is similar to the findings in Table 5.26 when using the WHO Asian Specific BMI Classification for South Asian women born in the UK and European women. However, among South Asian women not born in the UK obese pregnant women were 14% less likely to have low birthweight newborn (Obese: 12.3%, Normal BMI (ref):13.9%, OR= 0.86 (95% CI 0.77-0.97)) similar odds with normal BMI range of South Asian not born in UK women (Obese: 12.4%, Normal BMI (ref):13.9%, OR= 0.87 (95% CI 0.78-0.96)) .

Table 5.28: Logistic Regression Predicting of Low Birthweight on Ethnicity and Body Mass Index using WHO Asian Specific BMI Classification, (normal BMI European women as reference)

Ethnicity & BMI	n	%	AOR	95% CI for Odds Ratio		p
				Lower	Upper	
<u>European</u>						
Underweight	699	18.6	1.42	1.30	1.54	<0.001
Normal Ref	622	13.9	1	-	-	-
Overweight	8249	14.5	1.05	1.01	1.09	0.025
Obese	4419	17.3	1.30	1.25	1.35	<0.001
<u>SA bUK</u>						
Underweight	62	13.9	1.00	0.76	1.31	0.995
Normal	389	13.2	0.94	0.84	1.04	0.225
Overweight	453	14.9	1.08	0.97	1.19	0.162
Obese	441	16.6	1.22	1.10	1.35	<0.001
<u>SA nbUK</u>						
Underweight	81	13.7	0.97	0.77	1.23	0.805
Normal	428	12.4	0.87	0.78	0.96	0.007
Overweight	487	12.9	0.99	0.86	1.13	0.833
Obese	335	12.3	0.86	0.77	0.97	0.011

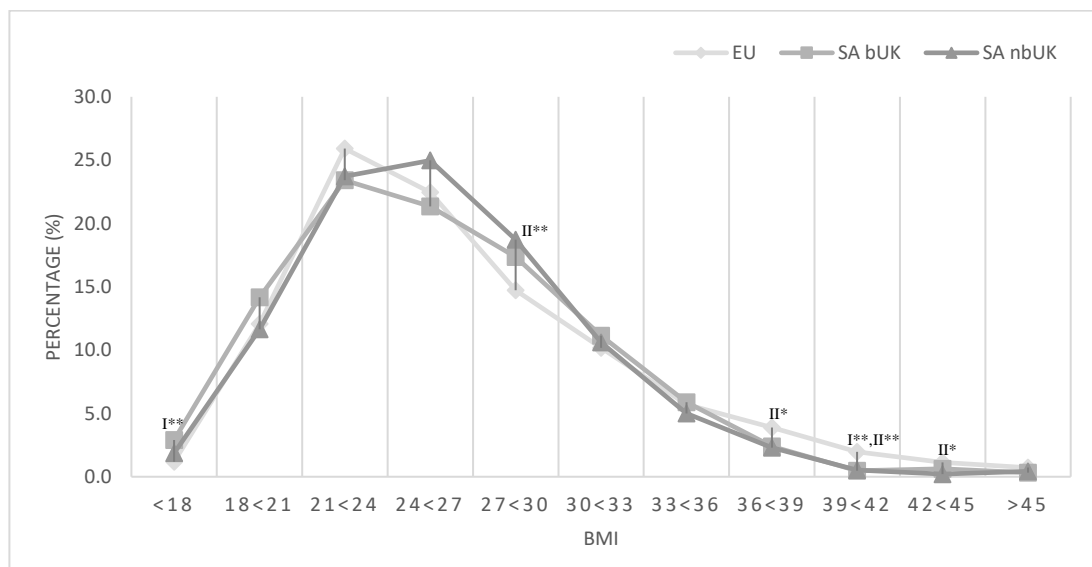
* Adjusted for Marital Status, Working Status, Partner working status, Index Multiple Deprivation, Housing Status, Smoking Status, Late Booking

5.10 MACROSOMIA

5.10.1 DISTRIBUTION OF MACROSOMIA CASES

Figure 5.7 shows the proportion of having macrosomia baby by BMI. The prevalence of South Asian not born in UK significantly higher compared to European at BMI range range 27 to $<30 \text{ kg/m}^2$. In contrast, proportion of having macrosomia baby at BMI range 36 to $<45 \text{ kg/m}^2$ significantly higher among European compared to South Asian not born in UK and the only difference between South Asian born in UK and European women at BMI range 39 to $<42 \text{ kg/m}^2$ which prevalence South Asian born in UK slightly higher compared to European women. There is no significant different of proportion on having macrosomia newborn between South Asian born in UK and not born in UK at any range of BMI level.

Figure 5.7 : Distribution Of Having Macrosomia baby by BMI



Different of Proportion (Z) Test:

I=Sig. diff between EU & SA bUK, II**= $p<0.01$,

II=Sig. diff between EU & SA nbUK, II*= $p<0.05$, II**= $p<0.01$

5.10.2 Association of Macrosomia with Maternal Obesity by Ethnicity

Table 5.29 shows the Odd Ratios of having a macrosomia baby comparing obese, overweight and normal BMI using WHO General BMI Classification (a) among European pregnant women and WHO Asian Specific BMI Classification (b) for South Asian populations. Macrosomia was defined as a baby weighing greater than the 90th percentile at birth in this analysis. South Asian women who were not born in the UK had the highest risk of having a macrosomia baby due to obesity (OR=1.85 (95% CI 1.55-2.20)) followed by South Asian women who were born in the UK (OR=1.47 (95% CI 1.19-1.81)) and the least European pregnant women (OR=1.27 (95% CI 1.20-1.34)) when compared to normal BMI women as a reference.

Table 5.29 : Odd Ratios of macrosomia comparing obese, overweight and normal BMI pregnant women as reference

Macrosomia	Normal n (%)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
European							
10-90 Centile (ref)	46,466 (79.6)	24,596 (79.6)	1		18,832 (74.9)	1	
> 90 Centile	3,654 (6.3)	2260 (7.2)	1.17	1.11-1.23	1876 (7.5)	1.27	1.20-1.34
Total, n	58,369	31,478			25127		
Missing, n	844	461			436		
SA bUK							
10-90 Centile (ref)	2354 (80.7)	2346 (77.9)	1		1981 (75.1)	1	
> 90 Centile	175 (6.0)	212 (7.0)	1.22	0.99-1.50	216 (8.2)	1.47	1.19-1.81
Total, n	2918	3011			2638		
Missing, n	21	32			25		
SA nbUK							
10-90 Centile (ref)	2753 (80.3)	2912 (77.6)	1		2032 (75.1)	1	
> 90 Centile	247 (7.2)	355 (9.5)	1.36	1.15-1.61	337 (12.5)	1.85	1.55-2.20

Total, n	3428	3754	2704
Missing, n	25	27	20

NB. WHO General Classification used for the European group. WHO Asian Classification for BMI used for the South Asian groups.

5.10.3 Logistic Regression Test of Maternal Obesity and Macrosomia

Using the logistic regression test to ascertain the effects of ethnicity and Body Mass Index on the possibility that pregnant woman gave birth to a macrosomia baby are presented in Table 5.30. Increasing BMI level slightly increased the risk of having macrosomia baby among all groups (Table 5.29). The risk relatively similar between European (Obese 7.3%, Normal BMI 6.2%, AOR=1.19 (CI 95% 1.10-1.27) and South Asian born in UK (Obese: 8.0%, Normal BMI: 6.0%, AOR=1.27 (CI 95% 1.10-1.63) obese pregnant women when using the WHO General BMI Classification. However, South Asian pregnant women had the higher risk (60% more chances to have macrosomia baby) when compared to normal BMI women, (Obese:13.0%, Normal BMI 8.0%, AOR=1.60 (CI 95% 1.27-2.01)). In contrast, being underweight reduce the risk of having macrosomia baby.

The results in Table 5.31 indicates the effects of ethnicity and Body Mass Index on the risk that pregnant women have a Macrosomia baby when using WHO General BMI Classification and European normal BMI as the reference population. The risk was significantly higher for women who were obese across all population groups, but was more than twice among the South Asian not born in UK women who were obese (OR= 2.25 (95% CI 1.92-2.63)). When using WHO Asian Specific Classification for South Asian women in Table 5.32, the risk was still highest among South Asian not born in UK obese pregnant women; which had double risk (OR= 2.13 (95% CI 1.89-2.40)) when compared to normal European pregnant women.

Table: 5.30 Logistic Regression Predicting of Macrosomia on Ethnicity and Body Mass Index (BMI) (normal BMI pregnant women as reference)

BMI Status	<u>European^a</u>		<u>SA bUK^a</u>		<u>SA bUK^b</u>		<u>SA nbUK^a</u>		<u>SA nbUK^b</u>	
	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)
Underweight	159 (4.2)	0.81 (0.67-0.99)	25 (5.6)	0.87 (0.54-1.41)	25 (5.6)	0.89 (0.55-1.47)	22 (3.7)	0.51 (0.31-0.83)	22 (3.7)	0.56 (0.34-0.92)
Normal (ref)	3,654 (6.2)	1	279 (6.2)	1	175 (6.0)	1	429 (8.0)	1	247 (7.2)	1
Overweight	2,260 (7.1)	1.14 (1.07-1.22)	193 (7.7)	1.22 (0.99-1.51)	212 (7.0)	1.14 (0.91-1.42)	327 (10.2)	1.28 (1.07-1.53)	355 (9.4)	1.28 (1.05-1.56)
Obese	1,876 (7.3)	1.19 (1.10-1.27)	131 (8.0)	1.27 (1.00-1.63)	216 (8.1)	1.23 (1.01-1.50)	183 (13.0)	1.60 (1.27-2.01)	337 (12.4)	1.66 (1.35-2.05)

^a WHO General BMI Classification

^b WHO Asian Specific BMI Classification

*Adjusted for Marital Status, Working Status, Partner working status, Index Multiple Deprivation, Housing Status, Smoking Status, Late Booking

Table 5.31: Logistic Regression Predicting of Macrosomia during pregnancy on Ethnicity and Body Mass Index using WHO General BMI Classification (normal BMI European women as reference)

Ethnicity & BMI	n	%	AOR	95% CI for Odds Ratio		p
				Lower	Upper	
<u>European</u>						
Underweight	159	4.2	0.67	0.57	0.79	<0.001
Normal Ref	3654	6.2	1	-	-	-
Overweight	2260	7.1	1.16	1.10	1.22	<0.001
Obese	1876	7.3	1.21	1.14	1.28	<0.001
<u>SA bUK</u>						
Underweight	25	5.6	0.90	0.60	1.36	0.626
Normal	279	6.2	1.00	0.88	1.13	0.578
Overweight	193	7.7	1.26	1.09	1.47	<0.001
Obese	131	8.0	1.33	1.10	1.59	<0.001
<u>SA nbUK</u>						
Underweight	22	3.7	0.58	0.38	0.89	<0.001
Normal	429	8.0	1.32	1.19	1.47	<0.001
Overweight	327	10.2	1.71	1.52	1.93	<0.001
Obese	183	13.0	2.25	1.92	2.63	<0.001

*Adjusted for Marital Status, Working Status, Partner working status, Index Multiple Deprivation, Housing Status, Smoking Status, Late Booking

Table 5.32 : Logistic Regression Predicting of Macrosomia on Ethnicity and Body Mass Index using WHO Asian Specific BMI Classification (normal BMI European women as reference)

Ethnicity & BMI	n	%	AOR	95% CI for Odds Ratio		p
				Lower	Upper	
<u>European</u>						
Underweight	159	4.2	0.67	0.57	0.79	<0.001
Normal (ref)	3654	6.2	1	-	-	-
Overweight	2260	7.1	1.16	1.10	1.22	<0.001
Obese	1876	7.3	1.21	1.14	1.28	<0.001
<u>SA bUK</u>						
Underweight	25	5.6	0.90	0.60	1.36	0.626
Normal	175	6.0	0.96	0.82	1.12	0.567
Overweight	212	7.0	1.13	0.98	1.31	0.086
Obese	216	8.1	1.34	1.16	1.54	<0.001
<u>SA nbUK</u>						
Underweight	22	3.7	0.58	0.38	0.89	0.013
Normal	247	7.2	1.16	1.02	1.33	0.027
Overweight	355	9.4	1.51	1.29	1.77	<0.001
Obese	337	12.4	2.13	1.89	2.40	<0.001

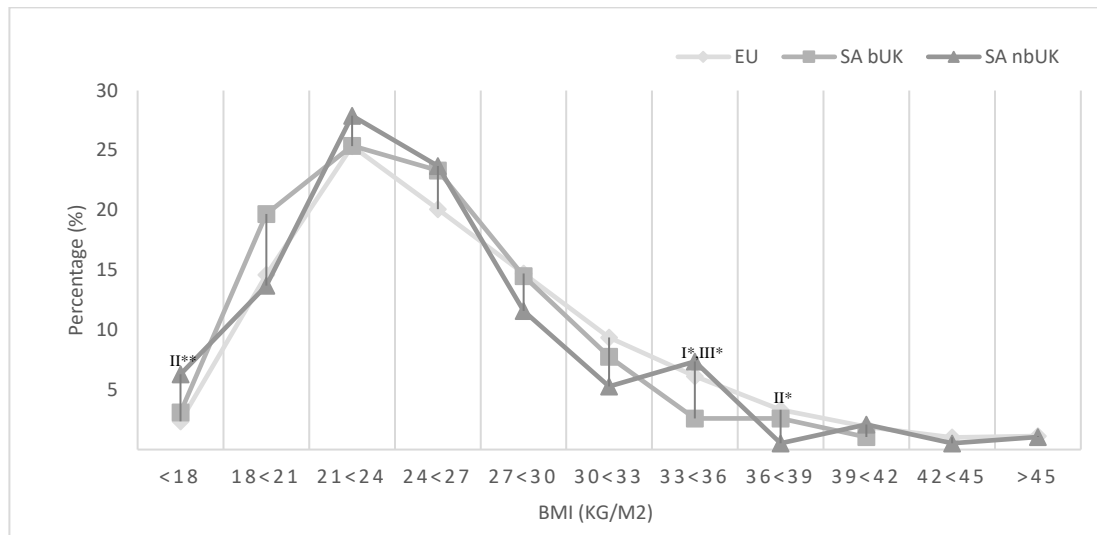
*Adjusted for Marital Status, Working Status, Partner working status, Index Multiple Deprivation, Housing Status, Smoking Status, Late Booking

5.11 NEONATAL INTENSIVE CARE USE (NICU)

5.11.1 Distribution of Neonatal Intensive Care Use (NICU) Cases by BMI

Figure 5.8 shows the proportion of the need of neonatal Intensive Care after delivery by BMI. Based on the results of proportion Z-test, it showing irregular trend of differences proportion between South Asian either born in UK or not born in UK and European women.

Figure 5.8 Distribution of Neonatal Intensive Care Use (NICU) by BMI



Different of Proportion (Z) Test:

I=Sig. diff between EU & SA bUK, I*=p<0.05

II=Sig. diff between EU & SA nbUK, II*=p<0.05, II**= p<0.01

III=Sig. diff between SA bUK & SA nbUK, III*=p<0.05

5.11.2 Association of Neonatal Intensive Care Unit (NICU) with Maternal Obesity by Ethnicity

Table 5.33 shows the Odd Ratios uses of NICU comparing obese, overweight and normal BMI using WHO General BMI Classification (a) among European pregnant women and WHO Asian Specific BMI Classification (b) for South Asian population. Through the statistical test, there is no different odds between the obese pregnant women with the normal BMI women.

Table 5.33: Odd Ratios of Neonatal Intensive Care Use (NICU) comparing obese, overweight and normal BMI pregnant women as reference

NICU	Normal n (%)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
European							
No (ref)	29,778 (95.4)	15,766 (95.0)	1		12,797 (94.8)	1	
Yes	1,422 (4.6)	838 (5.0)	1.11	1.02-1.21	701 (5.2)	0.93	0.85-1.02
Total, n	31,200	16,604			13,498		
Missing, n	28,013	15,335			12,065		
SA bUK							
No (ref)	1269 (95.6)	1223 (94.6)	1		1095 (95.5)	1	
Yes	59 (4.4)	70 (5.4)	1.23	0.86-1.76	51 (4.5)	1.00	0.68-1.47
Total, n	1,328	1,293			1,146		
Missing, n	1,611	1,750			1,517		
SA nbUK							
No (ref)	1,249 (95.6)	1,433 (95.6)	1		870 (94.8)	1	
Yes	58 (4.4)	66 (4.4)	0.99	0.69-1.42	48 (5.2)	1.19	0.80-1.76
Total, n	1,307	1,499			918		
Missing, n	2,146	2,282			1,906		

NB. WHO General Classification used for the European group.WHO Asian Classification for BMI used for the South Asian groups.

5.11.3 Logistic Regression Test of Maternal Obesity and Neonatal Intensive Care Use (NICU)

Table 5.34 presents the risk of the need for additional care directly after the delivery. The adjusted odds ratio shows the positive association between increasing BMI and increased risk of the need for additional care after delivery among obese European pregnant women only (Obese: 2.7%, Normal BMI: 2.4%, AOR 1.17 (95% CI 1.03-1.33), but the risk opposite for South Asian born in UK women (Obese: 1.2%, Normal BMI: 2.3%, AOR 0.56 (95% CI 0.32-0.99)).

The results in Table 5.35 and Table 5.36 indicates the effects of ethnicity and Body Mass Index on the possibility the new-born to be admitted at NICU after delivery using different BMI cut of point WHO General BMI Classification and WHO Asian Specific BMI Classification. The trend was different between European, South Asian born in UK and South Asian not born in UK.

Among European pregnant women, increasing BMI level increased the risk of admission to NICU after birth. However, there was no significant different at any level of BMI among the South Asian born in UK obese pregnant women group for their baby to be admitted at NICU when compare to normal BMI European pregnant women. South Asian not born in UK obese women had 56% more chances for their baby admitted to NICU (OR= 1.56 (95% CI 1.08-2.24)) when compare to normal BMI European pregnant women. However, the highest risk was among underweight South Asian not born in UK which experienced 68% more risk for their new born to be admitted at NICU (OR= 1.68 (95% CI 1.04-2.73)).

Table 5.34 Logistic Regression Predicting Admission to Neonatal Intensive Care Use on Ethnicity and Body Mass Index (BMI) (normal BMI pregnant women as reference)

BMI Status	<u>European^a</u>		<u>SA bUK^a</u>		<u>SA bUK^b</u>		<u>SA nbUK^a</u>		<u>SA nbUK^b</u>	
	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)
Underweight	104 (2.8)	0.94 (0.70-1.26)	13 (2.9)	0.94 (0.43-2.05)	13 (2.9)	1.22 (0.41-2.06)	18 (3.0)	1.25 (0.58-2.69)	18 (3.0)	1.14 (0.54-2.42)
Normal (ref)	1422 (2.4)	1	103 (2.3)	1	59 (2.3)	1	82 (1.5)	1	58 (1.7)	1
Overweight	838 (2.6)	1.14 (1.01-1.28)	50 (2.0)	0.89 (0.57-1.40)	70 (2.0)	0.85 (0.54-1.35)	58 (1.8)	1.12 (0.71-1.77)	66 (1.7)	1.00 (0.62-1.63)
Obese	701 (2.7)	1.17 (1.03-1.33)	32 (1.2)	0.56 (0.32-0.99)	51 (1.9)	0.76 (0.49-1.19)	32 (2.3)	1.66 (0.94-2.92)	48 (1.8)	1.19 (0.74-1.91)

^a WHO General BMI Classification

^b WHO Asian Specific BMI Classification

* Adjusted for Marital Status, Working Status, Partner working status, Index Multiple Deprivation, Housing Status, Smoking Status, Late Booking,

Table 5.35 Logistic Regression Predicting of NICU during pregnancy on Ethnicity and Body Mass Index using WHO General BMI Classification (normal BMI European women as reference)

Ethnicity & BMI	n	%	Odds Ratio	95% CI for Odds Ratio		p
				Lower	Upper	
<u>European</u>						
Underweight	104	2.8	1.14	0.93	1.40	0.21
Normal (ref)	1422	2.4	1	-	-	-
Overweight	838	2.6	1.11	1.02	1.22	0.02
Obese	701	2.7	1.15	1.05	1.26	0.00
<u>SA bUK</u>						
Underweight	13	2.9	1.36	0.78	2.39	0.28
Normal	103	2.3	1.14	0.92	1.39	0.23
Overweight	50	2.0	1.02	0.76	1.36	0.92
Obese	27	1.7	0.86	0.58	1.27	0.45
<u>SA nbUK</u>						
Underweight	18	3.0	1.68	1.04	2.73	0.04
Normal	82	1.5	0.87	0.69	1.09	0.23
Overweight	58	1.8	1.06	0.81	1.39	0.67
Obese	32	2.3	1.56	1.08	2.24	0.02

* Adjusted for Marital Status, Working Status, Partner working status, Index Multiple Deprivation, Housing Status, Smoking Status, Late Booking

When using WHO Asian Specific BMI Classification (Table 5.35), obese South Asian either born in UK or not, found no significant different with the reference group.

Table 5.36: Logistic Regression Predicting of NICU on Ethnicity and Body Mass Index using WHO Asian Specific BMI Classification (normal BMI European women as reference)

Ethnicity & BMI	n	%	Odds Ratio	95% CI for Odds Ratio		p
				Lower	Upper	
<u>European</u>						
Underweight	104	2.8	1.14	0.93	1.40	0.21
Normal (ref)	1422	2.4	1	-	-	-
Overweight	838	2.6	1.11	1.02	1.22	0.02
Obese	701	2.7	1.15	1.05	1.26	0.00
<u>SA bUK</u>						
Underweight	13	2.9	1.36	0.78	2.39	0.28
Normal	59	2.0	0.97	0.75	1.27	0.84
Overweight	70	2.3	1.20	0.94	1.53	0.15
Obese	51	1.9	0.98	0.73	1.30	0.86
<u>SA nbUK</u>						
Underweight	18	3.0	1.68	1.04	2.73	0.04
Normal	58	1.7	0.97	0.74	1.27	0.84
Overweight	66	1.7	1.25	0.91	1.71	0.17
Obese	48	1.8	1.16	0.86	1.55	0.34

* Adjusted for Marital Status, Working Status, Partner working status, Index Multiple Deprivation, Housing Status, Smoking Status, Late Booking

CHAPTER 6

RESULTS OF QUANTITATIVE STUDY: INDIAN, PAKISTANI AND BANGLADESHI WOMEN WITH EUROPEAN WOMEN AS REFERENCE

6.1 OVERVIEW

This chapter presents the findings from the quantitative data analysis of 141,985 pregnant women (Table 4.1) from the West Midlands Maternity Core Dataset. It addresses the first research question by examining the prevalence of maternal obesity in the population under scrutiny over a four-year period, from 2009 to 2012, and by looking at antenatal and foetal complications associated with maternal obesity among Indian, Pakistani and Bangladeshi versus the European reference group in the West Midlands obstetric population.

6.2 SOCIO-DEMOGRAPHIC CHARACTERISTICS

Table 6.1 shows the socio-demographic characteristics of the Indian, Pakistani and Bangladeshi pregnant women, and also indicates the breadth of the variables in the database for later analysis. The mean age of Indian women was higher compared to the other groups; however, the Indian women had the lowest BMI mean.

There was very large difference in the prevalence of parity 3 or more across the groups: the value for Indians was the lowest (4.1%), followed by the value for Europeans (8.1%), and for Pakistanis (21.9%), while the value for the Bangladeshis was the highest (22.6%). A similar trend was found regarding employment status and the Index of Multiple Deprivation. The percentage of Pakistani (77.9%) and Bangladeshi (77.3%) not working was almost double compared to that of unemployed European (39.2%) and Indian (40.4%) pregnant women. For the Index of Multiple Deprivation status, Bangladeshi women had the highest percentage of living in the most deprived area (80.9%), followed by Pakistani (75.3%), while only 31.6% of European and 37.6% of Indian women were found to be living in the most deprived area.

Table 6.1: Socio-demographic characteristics of the pregnancy cohort in the West Midlands database (2009-2012), Perinatal Institute

Detail	European	Indian	Pakistani	Bangladeshi
	References			
Age, mean (years)	28.1	30.2	28.5	28.2
Maternal weight, mean (kg)	70.7	63.0	65.3	60.8
Maternal height, mean (cm)	164.7	160.0	159.6	155.8
BMI , mean (kg/m2)	26.1	24.6	25.6	25.0
Birth weight, mean (g)	3349.9	3084.5	3096.5	3060.8
Age, (%)				
Total (Missing)	122027 (117)	7464 (19)	11240 (22)	2393 (4)
< 18 years	4.4	0.3	0.6	0.9
18 – 35 years	82.7	87.1	89.6	91.1
> 35 years	12.9	12.6	9.7	8.0
Parity, n (%)				
Total (missing)	120374 (1770)	7358 (125)	11045 (217)	2350 (47)
0	44.8	44.0	27.4	26.5
1	33.7	39.2	28.0	28.6
2	13.4	12.7	22.7	22.3
3 or more	8.1	4.1	21.9	22.6
Marital status, %				

Detail	European References	Indian	Pakistani	Bangladeshi
Total (missing)	11,4977 (7167)	7,166 (317)	10,710 (552)	2286 (111)
Single	58.7	6.4	5.6	4.6
Married/ CP	40.3	93.1	93.4	94.7
Separated/ divorced/ Widowed	1.0	0.5	1.0	0.7
Employment status, n (%)				
Total (missing)	115,020 (7124)	6,975 (508)	10,155 (1107)	2,172 (225)
Working full time	38.8	41.7	12.4	11.1
Working part time	22.0	17.9	9.7	11.5
Not Working	39.2	40.4	77.9	77.3
Partner employed, n (%)				
Total (missing)	102,249 (19,895)	6471 (1012)	9,225 (2037)	1981 (416)
Working	85.6	93.1	83.1	86.1
Not working	14.4	6.9	16.9	13.9
Education Level, n (%)				
Total (missing)	43731 (78413)	2792 (4691)	3649 (7613)	764 (1633)
No qualification	5.7	2.6	13.5	11.3
GCSE/ O Level/ A Level	36.5	18.0	33.8	44.1
First degree/ higher education	57.8	79.4	52.8	44.6
Housing Status, n (%)				
Total (missing)	106380 (15764)	6603 (880)	9626 (1636)	2087 (310)
Own	43.3	52.9	44.1	46.4
Rent	39.3	20.4	22.1	28.7
Others	17.4	26.7	34.5	24.9
Index of Multiple Deprivations, n (%)				
Total (Missing)	115330 (6814)	7280 (203)	10,958 (304)	2339 (58)
1: Least deprived	12.1	9.7	1.7	1.3
2	15.4	11.4	2.4	1.5
3	19.5	17.1	5.9	5.0
4	21.4	24.2	14.7	11.2
5 : Most deprived	31.6	37.6	75.3	80.9
Late booking (> 13 weeks), n (%)				
Total (missing)	117708 (4436)	7,175 (308)	10,677 (585)	2301 (96)
Yes	12.4	1.9	2.8	2.2
No	87.6	98.1	97.2	97.8

6.3 PREVALENCE OF MATERNAL OBESITY

6.3.1 Completeness of BMI data

As BMI is the main variable that I am interested in, I have examined the completeness of the data for this variable. Table 6.2 indicates that for each population sub-group at least 98% of the pregnant women had their weight and height recorded at booking, indicating that the completeness of this variable was high and did not vary across sub-groups.

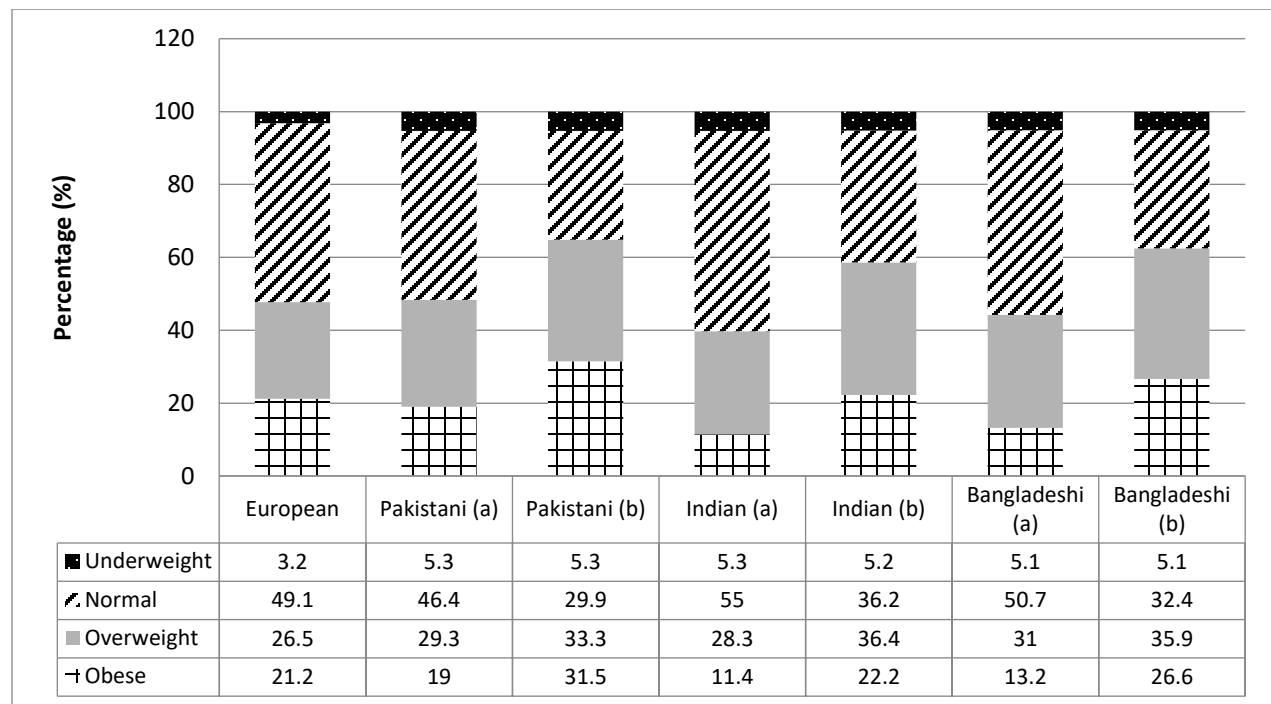
Table 6.2: Number of BMI recorded at booking and percentage (%) for Indian, Pakistani, Bangladeshi and European women

		Total Population	No. of BMI recorded at Booking	%
European	All	122 144	120 481	98.6
	Born UK	108 626	109 861	98.9
	Not Born UK	7 748	7 850	98.7
SOUTH ASIAN				
Indian	All	7 483	7 340	98.1
	Born UK	3 692	3 641	98.6
	Not Born UK	3 340	3 286	98.4
Pakistani	All	11 262	11 125	98.8
	Born UK	4 825	4 794	99.4
	Not Born UK	5 735	5 688	99.2
Bangladeshi	All	2 397	2 368	98.8
	Born UK	662	656	99.1
	Not Born UK	1 587	1 575	99.2

6.3.2 Maternal Obesity by Ethnic Group

Figure 6.1 shows the distribution sample of the Indian, Pakistani and Bangladeshi pregnant women using two BMI classifications. The percentage of obesity among Pakistani, Indian and Bangladeshi increased after using the WHO Asian Specific BMI Classification.

Figure 6.1: Distribution of sample by BMI classification using general WHO General BMI Classification (a) and WHO Asian specific BMI Classification



^a WHO General BMI Classification

^b WHO Asian Specific BMI Classification

6.3.3 Maternal obesity by ethnic group

Table 6.3 presents a bivariate analysis of obesity by ethnic group. This indicates that the prevalence of obesity ($\text{BMI} \geq 30 \text{ kg/m}^2$) for Indian (11.4%, OR=0.54 (95% CI 0.50-0.58), Pakistani (19.0%, OR = 0.90 (0.85-0.94) and Bangladeshi (13.2%, OR=0.62 (0.55-0.70) pregnant women is lower in comparison with the European reference population (21.2%) using WHO General BMI Classification.

However, using the Asian Specific BMI classifications to indicate obesity ($\text{BMI} > 27.5 \text{ kg/m}^2$) for the South Asian population, the prevalence of obesity is significantly higher among Pakistani (31.5 %, OR = 1.49 (95% CI 1.43-1.55)) and Bangladeshi (26.6%, OR = 1.26 (95% CI 1.15-1.37)) only, in comparison with the European reference population (21.2%) ($\text{BMI} \geq 30 \text{ kg/m}^2$) (Table 6.3).

Table 6.5 examines the odds of being obese for the Indian, Pakistani and Bangladeshi women not born in the UK (first generation) and those born in the UK (later generation) versus European women as the reference population. This indicates that the Indian, Pakistani and Bangladeshi women who were born in the UK had the highest risk of obesity when compared to the reference group.

Table 6.3: ORs (95% confidence interval) for being underweight, normal, overweight and obese among Indians, Pakistanis and Bangladeshis overall when compared to Europeans as reference

	Underweight			Normal			Overweight			Obese		
	N	%	OR (95%) for being underweight	N	%	OR (95%) for being normal	N	%	OR (95%) for being overweight	N	%	OR (95%) for being obese
European	3766	3.1	1	59213	49.1	1	31939	26.5	1	25563	21.2	1
References												
BMI General Classification												
Indian	383	5.2	1.67 (1.50-1.86)	4040	55.0	1.12 (1.08-1.17)	2077	28.3	1.07 (1.02-1.12)	840	11.4	0.54 (0.50-0.58)
Pakistani	588	5.3	1.69 (1.55-1.85)	5158	46.4	0.94 (0.91-0.98)	3261	29.3	1.11 (1.06-1.15)	2118	19.0	0.90 (0.85-0.94)
Bangladeshi	119	5.0	1.61 (1.33-1.94)	1201	50.7	1.03 (0.96-1.11)	735	31.0	1.17 (1.08-1.27)	313	13.2	0.62 (0.55-0.70)
BMI Asian Specific Classification												
Indian	383	5.2	1.67 (1.50-1.86)	2656	36.2	0.74 (0.70-0.77)	2673	36.4	1.37 (1.31-1.44)	1628	22.2	1.05 (0.99-1.10)
Pakistani	588	5.3	1.69 (1.55-1.85)	3324	29.9	0.61 (0.58-0.63)	3705	33.3	1.26 (1.21-1.31)	3508	31.5	1.49 (1.43-1.55)
Bangladeshi	119	5.0	1.61 (1.33-1.94)	767	32.4	0.66 (0.61-0.72)	851	35.9	1.36 (1.25-1.47)	631	26.6	1.26 (1.15-1.37)

Weighted percentage given; significant (*p<0.05)

Table 6.4: Odds ratios (95% confidence interval) for being obese, obese class I, obese class II, obese class III among overall South Asian, Indian, Pakistani and Bangladeshi when compared to Europeans as the reference population.

	<u>Obese (BMI > 30)</u>			<u>Obese Class I (BMI 30-34.99)</u>			<u>Obese Class II (BMI 35-39.99)</u>			<u>Obese Class III (BMI >40)</u>		
	N	%	OR (95% CI) for being obese	N	%	OR (95% CI) for being obese	N	%	OR (95% CI) for being obese	N	%	OR (95% CI) for being obese
European	22760	21.2	1	13571	11.1	1	6092	5	1	3097	2.5	1
References												
Indian												
All	680			503			129			51		
Not Born UK	235	7.1	0.33 (0.29-0.38)*	194	5.8	0.45 (0.39-0.52)*	30	0.9	0.16 (0.11-0.22)*	14	0.4	0.14 (0.08-0.24)*
Born UK	445	12.1	0.59 (0.53-0.66)*	309	8.4	0.69 (0.61-0.78)*	99	2.7	0.49 (0.40-0.60)*	37	1.0	0.36 (0.26-0.50)*
Pakistani												
All												
Not Born UK	862	15.0	0.84 (0.77-0.90)*	658	11.5	1.07 (0.98-1.17)	152	2.7	0.55 (0.47-0.65)*	10	1.5	0.37 (0.28-0.49)*
Born UK	864	17.9	1.00 (0.93-1.09)	580	12.0	1.13 (1.03-1.24)*	200	4.1	0.87 (0.75-1.00)	84	1.7	0.72 (0.57-0.89)*
Bangladeshi												
All												
Not Born UK	142	8.9	0.46 (0.38-0.55)*	114	7.2	0.61 (0.51-0.75)*	20	1.3	0.24 (0.15-0.37)*	8	0.5	0.19 (0.09-0.38)*
Born UK	115	17.4	0.92 (0.74-1.13)	82	12.4	1.11 (0.87-1.41)	23	3.5	0.68 (0.45-1.05)	10	1.5	0.59 (0.31-1.10)

Weighted percentage given; significant (*p<0.05)

Table 6.5 Odds Ratios (95% confidence interval) for being obese in Indian, Pakistani and Bangladeshi (New BMI Cut off points for Asian, BMI Obese 27.5+ kg/m²) when compared with European (BMI Obese 30+ kg/m²) as the reference population.

	N	% Obese	OR (95% CI) for being obese (BMI 27.5+) vs. European reference (BMI 30+)
European	22760	21.2	1
References			
Indian			
All			
Not Born UK	617	18.5	1.22 (1.11-1.34)*
Born UK	905	24.5	1.72 (1.58-1.87)*
Pakistani			
All	1728	30.1	2.22 (2.07-2.37)*
Not Born UK			
Born UK	1549	32.1	2.70 (2.51-2.90)*
Bangladeshi			
All			
Not Born UK	379	23.9	1.79 (1.57-2.04)*
Born UK	209	31.6	2.39 (1.99-2.88)*
Weighted percentage given; significant (*p<0.05)			

6.4 ASSOCIATION OF SOCIO-DEMOGRAPHIC FACTORS WITH MATERNAL OBESITY BY ETHNICITY

This part explored the association within the ethnic group for the risk of overweight and obesity based on the pregnant women's socio-demographic background. For this part, I used only BMI Asian Specific Classification to classify them as normal (BMI 8.5-23.5 kg/m²), overweight (BMI 23.5-27.5 kg/m²) and obese with a BMI of more than 27.5 kg/m². Nine socio-demographic factors have been discussed in this part, including: age, parity, marital status, employment status, partner's employment, Index of Multiple Deprivation, housing status, late booking, and smoking.

6.4.1 Indians (n=7483)

Table 6.7 presents the odd ratios for the socio-demographic characteristics of Indian pregnant women, comparing obesity, overweight and normal BMI using WHO Asian Specific BMI classification.

A factor significantly associated with obesity in Indian women was aging (age over 35 (OR =1.95 (95% CI 1.61-2.35)). The risk of having obesity was also associated with an increasing number of parity [(Parity 1: OR 1.82 (95% CI 1.58-2.09); (Parity 2: OR 2.37 (95%CI 1.95-2.88); (Parity 3 or more: OR 2.87 (95% CI 2.09-3.92)] and increasing deprivation quintile [(IMD 4: OR 1.34 (95% CI 1.14-1.58); IMD 5: OR 1.66 (95% CI 1.44-1.92)].

Indian obese women were 38% significantly less likely to renting house OR 0.62 (95% CI 0.53-0.73) and were 28% more likely to come late at booking OR 1.28 (95% CI 1.07-1.54)

compared to healthy weight women. However findings indicated there was no association between weight status and smoking among Indian women.

Table 6.7: Odds ratios (95% confidence interval) for the socio-demographic characteristics of Indian women

Indian	Normal n (%)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
Age							
< 35 (ref)	2417 (91.1)	2252 (84.4)	1		1362 (84.0)	1	
≥ 35	236 (8.9)	416 (15.6)	1.89	1.60-2.24	259 (16.0)	1.95	1.61-2.35
Total, n	2653	2668			1621		
Missing, n	3	5			7		
Parity							
0 (ref)	1339 (51.0)	1086 (41.2)	1		549 (34.3)	1	
1	932 (35.5)	1085 (41.2)	1.44	1.27-1.62	695 (43.4)	1.82	1.58-2.09
2	272 (10.4)	356 (13.5)	1.61	1.35-1.93	264 (16.5)	2.37	1.95-2.88
≥ 3	80 (3.1)	108 (4.1)	1.66	1.23-2.25	94 (5.8)	2.87	2.09-3.92
Total, n	2623	2635			1602		
Missing, n	33	38			26		
Marital Status							
Single	160 (6.2)	152 (5.9)	0.95	0.75-1.19	107 (6.9)	1.11	0.86-1.43
Married/ civil partner (ref)	2395 (93.5)	2406 (93.5)	1		1438 (92.7)	1	
Separate/ divorced/ widowed	8 (0.3)	16 (0.6)	1.99	0.85-4.66	6 (0.4)	1.25	0.43-3.61
Total, n	2563	2574			1551		
Missing, n	93	99			77		
Employment Status							
Working full time (ref)	1013 (40.5)	1089 (43.5)	1		645 (42.6)	1	
Working part time	472 (18.9)	429 (17.1)	0.85	0.72-0.99	272 (18.0)	0.91	0.76-1.08
Not working	1015 (40.6)	987 (39.4)	0.90	0.80-1.02	596 (39.4)	0.92	0.80-1.06
Total, n	2500	2505			1513		
Missing, n	156	168			115		

Indian	Normal n (%)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
Partner Employed							
Working (ref)	2184 (93.4)	2158 (93.2)	1		1298 (92.7)	1	
Not working	154 (6.6)	156 (6.8)	1.03	0.81-1.29	102 (7.3)	1.11	0.86-1.44
Total, n	2338	2314			1400		
Missing, n	318	359			228		
Index of Multiple Deprivation							
1 – 3 (ref)	1067 (41.1)	1041 (40.0)	1		495 (31.1)	1	
4	638 (24.5)	624 (24.0)	1.00	0.87-1.15	397 (25.1)	1.34	1.14-1.58
5	894 (34.4)	934 (36.0)	1.07	0.94-1.21	689 (43.6)	1.66	1.44-1.92
Total, n	2599	2599			1581		
Missing, n	57	74			2		
Housing Status							
Own (ref)	1187 (50.2)	1306 (55.4)	1		817 (56.6)	1	
Rent	447 (18.9)	479 (20.3)	0.97	0.84-1.13	319 (21.9)	1.04	0.88-1.23
Others	732 (30.9)	573 (24.3)	0.71	0.62-0.81	313 (21.5)	0.62	0.53-0.73
Total, n	2366	2358			1449		
Missing, n	290	315			179		
Late Booking							
No (ref)	2262 (87.6)	2246 (87.4)	1		1315 (84.7)	1	
Yes	319 (12.4)	323 (12.6)	1.02	0.86-1.20	238 (15.3)	1.28	1.07-1.54
Total, n	2581	2569			1553		
Missing, n	75	104			75		
Smoking							
No (ref)	2583 (98.4)	2567 (97.9)	1		1558 (97.9)	1	
Yes	41 (1.6)	54 (2.1)	1.33	0.88-2.00	34 (2.1)	1.37	0.87-2.18
Total, n	2624	2621			1592		
Missing, n	32	52			36		

NB. WHO Asian Classification for BMI used

6.4.2 Pakistani (n= 11,262)

Table 6.8 shows the odds ratios for the socio-demographic characteristics of Pakistani pregnant women, comparing obesity, overweight and normal BMI using WHO Asian-specific BMI cut off-points.

Some factors significantly associated with obesity in Pakistani women were aging, where the age was over 35 (OR =13.20 (95% CI 2.68-3.83)), partner not working (OR=1.19 (95% CI 1.03-1.37)), and smoking (OR=1.36 (95% CI 1.02-1.83)). The risk of having obesity was also associated with an increasing number of parity [(Parity 1: OR 1.62 (95% CI 1.42-1.85); (Parity 2: OR 2.29 (95%CI 1.99-2.63); (Parity 3 or more: OR 4.79 (95% CI 4.11-5.52)] and increasing deprivation quintile [(IMD 4: OR 1.30 (95%CI 1.06-1.58); IMD 5: OR 1.66 (95% CI 1.43-1.99)].

Findings indicated there was no association between obesity with housing and late booking status among Indian women. However, it was 41% more likely among overweight Pakistani (OR 1.41 (95% CI 1.05-1.89)) and 36% more likely among Pakistani obese women (OR 1.36 (95% CI 1.02-1.83) to be smoking when compared to women with healthy weight status.

Table 6.8: Odds ratios (95% confidence interval) for the socio-demographic characteristics of Pakistani women

Pakistani	Normal n (%)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
Age							
< 35 (ref)	3145 (94.7)	3333 (91.1)	1		2970 (84.9)	1	
> 35	175	366	1.81	1.50-2.19	529	3.20	2.68-3.83

Pakistani	Normal n (%)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
	(5.3)	(9.9)			(15.1)		
Total, n	3320	3699			3499		
Missing, n	4	6			9		
Parity							
0 (ref)	1161 (35.4)	958 (26.3)	1		626 (18.2)	1	
1	1001 (30.5)	1021 (28.1)	1.24	1.09-1.40	874 (25.4)	1.62	1.42-1.85
2	684 (20.9)	859 (23.6)	1.52	1.33-1.74	843 (24.5)	2.29	1.99-2.63
≥ 3	430 (13.1)	806 (22.1)	2.27	1.97-2.63	1104 (32.0)	4.76	4.11-5.52
Total, n	3276	3644			3447		
Missing, n	48	61			61		
Marital status							
Married/ civil partnership (ref)	2949 (92.8)	3311 (93.2)	1		3157 (94.8)	1	
Single	196 (6.2)	204 (5.7)	0.93	0.76-1.13	145 (4.4)	0.69	0.55-1.43
Separate/ divorced/ widowed	33 (1.0)	37 (1.1)	1.00	0.62-1.60	29 (0.8)	1.25	0.43-3.61
Total, n	3178	3552			3331		
Missing, n	146	153			177		
Employment Status							
Working full time (ref)	397 (13.1)	434 (12.9)	1		365 (11.6)	1	
Working part time	299 (9.9)	333 (9.9)	1.02	0.83-1.25	305 (9.6)	1.11	0.90-1.37
Not working	2330 (78.0)	2600 (77.2)	1.02	0.88-1.88	2489 (78.8)	1.16	1.00-1.35
Total, n	3026	3367			3159		
Missing, n	298	338			349		
Partner employed							
Working (ref)	2315 (84.5)	2520 (83.2)	1		2393 (82.1)	1	
Not working	426 (15.5)	510 (16.8)	1.10	0.96-1.27	523 (12.9)	1.19	1.03-1.37
Total, n	2741	3030			2916		
Missing, n	583	675			592		
Index of Multiple Deprivations							
1 – 3 (ref)	397 (12.2)	369 (10.2)	1		267 (7.9)	1	
4	515 (15.8)	544 (15.0)	1.14	0.94-1.37	449 (13.2)	1.30	1.06-1.58
5	2351	2719	1.24	1.07-1.45	2674	1.66	1.43-1.99

Pakistani	Normal n (%)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
	(72.0)	(74.8)			(78.9)		
Total, n	3263	3632			3390		
Missing, n	61	73			118		
Housing status							
Own (ref)	1121 (39.1)	1472 (46.0)	1		1480 (49.6)	1	
Rent	552 (19.3)	647 (20.2)	0.89	0.78-1.02	721 (24.2)	0.99	0.86-1.13
Others	1191 (41.6)	1081 (33.8)	0.69	0.62-0.77	782 (26.2)	0.50	0.44-0.56
Total, n	2864	3200			2983		
Missing, n	460	505			525		
Late booking							
No (ref)	2550 (79.8)	2823 (79.7)	1		2617 (78.9)	1	
Yes	647 (20.2)	717 (20.3)	1.00	0.89-1.13	698 (21.1)	1.05	0.93-1.19
Total, n	3197	3540			3315		
Missing, n	127	165			193		
Smoking							
No (ref)	3147 (96.8)	3533 (97.7)	1		3291 (96.9)	1	
Yes	103 (3.2)	82 (2.3)	1.41	1.05-1.89	104 (3.1)	1.36	1.02-1.83
Total, n	3250	3615			3395		
Missing, n	74	90			113		

NB. WHO Asian Classification for BMI used

6.4.3 Bangladeshi (n= 2397)

Table 6.9 highlights the results of odds ratios for the socio-demographic characteristics of Bangladeshi women, comparing obesity, overweight and normal BMI using WHO Asian Specific BMI classifications.

Some factors significantly associated with obesity in Bangladeshi women are aging, where the age was over 35 (OR =3.50 (95% CI 2.32-5.27), and living in the most deprived area, IMD 5: OR 1.86 (95% CI 1.20-2.88)]. The risk of having obesity is also associated with

increasing number of parity [(Parity 1: OR 1.56 (95% CI 1.15-2.11); (Parity 2: OR 2.39 (95%CI 1.74-3.27); (Parity 3 or more: OR 5.27 (95% CI 3.82-7.26)]. Findings indicated there is no association between renting house, late booking and smoking status with weight status among Bangladeshi women.

Table 6.9: Odds ratios for the socio-demographic characteristics of Bangladeshi women

Bangladeshi	Normal n (%)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
Age							
< 35 (ref)	732 (95.6)	787 (92.7)	1		542 (86.0)	1	
≥ 35	34 (4.4)	62 (7.3)	1.70	1.10-2.61	88 (14.0)	3.50	2.32-5.27
Total, n	766	849			630		
Missing, n	1	2			1		
Parity							
0 (ref)	282 (37.2)	170 (20.4)	1		115 (18.5)	1	
1	225 (29.7)	256 (30.7)	1.84	1.45-2.45	143 (23.1)	1.56	1.15-2.11
2	150 (19.8)	210 (25.2)	2.32	1.75-3.08	146 (23.5)	2.39	1.74-3.27
≥ 3	101 (13.3)	198 (23.7)	3.25	2.39-4.42	217 (34.9)	5.27	3.82-7.26
Total, n	758	834			621		
Missing, n	9	17			10		
Marital status							
Single	36 (4.9)	35 (4.3)	1		23 (3.8)	1	
Married/ civil partnership (ref)	692 (98.9)	777 (99.6)	0.87	0.54-1.39	574 (99.3)	0.77	0.45-1.31
Separate/ divorced/ widowed	8 (1.1)	3 (0.4)	0.33	0.09-1.26	4 (0.7)	0.60	0.18-2.01
Total, n	700	780			578		
Missing, n	31	36			30		
Employment status							
Working full	80	90	1		59	1	

Bangladeshi	Normal n (%)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
time (ref)	(10.4)	(11.7)			(10.3)		
Working part time	75 (9.7)	89 (11.5)	1.05	0.69-1.62	79 (13.8)	1.43	0.90-2.27
Not working	548 (70.9)	593 (76.8)	0.96	0.72-1.33	435 (75.9)	1.08	0.70-1.54
Total, n	772	772			573		
Missing, n	79	79			58		
Partner employed							
Working (ref)	84 (13.0)	91 (12.9)	1		88 (17.0)	1	
Not working	561 (87.0)	616 (87.1)	1.01	0.74-1.39	428 (83.0)	0.73	0.53-1.01
Total, n	645	707			516		
Missing, n	122	144			115		
Index of Multiple Deprivation							
1 – 3 (ref)	68 (9.1)	81 (9.7)	1		32 (5.2)	1	
4	88 (11.8)	98 (11.7)	0.93	0.61-1.44	64 (10.4)	1.55	0.91-2.62
5	592 (79.1)	657 (78.6)	0.93	0.66-1.31	519 (84.4)	1.86	1.20-2.88
Total, n	748	836			615		
Missing, n	19	15			16		
Housing status							
Own (ref)	282 (41.7)	361 (48.7)	1		279 (50.4)	1	
Rent	173 (25.6)	219 (29.6)	0.99	0.77-1.27	178 (32.1)	1.04	0.80-1.36
Others	221 (32.7)	161 (21.7)	0.57	0.44-0.74	97 (17.5)	0.44	0.33-0.59
Total, n	676	741			554		
Missing, n	91	110			77		
Late booking							
No (ref)	588 (78.9)	621 (75.6)	1		462 (76.5)	1	
Yes	157 (21.1)	200 (24.4)	1.21	0.95-1.53	142 (23.5)	1.15	0.89-1.49
Total, n	745	821			604		
Missing, n	22	30			27		
Smoking							
No (ref)	738 (98.0)	823 (98.3)	1		600 (98.2)	1	
Yes	15 (2.0)	14 (1.7)	0.84	0.40-1.75	11 (1.8)	0.90	0.41-1.98
Total, n	753	837			611		
Missing, n	14	14			20		

NB. WHO Asian Classification for BMI used

6.4.4 Summary

Being an older mother (more than 35 years old) is significantly associated with obesity in each population group, although the elevated risk is most marked among Bangladeshi women (OR =3.50 (95% CI 2.32-5.27)). The same trend is shown for the odds ratios of obese pregnant women classified as parity three or more. The odds of being obese increase with an increasing number of parity. Bangladeshi women have the highest risk to become obese at a parity of three or more (OR =5.27 (95% CI 3.82-7.26)), followed by Pakistani (OR =4.76 (95% CI 4.11-5.52)), Indian (OR =2.87 (95% CI 2.09-3.92)), and European (OR =2.39 (95% CI 2.27-2.52)) women when compared to the normal BMI group for reference.

Overall, obese pregnant women are at a higher risk of living in the most deprived area (IMD=5), as well, in comparison with the normal BMI group. Bangladeshi women have the highest risk (OR =1.86 (95% CI 1.20-2.88)), followed by European pregnant women who were obese (OR =1.72 (95% CI 1.66-1.78)), compared to the normal BMI group. The odds ratio for living in the most deprived area (IMD=5) is similar between Indian (OR =1.66 (95% CI 1.44-1.92)) and Pakistani (OR =1.69 (95% CI 1.43-1.99)) obese pregnant women compared to the reference group.

Indian obese women were found more likely to inform the clinic of their pregnancy status late (after 13 weeks of pregnancy), (OR=1.28 (95% CI 1.07-1.54)). Considering the smoking status among Pakistani women, it became apparent that obese women were 36% more likely to be smokers (OR=1.36 (95% CI 1.02-1.83)), and the risk was even higher among the overweight women (OR=1.41 (95% CI 1.05-1.89)) when compared to normal BMI women as references. However, the results showed no significant difference between Indian and Bangladeshi obese women compared to normal BMI women.

6.5 ASSOCIATION OF PRE-EXISTING DISEASE WITH MATERNAL OBESITY BY ETHNICITY

In this section, I calculated the the odds ratios of having pre-existing diabetes and hypertension by comparing the obese and overweight Indian, Pakistani, and Bangladeshi women to the normal BMI reference group, using the WHO Asian Specific BMI Classification.

6.5.1 Indian (n=7483)

An increasing BMI level shows a positive correlation with developing pre-existing diseases among Indian women. Obese Indian pregnant women presented 7.4 times as high a risk of having pre-existing diabetes (Obese : 2.2%, Normal BMI: 0.3%, OR=7.38 (95% CI 3.41-15.95) and 5.8 as high a risk of having pre-existing hypertension (Obese: 3.7%, Normal BMI: 0.7%; OR=5.82 (95% CI 3.37-10.02)) than the normal BMI reference group.

Table 6.10: Odds Ratios (95% confidence interval) for Pre-Existing Diseases in Indian Women

Indian	Normal n (%)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
Diabetes							
No (ref)	2587 (99.7)	2564 (99.0)	1		1534 (97.8)	1	
Yes	8 (0.3)	27 (1.0)	3.41	1.54-7.51	35 (2.2)	7.38	3.41-15.95
Total, n	2595	2591			1569		
Missing, n	61	82			59		
Pre-existing hypertension							

Indian	Normal n (%)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
No (ref)	2579 (99.3)	2549 (98.4)	1		1513 (96.3)	1	
Yes	17 (0.7)	42 (1.6)	2.50	1.42-4.40	58 (3.7)	5.82	3.37-10.02
Total , n	2596	2591			1571		
Missing, n	60	82			57		

NB. WHO Asian Classification for BMI used

6.5.2 Pakistanis (n=11,262)

Table 5.10 shows that obese Pakistani women have a higher risk of pre-existing diabetes (Obese: 2.8%, Normal BMI: 0.4%, OR=7.12 (95% CI 3.66-11.73)); they are three times more likely to have pre-existing hypertension (Obese: 3.7%, Normal BMI: 1.2%, OR= 3.24 (95% CI 2.24-4.67)) when compared with the normal BMI group. Increasing BMI levels show a positive correlation with developing pre-existing diseases among Pakistani women.

Table 6.11: Odds ratios (95% confidence interval) for pre-existing diseases in Pakistani women

Pakistani	Normal n (%)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
Diabetes							
No (ref)	3197 (99.6)	3528 (98.9)	1		3246 (97.2)	1	
Yes	13 (0.4)	38 (1.1)	2.65	1.41-4.98	94 (2.8)	7.12	3.66-11.73
Total, n	3210	3566			3340		
Missing, n	114	139			168		
Pre-existing hypertension							
No (ref)	3178 (98.8)	3502 (98.3)	1		3203 (96.3)	1	

Pakistani	Normal n (%)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
Diabetes							
Yes	38 (1.2)	59 (1.7)	1.41	0.93-2.12	124 (3.7)	3.24	2.24-4.67
Total , n	3216	3561			3327		
Missing, n	108	144			181		

NB. WHO Asian Classification for BMI used

6.5.3 Bangladeshi (n=2397)

According to the results shown in table 6.12, Bangladeshi obese women have 8.5 times as high a risk to have pre-existing diabetes (Obese: 3.3%, Normal BMI : 0.4%, OR=8.48 (95% CI 2.51-28.67)), and 4.4 as high a risk of having pre-existing hypertension (Obese: 4.0%, Normal BMI: 0.9%, OR=4.36 (95% CI 1.87-10.19)) than normal BMI women, but this did apply to the overweight women. Increasing BMI levels show a positive correlation with developing pre-existing diseases among Bangladeshi women.

Table 6.12 : Odds ratios (95% confidence interval) of pre-existing diseases in Bangladeshi women

Bangladeshi	Normal n (%)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
Diabetes							
No (ref)	744 (99.6)	804 (97.7)	1		585 (96.7)	1	
Yes	3 (0.4)	19 (2.3)	5.86	1.73-19.89	20 (3.3)	8.48	2.51-28.67
Total, n	747	823			605		
Missing, n	20	28			26		
Pre-existing hypertension							
No (ref)	739 (99.1)	801 (97.8)	1		581 (96.0)	1	
Yes	7	18	2.37	0.99-5.71	24	4.36	1.87-10.19

Bangladeshi	Normal n (%)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
Diabetes							
	(0.9)	(2.2)			(4.0)		
Total , n	746	819			605		
Missing, n	21	32			26		

NB. WHO Asian Classification for BMI used

6.5.4 Summary

Compared to the reference group of normal-BMI women, obesity increases the chance of having pre-existing diabetes mellitus by seven to eight times. The highest risk is among Bangladeshi women, OR=8.48 (95% CI 2.51-28.67), followed by Indian women, OR=7.38 (95% CI 3.41-15.96)), and Pakistani women OR 7.12 (95% CI 3.66-11.73), compared to women with a normal BMI. The odds ratio of the risk of having pre-existing diabetes among European women is OR=2.63 (95% CI 2.22-3.11) compared to the reference group.

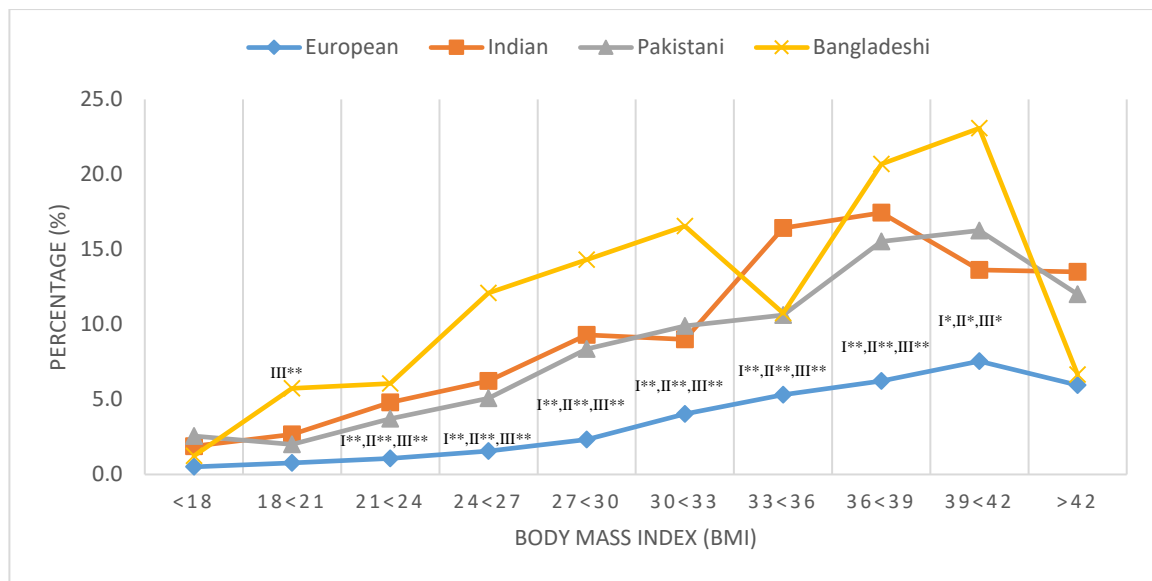
Overall, the obese pregnant women have a three to five fold increased chance of having pre-existing hypertension among all of the four ethnic groups. The highest risk is among Indian women (OR 5.82, 95% CI 3.37-10.02), followed by Bangladeshi (OR 4.36, 95% CI 1.87-10.19), European (OR=3.51 (95% CI 3.21-3.83)), and Pakistani (OR 3.24, 95% CI 2.24-4.67) compared to normal BMI pregnant women.

6.6 GESTATIONAL DIABETES MELLITUS (GDM)

6.6.1 Prevalence of gestational diabetes mellitus (GDM) by BMI

Gestational Diabetes Mellitus prevalence appears to be increased with increasing BMI level. Indian, Pakistani and Bangladeshi women have a higher prevalence of GDM at any level of BMI when compared to the European women.

Figure 6.2: Prevalence of gestational diabetes mellitus cases by BMI



Different of Proportion (Z) Test:

I=Sig. diff between EU & Indian, I*= $p < 0.05$, I**= $p < 0.01$

II=Sig. diff between EU & Pakistani, II*= $p < 0.05$, II**= $p < 0.01$

III=Sig. diff between EU & Bangladeshi, III*= $p < 0.05$, III**= $p < 0.01$

6.6.2 Association of gestational diabetes mellitus (GDM) with maternal obesity by ethnicity

Table 6.13 shows the odds ratios for obstetric outcomes, comparing obese, overweight and normal BMI women using the WHO General BMI Classification (a) among European pregnant women, and the WHO Asian Specific BMI Classification (b) for Indian, Bangladeshi and Pakistani women.

After excluding women who had been diagnosed with diabetes mellitus before pregnancy, surprisingly, the odds of having gestational diabetes is 5.5 times higher than normal BMI pregnant women among European obese women (Obese: 5.7%, Normal BMI 1.1%, OR=5.55 (95% CI 5.04-6.11), followed by Pakistani ((Obese 10.9%, Normal BMI 2.9%, OR=4.57 (95% CI 3.58-5.84)), and Indian women ((Obese: 11.5%, Normal BMI: 4.0%, OR=3.15 (95% CI 2.45-4.06)). However, the prevalence of having gestational diabetes mellitus is highest among Bangladeshi women (Obese: 15.3%, Normal BMI: 6.0%, OR=2.83 (95% CI 1.94-4.14)).

Table 6.13: Odds ratios (95% confidence interval) of having gestational diabetes comparing obese and overweight pregnant women, with normal BMI pregnant women as reference

Gestational diabetes	Normal n (%) (Reference:1)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
Europeans							
No (ref)	56,729 (98.9)	30,178 (97.9)	1		23,037 (94.3)	1	
Yes	616 (1.1)	638 (2.1)	1.95	1.74-2.18	1,386 (5.7)	5.55	5.04-6.11
Total, n	57,345	30,816			24,423		
Missing, n	1,868	1,123			1140		
Indians							
No (ref)	2453 (96.0)	2387 (93.6)	1		1379 (88.5)	1	
Yes	101 (4.0)	162 (6.4)	1.65	1.28-2.13	179 (11.5)	3.15	2.45-4.06
Total, n	2554	2549			1558		
Missing, n	102	124			70		
Pakistanis							
No (ref)	3071 (97.1)	3331 (94.6)	1		2933 (89.1)	1	
Yes	92 (2.9)	189 (5.4)	1.89	1.47-2.44	358 (10.9)	4.57	3.58-5.84
Total, n	3163	3520			3291		
Missing, n	161	185			217		
Bangladeshis							
No (ref)	690 (94.0)	713 (88.4)	1		498 (84.7)	1	
Yes	44 (6.0)	94 (11.6)	2.07	1.42-3.00	90 (15.3)	2.83	1.94-4.14
Total, n	734	807			588		
Missing, n	33	44			43		

NB. WHO General Classification used for the European group.

WHO Asian Classification for BMI used for the South Asian groups.

6.6.3 Logistic regression test of maternal obesity and gestational diabetes mellitus

Table 6.14 gives the results from a logistic regression test to analyse the effects of ethnicity and body mass index on the likelihood that pregnant women within the same ethnic group have gestational diabetes. It uses two BMI classifications, namely: (a) WHO General BMI Classification, and (b) WHO Asian Specific BMI Classification. These calculations excluded women who had been diagnosed as having diabetes mellitus before pregnancy. Based on the adjusted odds ratio in Table 6.14, increasing BMI category is associated with increased chances to have gestational diabetes among European, Indian, Pakistani and Bangladeshi women, as shown previously through the bivariate analysis as well.

When using the WHO General BMI Classification (a), obese European pregnant women are at the highest risk of having gestational diabetes during pregnancy compared to the reference group (Obese: 5.4%, Normal BMI: 1.0%, AOR=5.31 (95% CI 4.70-6.01)). They are followed by Pakistani (Obese: 11.2%, Normal BMI: 3.4%, AOR=3.31(95% CI 2.41-4.06)), and Indian (Obese: 12.1%, Normal BMI 4.5%, AOR=2.79 (95% CI 2.02-3.84)) women. Bangladeshi women had the lowest risk of exhibiting gestational diabetes (AOR=2.05 (95% CI 1.16-3.61)) compared to the reference group, but they had the highest prevalence of GDM among obese pregnant women (14.3%). Similar findings were also observed using the WHO Asian-specific BMI Classification (b) in Table 6.14 among Indian and Pakistani women. However, the risk increases by 86% among Bangladeshi women from (AOR=2.05 (95% CI 1.16-3.61)) to (AOR=2.91(95% CI 1.72-4.95)).

Table 6.14 : Logistic regression predicting gestational diabetes using ethnicity and body mass index (BMI) with normal BMI pregnant women as reference

Ethnicity	<u>Underweight</u>		<u>Normal</u>		<u>Overweight</u>		<u>Obese</u>	
	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)
European	23 (0.6)	0.66 (0.37-1.18)	616 (1.0)	1	638 (2.0)	1.91 (1.66-2.20)	1386 (5.4)	5.31 (4.70-6.01)
Indian ^a	6 (1.6)	0.20 (0.05-0.81)	183 (4.5)	1	157 (7.6)	1.74 (1.32-2.28)	102 (12.1)	2.79 (2.02-3.84)
Indian ^b	6 (1.6)	0.22 (0.05-0.89)	101 (3.8)	1	162 (6.1)	1.41 (1.03-1.93)	179 (11.0)	2.70 (1.97-3.69)
Pakistani ^a	13 (2.2)	0.74 (0.37-1.48)	176 (3.4)	1	225 (6.9)	1.75 (1.34-2.27)	238 (11.2)	3.13 (2.41-4.06)
Pakistani ^b	13 (2.2)	0.93 (0.46-1.90)	92 (2.8)	1	189 (5.1)	1.70 (1.24-2.33)	358 (10.2)	3.42 (2.56-4.58)
Bangladeshi ^a	4 (3.4)	0.23 (0.03-1.73)	76 (6.3)	1	105 (14.3)	2.27 (1.50-3.45)	47 (15.0)	2.05 (1.16-3.61)
Bangladeshi ^b	4 (3.4)	0.30 (0.04-2.24)	44 (5.7)	1	94 (11.0)	2.63 (1.60-4.33)	90 (14.3)	2.91 (1.72-4.95)

^a WHO General BMI Classification

^b WHO Asian-specific BMI Classification

* Adjusted for marital status, employment status, partner's employment status, Multiple Deprivation Index, housing status, smoking status, late booking, hypertensive disease during pregnancy, IUGR, macrosomia and premature birth

Table 6.15 reports the results from a logistic regression test to predict the effects of ethnicity and body mass index on the likelihood that pregnant women have gestational diabetes, using the WHO General BMI Classification for the whole sample. According to the results in Table 6.15, Indian, Pakistani and Bangladeshi pregnant women have a higher risk of developing gestational diabetes at any BMI level than the reference normal BMI European group. Bangladeshi women, both overweight and obese, have a higher risk than the reference group, (AOR=16.56 (95% CI 13.26-20.68)) and (OR=17.74 (95% CI 12.85-24.48)), respectively. Similar risks of developing GDM during pregnancy were identified among obese Indian women (AOR=13.34 (95% CI 10.68-16.67)) and Pakistani women (AOR=12.56 (95% CI 10.74-14.74)) with normal BMI European women as a reference

The results from the logistic regression test in Table 6.16 are similar to the results in Table 6.15 using the WHO Asian-specific BMI Classification for the South Asian groups. The calculations in both tables (6.15 & 6.16) excluded women who had been diagnosed with diabetes mellitus before pregnancy, and used the European normal BMI group as reference.

Table 6.15: Logistic regression predicting gestational diabetes on ethnicity and body mass index using WHO general BMI classification (normal BMI European women as reference)

Ethnicity & BMI	n	%	AOR	95% CI for Odds Ratio		p
				Lower	Upper	
<u>European</u>						
Underweight	23	0.6	0.59	0.39	0.89	0.013
Normal Ref	616	1.0	1	-	-	-
Overweight	638	2.0	1.95	1.74	2.18	<0.001
Obese	1386	5.4	5.54	5.03	6.10	<0.001
<u>Indian</u>						
Underweight	6	1.6	1.53	0.68	3.44	0.303
Normal	183	4.5	4.55	3.85	5.39	<0.001
Overweight	157	7.6	7.98	6.65	9.56	<0.001
Obese	102	12.1	13.34	10.68	16.67	<0.001
<u>Pakistani</u>						
Underweight	13	2.2	2.20	1.26	3.84	0.005
Normal	176	3.4	3.42	2.89	4.06	<0.001
Overweight	225	6.9	7.26	6.20	8.50	<0.001
Obese	238	11.2	12.56	10.74	14.70	<0.001
<u>Bangladeshi</u>						
Underweight	4	3.4	3.29	1.21	8.95	0.020
Normal	76	6.3	6.52	5.10	8.34	<0.001
Overweight	105	14.3	16.56	13.26	20.68	<0.001
Obese	47	15.0	17.74	12.85	24.48	<0.001

* Adjusted for marital status, employment status, partner's employment status, Multiple Deprivation Index, housing status, smoking status, late booking, hypertensive disease during pregnancy, IUGR, macrosomia and premature birth

Table 6.16 : Logistic regression predicting gestational diabetes on ethnicity and body mass index using Asian Specific BMI Classification (normal BMI European women as reference)

Ethnicity & BMI	n	%	AOR	95% CI for Odds Ratio		p
				Lower	Upper	
<u>European</u>						
Underweight	23	0.6	0.59	0.39	0.89	0.013
Normal Ref	616	1.0	1			
Overweight	638	2.0	1.95	1.74	2.18	<0.001
Obese	1386	5.4	5.54	5.03	6.10	<0.001
<u>Pakistani</u>						
Underweight	13	2.2	2.20	1.26	3.84	0.005
Normal	92	2.8	2.76	2.21	3.45	<0.001
Overweight	189	5.1	5.23	4.42	6.17	<0.001
Obese	358	10.2	11.24	9.82	12.87	<0.001
<u>Indian</u>						
Underweight	6	1.6	1.53	0.68	3.44	0.303
Normal	101	3.8	3.79	3.06	4.70	<0.001
Overweight	162	6.1	6.47	5.09	8.23	<0.001
Obese	179	11.0	11.95	10.04	14.24	<0.001
<u>Bangladeshi</u>						
Underweight	4	3.4	3.29	1.21	8.95	0.020
Normal	44	5.7	5.87	4.29	8.05	<0.001
Overweight	94	11.0	17.30	13.04	22.95	<0.001
Obese	90	14.3	16.64	13.12	21.12	<0.001

* Adjusted for marital status, employment status, partner's employment status, Multiple Deprivation Index, housing status, smoking status, late booking, hypertensive disease during pregnancy, IUGR, macrosomia and premature birth

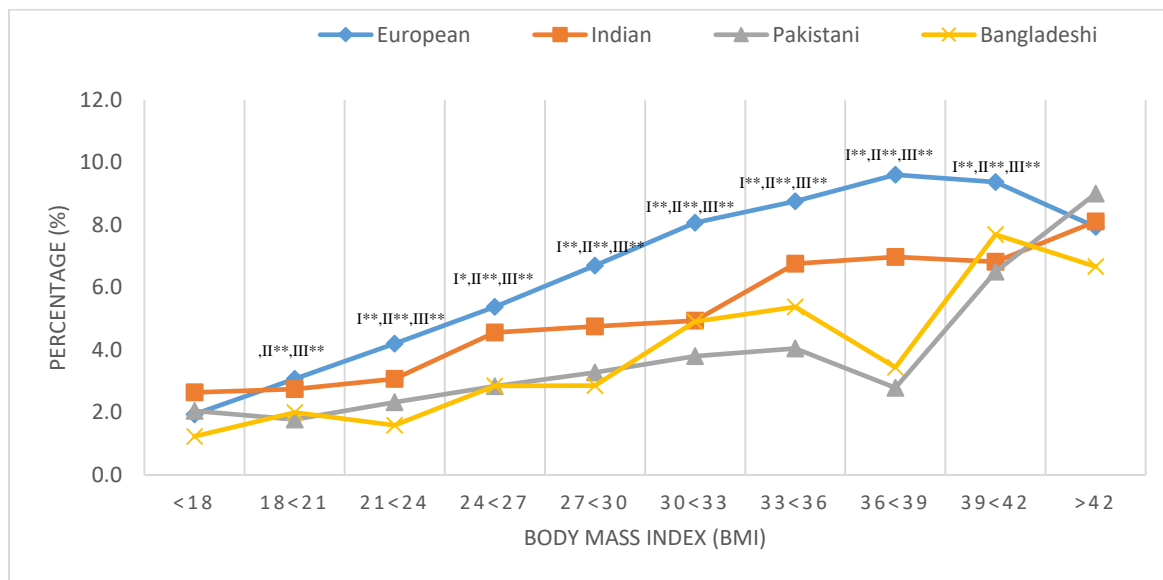
6.7 HYPERTENSIVE DISEASE DURING PREGNANCY

6.7.1 Prevalence of hypertensive disease during pregnancy by BMI

Figure 6.3 presents the prevalence of hypertensive disease during pregnancy by BMI level.

Overall, European has the highest prevalence of hypertensive disease at most of the BMI category. This finding also shows that prevalence of hypertensive disease increases by increasing BMI level.

Figure 6.3: Prevalence of hypertensive disease during pregnancy by BMI



Different of Proportion (Z) Test:

I=Sig. diff between EU & Indian, I*= $p<0.05$, I**= $p<0.01$

II=Sig. diff between EU & Pakistani, II**= $p<0.01$

III=Sig. diff between EU & Bangladeshi, III**= $p<0.01$

6.7.2 Association of hypertensive disease during pregnancy with maternal obesity by ethnicity

Table 6.17 shows the odds ratios for hypertensive disease comparing obese, overweight and normal-BMI women, using the WHO general BMI classification (a) for European pregnant women and the WHO Asian-specific BMI Classification (b) for Indian, Pakistani and Bangladeshi women. After excluding women who had been diagnosed with hypertension before pregnancy, overall, obese pregnant women have twice as high a risk to develop hypertensive disease during pregnancy: European (Obese: 9.3%, Normal BMI: 4.2%, OR=2.34 (95% CI 2.20-2.48), Bangladeshi (Obese: 4.6%, Normal BMI 1.9%, OR=2.63 (95% CI 1.26-4.70), Pakistani (Obese : 4.1%, Normal BMI 2.1%, OR 2.02 (95% CI 1.50-2.73) and Indian (Obese: 5.5%, Normal BMI: 2.9%, OR=1.98 (95% CI 1.44-2.72), compared to normal BMI pregnant women.

Table 6.17: Odds ratios of having hypertensive disease during pregnancy comparing obese pregnant women and overweight pregnant women, with normal-BMI pregnant women as reference

Hypertensive disease during pregnancy	Normal n (%)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
European							
No (ref)	55,152 (95.8)	29,036 (93.8)	1		22,282 (90.7)	1	
Yes	2,420 (4.2)	1,935 (6.2)	1.52	1.43-1.62	2,283 (9.3)	2.34	2.20-2.48
Total, n	57,572	30,971			24,565		
Missing, n	1641	968			998		
Indian							
No (ref)	2485 (97.1)	2417 (95.2)	1		1446 (94.5)	1	
Yes	73	121	1.70	1.27-2.29	84	1.98	1.44-2.72

	(2.9)	(4.8)			(5.5)		
Total, n	2558	2538			1530		
Missing, n	98	135			98		
Pakistani							
No (ref)	3097 (97.9)	3386 (96.9)	1		3084 (95.9)	1	
Yes	66 (2.1)	107 (3.1)	1.48	1.09-2.02	133 (4.1)	2.02	1.50-2.73
Total, n	3163	3493			3217		
Missing, n	161	212			297		
Bangladeshi							
No (ref)	710 (98.1)	771 (97.3)	1		542 (95.4)	1	
Yes	14 (1.9)	21 (2.7)	1.38	0.70-2.74	26 (4.6)	2.63	1.26-4.70
Total, n	724	792			568		
Missing, n	43	59			63		

NB. WHO General Classification used for the European group.

WHO Asian Classification for BMI used for the South Asian groups.

6.7.3 Logistic regression test of maternal obesity and hypertensive disease during pregnancy

Table 6.18 gives the results from a logistic regression test to analyse the effects of ethnicity and body mass index on the likelihood of developing hypertensive disease during pregnancy. Based on the adjusted odds ratio in Table 6.18, increasing BMI category is associated with increased chances to have a hypertensive disease during pregnancy among Indian, Pakistani and European pregnant women. This calculation excludes women who had been diagnosed with pre-existing hypertensive disease before pregnancy. Hypertensive diseases during pregnancy were calculated by combining all pre-eclampsia and pregnancy-induced hypertension cases.

Using the WHO General BMI Classifications, obese European pregnant women had the highest chance to develop hypertensive disease during pregnancy compared to Indian and Pakistani and European pregnant women, using normal-BMI pregnant women within each ethnic group as references. After using the WHO Asian-specific BMI classifications (b), the risk to develop hypertensive disease increases by 99% among Pakistani women (AOR=1.62 (95% CI 1.12-2.33)) to (AOR= 2.61 (95% CI 1.76-3.63)). However, among Indian women the odds are similar even after changing BMI classifications from (AOR=2.38 (95% CI 1.56-3.61)) to (AOR= 2.39 (95% CI 1.57-3.63)).

Table 6.18 : Logistic regression predicting hypertensive disease during pregnancy on ethnicity and body mass index (BMI) with normal BMI pregnant women as reference

Ethnicity	<u>Underweight</u>		<u>Normal</u>		<u>Overweight</u>		<u>Obese</u>	
	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)
European	90 (2.4)	0.49 (0.35-0.66)	2596 (4.4)	1	2143 (6.7)	1.61 (1.49-1.74)	2622 (10.3)	2.43 (2.25-2.62)
Indian ^a	10 (2.6)	0.93 (0.42-2.04)	136 (3.4)	1	109 (5.2)	1.73 (1.24-2.42)	60 (7.1)	2.38 (1.56-3.61)
Indian ^b	10 (2.6)	0.69 (0.27-1.80)	67 (2.8)	1	130 (4.8)	1.96 (1.29-2.96)	158 (6.2)	2.39 (1.57-3.63)
Pakistani ^a	10 (1.7)	0.47 (0.19-1.16)	124 (2.4)	1	124 (3.8)	1.29 (0.89-1.87)	107 (5.1)	1.62 (1.12-2.33)
Pakistani ^b	10 (1.7)	1.14 (0.51-2.58)	75 (2.0)	1	129 (3.5)	1.85 (1.28-2.68)	101 (4.5)	2.61 (1.76-3.63)
Bangladeshi ^a	1 (0.8)	0.00 (-)	24 (2.0)	1	28 (3.8)	0.00 (-)	23 (7.3)	0.00 (-)
Bangladeshi ^b	1 (0.8)	0.00 (-)	15 (2.0)	1	26 (3.1)	1.72 (0.69-4.28)	34 (5.4)	2.45 (1.25-4.83)

^a WHO General BMI Classification

^b WHO Asian-specific BMI Classification

* Adjusted for marital status, employment status, partner's employment status, Multiple Deprivation Index, housing status, smoking status, late booking, hypertensive disease during pregnancy, IUGR, macrosomia and premature birth

Table 6.19 presents the findings from a logistic regression test to assess the effects of ethnicity and body mass index on hypertensive disease during pregnancy, using the WHO General BMI classification (a), and using normal BMI European women as the reference population. As shown in table 6.19, obese European women have almost two and a half as high a chance of developing hypertensive disease during pregnancy (Obese: 10.3%, Normal BMI (ref) 4.4%, AOR= 2.34 (95% CI 2.20-2.48)) and Indian women have a 58% higher risk (Obese: 7.1%, Normal BMI (ref) 4.4%, AOR= 1.58 (95% CI 1.18-2.10)) than the reference group of normal-BMI European pregnant women. However, there is no significant difference between Pakistani and Bangladeshi obese pregnant women on the one hand, and the reference group on the other, related to the risk of developing hypertensive disease during pregnancy. Table 6.20, which uses the WHO Asian-specific BMI classification (b), shows similar findings to Table 6.19 (using the WHO general BMI classification (a)), except that there is a 26% lower risk of developing hypertensive disease during pregnancy among Indian women from (AOR= 1.58 (95% CI 1.18-2.10)) to (AOR= 1.32 (95% CI 1.06-1.67)).

Table 6.19: Logistic regression predicting hypertensive disease during pregnancy on ethnicity and body mass index WHO general BMI classification (normal BMI European women as reference)

Ethnicity & BMI	n	%	Odds Ratio	95% CI for Odds Ratio		p
				Lower	Upper	
<u>European</u>						
Underweight	90	2.4	0.54	0.43	0.67	<0.001
Normal Ref	2596	4.4	1			
Overweight	2143	6.7	1.52	1.43	1.62	0.000
Obese	2622	10.3	2.34	2.20	2.48	0.000
<u>Pakistani</u>						
Underweight	10	1.7	0.42	0.22	0.78	0.006
Normal	124	2.4	0.54	0.45	0.65	<0.001
Overweight	124	3.8	0.82	0.67	0.99	0.045

Obese	107	5.1	1.09	0.87	1.35	0.461
<u>Indian</u>						
Underweight	10	2.6	0.64	0.34	1.20	0.160
Normal	136	3.4	0.79	0.66	0.95	0.011
Overweight	109	5.2	1.19	0.96	1.46	0.109
Obese	60	7.1	1.58	1.18	2.10	0.002
<u>Bangladeshi</u>						
Underweight	1	0.8	0.20	0.03	1.49	0.113
Normal	24	2.0	0.43	0.28	0.66	<0.001
Overweight	28	3.8	0.84	0.56	1.27	0.417
Obese	23	7.3	1.39	0.84	2.31	0.201

* Adjusted for marital status, employment status, partner's employment status, Multiple Deprivation Index, housing status, smoking status, late booking, hypertensive disease during pregnancy, IUGR, macrosomia and premature birth

Table 6.20: Logistic regression predicting hypertensive disease on ethnicity and body mass index WHO Asian Specific BMI classification (normal BMI European women as reference)

Ethnicity & BMI	n	%	Odds Ratio	95% CI for Odds Ratio		p
				Lower	Upper	
<u>European</u>						
Underweight	90	2.4	0.54	0.43	0.67	<0.001
Normal Ref	2596	4.4	1			
Overweight	2143	6.7	1.52	1.43	1.61	<0.001
Obese	2622	10.3	2.34	2.20	2.48	<0.001
<u>Pakistani</u>						
Underweight	10	1.7	0.64	0.34	1.20	0.160
Normal	75	2.0	0.67	0.53	0.85	<0.001
Overweight	129	3.5	1.26	0.98	1.63	0.075
Obese	101	4.5	1.32	1.06	1.67	0.014
<u>Indian</u>						
Underweight	10	2.6	0.42	0.22	0.78	0.006
Normal	67	2.8	0.49	0.38	0.62	<0.001
Overweight	130	4.8	0.72	0.59	0.88	0.001
Obese	158	6.2	0.98	0.82	1.18	0.849
<u>Bangladeshi</u>						
Underweight	1	0.8	0.20	0.03	1.46	0.113
Normal	15	2.0	0.45	0.26	0.76	0.003
Overweight	26	3.1	0.87	0.51	1.48	0.601
Obese	34	5.4	1.09	0.74	1.62	0.659

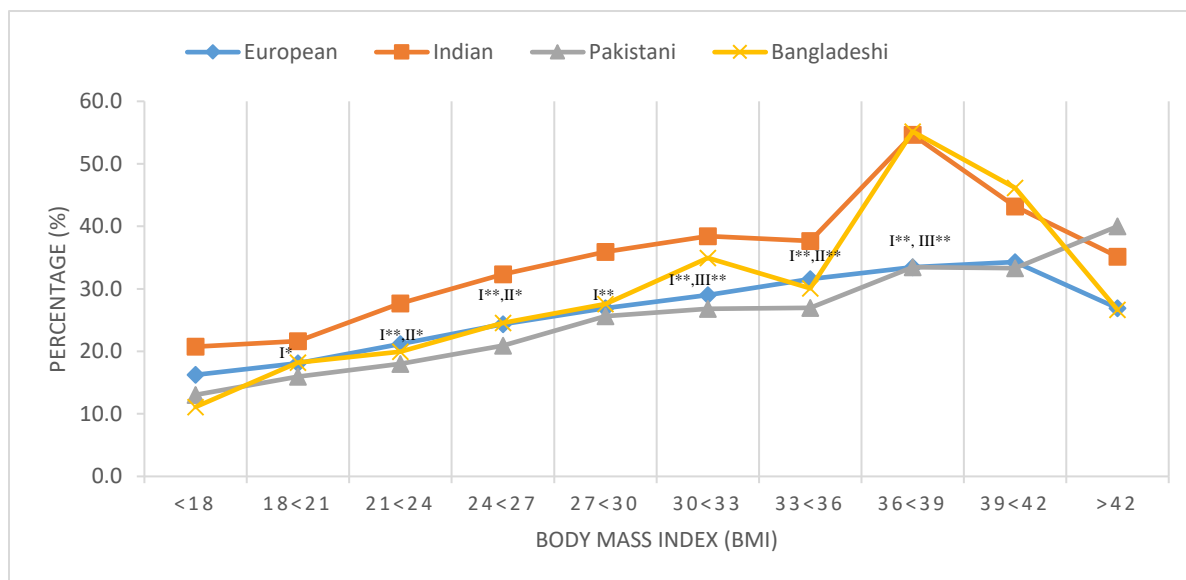
* Adjusted for marital status, employment status, partner's employment status, Multiple Deprivation Index, housing status, smoking status, late booking, hypertensive disease during pregnancy, IUGR, macrosomia and premature birth

6.8 CAESAREAN SECTION

6.8.1 Prevalence of Caesarean Section by BMI

Figure 6.4 indicate that the prevalence of caesarean section increased by increasing the BMI range. Overall, Indian women has the highest prevalence on having caesarean section compared to the other groups.

Figure 6.4 : Prevalence of Caesarean Section by BMI



Different of Proportion (Z) Test:

I=Sig. diff between EU & Indian, I*= $p<0.05$, I**= $p<0.01$

II=Sig. diff between EU & Pakistani, II*= $p<0.05$, II**= $p<0.01$

III=Sig. diff between EU & Bangladeshi, III**= $p<0.01$

6.8.2 Association of caesarean section with maternal obesity by ethnicity

Table 6.21 and Table 6.22 show the odds ratios for final mode of birth and type of caesarean section, comparing obese, overweight and normal-BMI women, using the WHO general BMI

Classification (a) for European pregnant women and the WHO Asian-specific BMI classification (b) for Indian, Pakistani and Bangladeshi women.

Obesity increases the chance of delivery by caesarean section by approximately 70% - 90 % for all ethnic groups compared with women with a normal BMI: European (OR=1.69 (95% CI 1.63-1.75), Pakistani (OR=1.74 (95% CI 1.54-1.96), Bangladeshi (OR=1.87 (95% CI 1.46-2.40) and Indian (OR=1.89 (95% CI 1.64-2.17). However, there is no significant difference for the type of caesarean section between obese pregnant women and the reference group (Table 6.22).

Table 6.21: Odds ratios of final mode of birth, comparing obese, overweight and normal-BMI pregnant women among Indian, Pakistani, Bangladeshi and European women with normal BMI pregnant women as reference

Final mode of birth	Normal n (%)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
European							
Normal vaginal (ref)	38,742 (65.7)	19,989 (63.0)	1		15,114 (59.6)	1	
Ventouse	4,215 (7.2)	1,735 (5.5)	0.80	0.75-0.85	979 (3.8)	0.60	0.55-0.64
Forceps	3,275 (5.5)	1,640 (5.2)	0.97	0.91-1.03	1,037 (4.1)	0.81	0.76-0.87
Breech	273 (0.6)	123 (0.4)	0.87	0.71-1.08	90 (0.4)	0.85	0.67-1.07
Caesarean section	12,349 (21.0)	8,231 (25.9)	1.29	1.25-1.33	8,130 (32.1)	1.69	1.63-1.75
Total, n	58,854	31,718			25,350		
Missing, n	359	221			213		
Indian							
Normal vaginal (ref)	1603 (60.8)	1422 (54.0)	1		829 (51.8)	1	
Ventouse	182 (6.9)	154 (5.8)	0.95	0.76-1.20	62 (3.9)	0.66	0.49-0.89
Forceps	205 (7.8)	184 (6.9)	1.01	0.82-1.25	84 (5.2)	0.79	0.61-1.04
Breech	12	8	0.75	0.31-1.84	8	1.29	0.52-3.17

	(0.5)	(0.3)			(0.5)		
Caesarean section	633 (24.0)	865 (33.0)	1.54	1.36-1.75	618 (38.6)	1.89	1.64-2.17
Total, n	2635	2633			1601		
Missing, n	21	40			27		
Pakistani							
Normal vaginal (ref)	2328 (71.1)	2567 (70.4)	1		2255 (66.2)	1	
Ventouse	207 (6.3)	167 (4.6)	0.73	0.59-0.90	84 (2.5)	0.42	0.32-0.54
Forceps	144 (4.4)	137 (3.8)	0.86	0.68-1.10	84 (2.5)	0.60	0.46-0.79
Breech	23 (0.7)	11 (0.3)	0.43	0.21-0.89	19 (0.6)	0.85	0.46-1.57
Caesarean section	537 (17.5)	762 (20.9)	1.21	1.07-1.36	965 (28.3)	1.74	1.54-1.96
Total, n	3275	3644			3407		
Missing, n	49	61			101		
Bangladeshi							
Normal vaginal (ref)	520 (68.9)	583 (69.4)	1		381 (61.7)	1	
Ventouse	49 (6.5)	27 (3.2)	0.49	0.30-0.80	15 (2.4)	0.42	0.23-0.76
Forceps	32 (4.2)	29 (3.5)	0.81	0.48-1.35	16 (2.7)	0.68	0.37-1.26
Breech	6 (0.8)	4 (0.5)	0.59	0.17-2.12	2 (0.3)	0.45	0.09-2.27
Caesarean section	148 (19.6)	196 (23.4)	1.18	0.93-1.51	203 (32.9)	1.87	1.46-2.40
Total, n	755	839			617		
Missing, n	12	12			14		

NB. WHO General Classification used for the European group.

WHO Asian Classification for BMI used for the South Asian groups.

Table 6.22: Odds ratios of type of caesarean, comparing obese pregnant women and overweight pregnant women, with normal BMI pregnant women as reference

Type of caesarean	Normal n (%)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
European							
Scheduled (ref)	703 (5.8)	468 (5.8)	1		469 (5.9)	1	
Emergency	4,757	3,014	0.95	0.84-1.08	2,868	0.90	0.80-1.02

	(39.6)	(37.5)			(36.1)		
Urgent	1,736 (14.4)	1,135 (14.1)	0.98	0.85-1.13	1,067 (13.4)	0.92	0.48-1.46
Elective	4,849 (40.2)	3,397 (42.5)	1.05	0.93-1.19	3,537 (44.6)	1.09	0.75-2.11
Total, n	12,045	23,925			7,941		
Missing, n	47,168	31,939			17,622		
Indian							
Scheduled (ref)	30 (4.9)	39 (4.6)	1		19 (3.2)	1	
Emergency	305 (50.3)	372 (44.0)	0.94	0.57-1.55	278 (46.7)	1.44	0.79-2.62
Urgent	87 (14.3)	106 (12.6)	0.94	0.54-1.63	69 (11.6)	1.25	0.65-2.41
Elective	186 (30.5)	327 (38.8)	1.35	0.81-2.25	229 (38.5)	1.94	1.06-3.56
Total, n	608	844			595		
Missing, n	2048	1829			1033		
Pakistani							
Scheduled (ref)	29 (5.3)	25 (3.5)	1		54 (5.9)	1	
Emergency	251 (45.4)	322 (44.5)	1.49	0.85-2.60	388 (42.2)	0.83	0.51-1.34
Urgent	73 (13.2)	90 (12.4)	1.43	0.77-2.65	113 (12.3)	0.83	0.49-1.42
Elective	200 (36.1)	287 (39.6)	1.66	0.95-2.93	365 (39.6)	0.98	0.60-1.59
Total, n	553	724			920		
Missing, n	2771	2981			2588		
Bangladeshi							
Scheduled (ref)	6 (4.2)	8 (4.2)	1		8 (4.0)	1	
Emergency	86 (59.7)	97 (50.5)	0.85	0.28-2.54	92 (46.2)	0.80	0.27-2.41
Urgent	18 (12.5)	28 (14.6)	1.17	0.35-3.92	17 (8.4)	0.71	0.20-2.47
Elective	34 (23.6)	59 (30.7)	1.30	0.42-4.07	82 (41.2)	1.81	0.58-5.61
Total, n	144	192			199		
Missing, n	623	659			432		

NB. WHO General Classification used for the European group.

WHO Asian Classification for BMI used for the South Asian groups.

6.8.3 Logistic regression test of maternal obesity and caesarean section

The risk of having a caesarean section during delivery increases by increasing BMI level for all ethnic groups. The increased risk is quite similar between European (Obese: 31.8%, normal BMI: 20.9%, AOR= 1.75 (95% 1.68-1.83 CI)), Indian (Obese: 40.0%, Normal BMI: 26.2 %, AOR= 1.97 (95% CI 1.63-2.37)), Pakistani (Obese: 28.7%, Normal BMI: 17.7%, AOR= 1.96 (95% CI 1.68-2.28)) and Bangladeshi women (Obese: 35.5%, Normal BMI: 25.9%, AOR= 12.04 (95% CI 1.43-2.91)) comparing the obese women with the reference group women and using the WHO general BMI classification. The risk is much lower using the WHO Asian Specific BMI Classification (b) for Indian, Pakistani and Bangladeshi women. However, obese pregnant women still have a 75-93% higher chance to go through a caesarean section as a delivery method than healthy BMI pregnant women.

Table 6.24 presents the findings from a logistic regression test to assess the effects of ethnicity and body mass index on caesarean section, using the WHO general BMI classification (a), and using European normal-BMI women as the reference. As shown in table 6.24, indicated BMI positively increases the chances to go through caesarean section during delivery. The risk is fairly high for Indian (Obese: 40.0%, Normal BMI (ref) 20.9%, AOR= 2.58 (95 CI % 2.24-2.97)) and Bangladeshi (Obese: 35.5%, Normal BMI (ref) 20.9%, AOR= 2.18 (95% 1.72-2.75 CI)) obese pregnant women, twice as high as the reference group. Obese Pakistani women only have a 58% high risk than the reference group (Obese: 28.7%, Normal BMI (ref) 20.9%, AOR= 1.58 (95% 1.43-1.74 CI)), and were the least. In contrast, underweight pregnant women are 30-46% less likely to experience caesarean section during delivery, with the exception of underweight

Indian women, for whom the values are not significantly different from those of the reference group.

After adjusting the data by following the WHO Asian-specific BMI classification (Table 6.25), the logistic regression result shows a decreased risk of having a caesarean section during delivery among the Indian, Bangladeshi and Pakistani women with odds ratios of (AOR= 2.37 (95% CI 2.14-2.62)), (AOR= 1.85 (95% CI 1.56-2.19)) and (AOR= 1.49 (95% CI 1.38-1.61)) respectively. The findings also indicated that Caesarean Section rates are higher in Indian sub-groups regardless of their weight status.

Table 6.23: Logistic Regression Predicting of Caesarean Section during delivery on Ethnicity and Body Mass Index (BMI) with normal BMI pregnant women as reference

Ethnicity	<u>Underweight</u>		<u>Normal</u>		<u>Overweight</u>		<u>Obese</u>	
	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)
European	588 (15.6)	0.80 (0.72-0.90)	12349 (20.9)	1	8231 (25.8)	1.28 (1.23-1.33)	8130 (31.8)	1.75 (1.68-1.83)
India ^a	84 (21.9)	0.78 (0.58-1.06)	1058 (26.2)	1	722 (34.8)	1.51 (1.32-1.73)	336 (40.0)	1.97 (1.63-2.37)
India ^b	84 (21.9)	0.88 (0.65-1.20)	633 (23.8)	1	865 (32.4)	1.56 (1.36-1.79)	618 (38.0)	1.93 (1.65-2.26)
Pakistani ^a	77 (13.1)	0.72 (0.53-0.97)	913 (17.7)	1	780 (23.9)	1.46 (1.27-1.67)	607 (28.7)	1.96 (1.68-2.28)
Pakistani ^b	77 (13.1)	0.74 (0.55-1.01)	573 (17.2)	1	762 (20.6)	1.22 (1.05-1.42)	965 (27.5)	1.91 (1.65-2.23)
Bangladeshi ^a	15 (12.6)	0.57 (0.29-1.15)	246 (20.5)	1	190 (25.9)	1.52 (1.16-2.01)	111 (35.5)	2.04 (1.43-2.91)
Bangladeshi ^b	15 (12.6)	0.63 (0.31-1.28)	148 (19.3)	1	196 (23.0)	1.53 (1.14-2.04)	203 (13.2)	1.88 (1.37-2.57)

^a WHO General BMI classification

^b WHO Asian-specific BMI classification

* Adjusted for marital status, employment status, partner's employment status, Multiple Deprivation Index, housing status, smoking status, late booking, hypertensive disease during pregnancy, IUGR, macrosomia and premature birth

Table 6.24: Logistic regression predicting caesarean during pregnancy on ethnicity and body mass index using the WHO general BMI classification (normal BMI European women as reference)

Ethnicity & BMI	n	%	AOR	95% CI for Odds Ratio		p
				Lower	Upper	
<u>European</u>						
Underweight	588	15.6	0.70	0.64	0.77	<0.001
Normal Ref	12349	20.9	1			
Overweight	8231	25.8	1.32	1.28	1.36	<0.001
Obese	8130	31.8	1.78	1.72	1.84	<0.001
<u>Pakistani</u>						
Underweight	77	13.1	0.58	0.46	0.74	<0.001
Normal	913	17.7	0.83	0.77	0.89	<0.001
Overweight	780	23.9	1.22	1.12	1.33	<0.001
Obese	607	28.7	1.58	1.43	1.74	<0.001
<u>Indian</u>						
Underweight	84	21.9	1.06	0.83	1.35	0.630
Normal	1058	26.2	1.36	1.26	1.46	<0.001
Overweight	722	34.8	2.05	1.87	2.25	<0.001
Obese	336	40.0	2.58	2.24	2.97	<0.001
<u>Bangladeshi</u>						
Underweight	15	12.6	0.54	0.32	0.93	0.027
Normal	246	20.5	0.99	0.86	1.14	0.875
Overweight	190	25.9	1.34	1.13	1.58	0.001
Obese	111	35.5	2.18	1.72	2.75	<0.001

* Adjusted for marital status, employment status, partner's employment status, Multiple Deprivation Index, housing status, smoking status, late booking, hypertensive disease during pregnancy, IUGR, macrosomia and premature birth

Table 6.25: Logistic regression predicting caesarean during pregnancy on ethnicity and body mass index using the WHO Asian-specific BMI classification normal BMI European women as reference)

Ethnicity & BMI	n	%	AOR	95% CI for Odds Ratio		p
				Lower	Upper	
<u>European</u>						
Underweight	588	15.6	0.70	0.64	0.77	<0.001
Normal Ref	12349	20.9				
Overweight	8231	25.8	1.32	1.28	1.36	<0.001
Obese	8130	31.8	1.78	1.72	1.84	<0.001
<u>Pakistani</u>						
Underweight	77	13.1	0.58	0.46	0.74	<0.001
Normal	573	17.2	0.80	0.73	0.88	<0.001
Overweight	762	20.6	1.00	0.92	1.08	0.918
Obese	965	27.5	1.49	1.38	1.61	<0.001
<u>Indian</u>						
Underweight	84	21.9	1.06	0.83	1.35	0.630
Normal	633	23.8	1.19	1.09	1.31	<0.001
Overweight	865	32.4	1.99	1.77	2.24	<0.001
Obese	618	38.0	2.37	2.14	2.62	<0.001
<u>Bangladeshi</u>						
Underweight	15	12.6	0.54	0.32	0.93	0.027
Normal	148	19.3	0.92	0.77	1.10	0.355
Overweight	196	23.0	1.18	0.94	1.48	0.156
Obese	203	32.2	1.85	1.56	2.19	<0.001

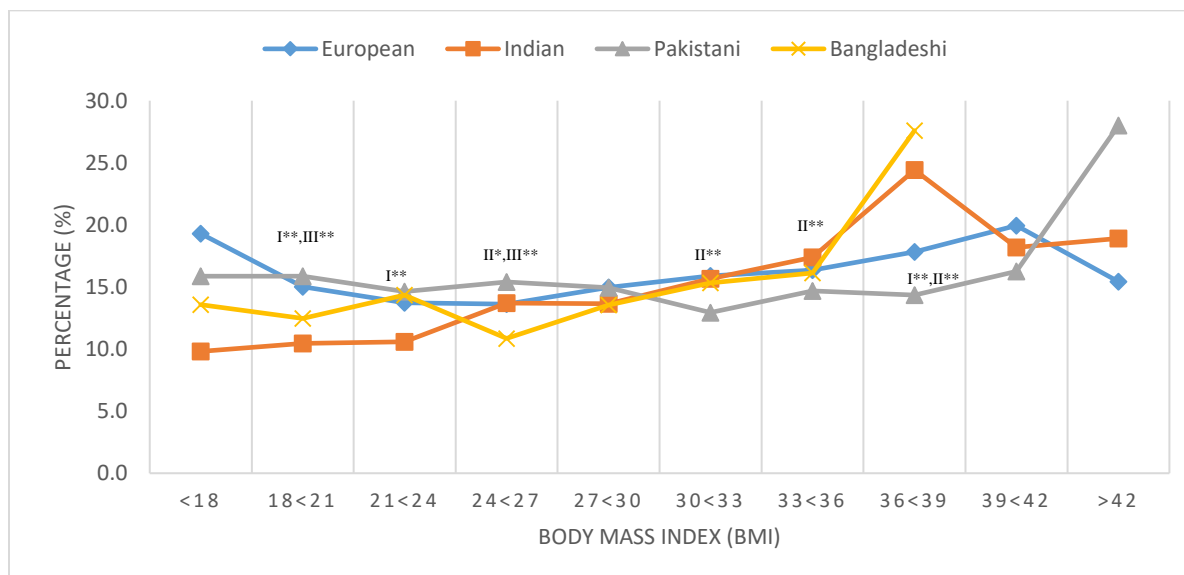
* Adjusted for marital status, employment status, partner's employment status, Multiple Deprivation Index, housing status, smoking status, late booking, hypertensive disease during pregnancy, IUGR, macrosomia and premature birth

6.9 LOW BIRTHWEIGHT

6.9.1 Prevalence of low birthweight baby by mother's BMI

Based on the Figure 6.5, European has the highest prevalence of having low birth weight baby for BMI less than 18 kg/m² compared to other groups. Among Indian women, increasing BMI shows increasing prevalence of having low birth weight baby.

Figure 6.5: Prevalence of low birthweight baby by mother's BMI



Different of Proportion (Z) Test:

I=Sig. diff between EU & Indian, I**=p<0.01

II=Sig. diff between EU & Pakistani, II*= p<0.05, II**=p<0.01

III=Sig. diff between EU & Bangladeshi, III**=p<0.01

6.9.2 Association of low birthweight with maternal obesity by ethnicity

Table 6.26 shows the odds ratios for low birthweight, comparing obese, overweight and normal-BMI women, using the WHO General BMI classification (a) for European pregnant women and the WHO Asian-specific BMI classification (b) for South Asian women. Obese European

women have a 32% chance of having a low birthweight baby (Obese 17.6%, Normal BMI: 14.1%, OR 1.32 (95% CI 1.27-1.38) and the risk is 71% higher among Indian women (Obese 3.4%, Normal BMI: 3.6%, OR 1.71 (95% CI 1.42-2.07) than normal-BMI women. There is no significant difference between obese Pakistani and Bangladeshi women and the reference group.

Table 6.26: Odds ratios of low birthweight comparing obese pregnant women and overweight pregnant women, with normal-BMI pregnant women as reference

Low birthweight	Normal n (%)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
European							
10-90 centile (ref)	46,466 (79.6)	24,596 (78.1)	1		18,832 (74.9)	1	
< 10 centile	8,249 (14.1)	4,622 (14.7)	1.06	1.02-1.10	4419 (17.6)	1.32	1.27-1.38
Total, n	58,369	31,478			25127		
Missing, n	844	461			436		
Indian							
10-90 centile (ref)	2156 (82.4)	2027 (77.2)	1		1182 (74.1)	1	
< 10 centile	267 (10.2)	359 (13.7)	1.43	1.21-1.69	251 (15.7)	1.71	1.42-2.07
Total, n	2615	2626			1596		
Missing, n	41	47			32		
Pakistani							
10-90 centile (ref)	2551 (78.1)	2794 (77.1)	1		2562 (74.6)	1	
< 10 centile	513 (15.7)	552 (15.3)	1.02	0.89-1.16	515 (15.0)	1.02	0.89-1.16
Total, n	3266	3625			3433		
Missing, n	58	80			75		
Bangladeshi							
10-90 centile (ref)	609 (80.6)	653 (78.4)	1		457 (74.4)	1	
< 10 centile	97 (12.8)	105 (12.6)	1.01	0.75-1.36	92 (15.0)	1.26	0.93-1.72
Total, n	756	833			614		
Missing, n	11	18			17		

NB. WHO General Classification used for the European group.

WHO Asian Classification for BMI used for the South Asian groups.

6.9.3 Logistic regression test of maternal obesity and low birthweight

A logistic regression test has been performed to examine the effects of ethnicity and body mass index on the likelihood to deliver a low birthweight baby, as shown in Table 6.27. “Low birthweight” is defined as a birth weight lower than the 10th percentile in this analysis. Based on the adjusted odds ratio from the logistic regression test and using the WHO general BMI classification, it shows that Indian women have a 50% higher risk (Obese: 17.3%, Normal BMI: 10.9%. AOR=1.50 (95% CI 1.21-1.86)) and European obese pregnant women had a 24% higher risk to have a low birthweight baby (Obese: 17.3%, Normal BMI: 13.9%. AOR=1.24 (95% CI 1.18-1.31)) than the reference group of normal-BMI women, but this is not true of Pakistani and Bangladeshi women using the WHO general BMI classification. Using the WHO Asian-specific classification, the results turn out no significantly different from those of the reference group.

The results in Table 6.28 indicate the effects of ethnicity and body mass index on the chances for pregnant women to have a low birthweight baby, using the WHO general BMI classification and taking normal-BMI women as reference. The risk is similar between European (AOR= 1.30 (95% CI 1.25-1.35)) and Indian (AOR= 1.28 (95% CI 1.06-1.53)) obese pregnant women. The risk is not significantly different between normal BMI European women and obese Pakistani and Bangladeshi pregnant women. Using the WHO Asian-specific classification (b) for Indian, Pakistani and Bangladeshi women, the results turn out not significantly different for obese women compared to the reference group (Table 6.29).

Table 6.27: Logistic regression predicting low birthweight during delivery on ethnicity and body mass index (BMI) with normal BMI pregnant women as reference

Ethnicity	<u>Underweight</u>		<u>Normal</u>		<u>Overweight</u>		<u>Obese</u>	
	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)
European	699 (18.6)	1.16 (1.03-1.30)	8249 (13.9)	1	4622 (14.5)	1.05 (1.00-1.10)	4419 (17.3)	1.24 (1.18-1.31)
Indian ^a	37 (9.7)	0.95 (0.62-1.45)	439 (10.9)	1	293 (14.1)	1.35 (1.12-1.64)	145 (17.3)	1.50 (1.21-1.86)
Indian ^b	37 (9.7)	1.02 (0.77-1.35)	267 (10.1)	1	359 (13.4)	0.96 (0.84-1.11)	251 (15.4)	1.99 (0.82-1.19)
Pakistani ^a	95 (16.2)	1.02 (0.77-1.35)	768 (14.9)	1	505 (15.5)	0.96 (0.84-1.11)	307 (14.5)	0.99 (0.82-1.19)
Pakistani ^b	95 (16.2)	0.97 (0.73-1.30)	513 (15.4)	1	552 (14.9)	0.94 (0.82-1.08)	515 (14.7)	0.93 (0.79-1.10)
Bangladeshi ^a	19 (16.0)	1.21 (0.65-2.26)	159 (13.2)	1	86 (11.7)	0.70 (0.50-0.97)	49 (15.7)	1.02 (0.65-1.60)
Bangladeshi ^b	19 (16.0)	1.32 (0.71-2.44)	97 (12.6)	1	105 (12.3)	0.99 (0.70-1.42)	92 (14.6)	0.95 (0.68-1.34)

^a WHO general BMI classification

^b WHO Asian-specific BMI classification

* Adjusted for marital status, employment status, partner's employment status, Multiple Deprivation Index, housing status, smoking status, late booking, hypertensive disease during pregnancy, IUGR, macrosomia and premature birth

Table 6.28: Logistic regression predicting low birthweight during pregnancy on ethnicity and body mass index using the WHO general BMI classification (normal BMI European women as reference)

Ethnicity & BMI	n	%	Odds Ratio	95% CI for Odds Ratio		p
				Lower	Upper	
<u>European</u>						
Underweight	699	18.6	1.42	1.30	1.54	<0.001
Normal (Ref)	8249	13.9	1	-	-	-
Overweight	4622	14.5	1.05	1.01	1.08	0.025
Obese	4419	17.3	1.30	1.25	1.35	<0.001
<u>Pakistani</u>						
Underweight	95	16.2	1.16	0.92	1.45	0.206
Normal	768	14.9	1.05	0.97	1.14	0.224
Overweight	505	15.5	1.07	0.97	1.19	0.175
Obese	307	14.5	1.00	0.88	1.13	0.940
<u>Indian</u>						
Underweight	37	9.7	0.65	0.46	0.91	0.013
Normal	439	10.9	0.73	0.66	0.81	<0.001
Overweight	293	14.1	0.98	0.86	1.11	0.757
Obese	145	17.3	1.28	1.06	1.53	0.009
<u>Bangladeshi</u>						
Underweight	19	16.0	1.20	0.74	1.97	0.463
Normal	159	13.2	0.92	0.77	1.09	0.321
Overweight	86	11.7	0.81	0.65	1.02	0.076
Obese	49	15.7	1.12	0.82	1.54	0.473

Table 6.29: Logistic regression predicting low birthweight on ethnicity and body mass index using the WHO Asian-specific BMI classification (normal BMI European women as reference)

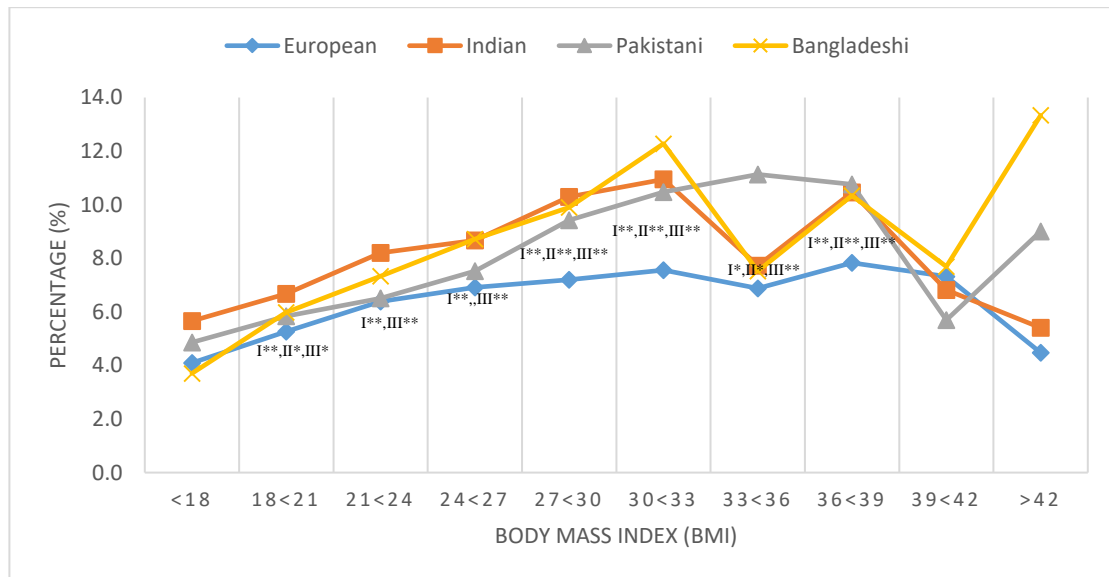
Ethnicity & BMI	n	%	Odds Ratio	95% CI for Odds Ratio		p
				Lower	Upper	
<u>European</u>						
Underweight	699	18.6	1.42	1.30	1.54	<0.001
Normal Ref	8249	13.9	-	-	-	-
Overweight	4622	14.5	1.05	1.01	1.09	0.025
Obese	4419	17.3	1.30	1.25	1.35	<0.001
<u>Pakistani</u>						
Underweight	95	16.2	1.16	0.92	1.45	0.206
Normal	513	15.4	1.10	1.00	1.21	0.062
Overweight	552	14.9	1.04	0.95	1.14	0.423
Obese	515	14.7	1.01	0.91	1.11	0.923
<u>Indian</u>						
Underweight	37	9.7	0.65	0.46	0.91	0.013
Normal	267	10.1	0.68	0.60	0.77	<0.001
Overweight	359	13.4	1.02	0.87	1.20	0.824
Obese	251	15.4	1.10	0.96	1.26	0.186
<u>Bangladeshi</u>						
Underweight	19	16.0	1.20	0.74	1.97	0.463
Normal	97	12.6	0.86	0.69	1.06	0.161
Overweight	105	12.3	0.72	0.53	0.99	0.046
Obese	92	14.6	1.02	0.82	1.29	0.836

6.10 MACROSOMIA

6.10.1 PREVALNCE OF MACROSOMIA CASES

Figure 6.6 indicate that, generally European women had the less prevalence of having macrosomic baby at any level of BMI when compared to Indian, Pakistani and Bangladeshi. These findings also show that prevalence of having macrosomic baby increased by increasing BMI level especially among the South Asian sub groups for BMI level between 18 to 33 kg/m².

Figure 6.6: Prevalence of macrosomic baby by mother's BMI



Different of Proportion (Z) Test:

I=Sig. diff between EU & Indian, I*= p<0.05, I**=p<0.01

II=Sig. diff between EU & Pakistani, II*= p<0.05, II**=p<0.01

III=Sig. diff between EU & Bangladeshi, III*= p<0.05, III**=p<0.01

6.10.2 Association of macrosomia with maternal obesity by ethnicity

Table 6.30 shows the odds ratios of having a macrosomic baby, comparing obese, overweight and normal-BMI women, using the WHO general BMI classification (a) for European pregnant women and the WHO Asian-specific BMI classification (b) for Indian, Pakistani and Bangladeshi women. Macrosomia is defined as a baby weight greater than the 90th percentile at birth in this analysis. Bangladeshi women have the highest risk of having a macrosomic baby due to obesity (Obese: 10%, Normal BMI 6.6%, OR=1.73 (95% CI 1.18-2.55), followed by Indian (Obese: 10.2%, Normal BMI 7.3%, OR=1.55 (95% CI 1.24-1.93), Pakistani (Obese: 10.4%, Normal BMI 6.2%, OR=1.39 (95% CI 1.18-1.64)) and European pregnant women (OR=1.27 (95% CI 1.20-1.34)), with normal-BMI women as reference.

Table 6.30: Odds ratios of macrosomia comparing obese pregnant women and overweight pregnant women, with normal BMI pregnant women as reference

Macrosomia	Normal n (%)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
European							
10-90 centile (ref)	46,466 (79.6)	24,596 (78.1)	1		18,832 (74.9)	1	
> 90 centile	3,654 (6.3)	2260 (7.2)	1.17	1.11-1.23	1876 (7.5)	1.27	1.20-1.34
Total, n	58,369	31,478			25127		
Missing, n	844	461			436		
Indian							
10-90 centile (ref)	2156 (82.4)	2027 (77.2)	1		1182 (74.1)	1	
> 90 centile	192 (7.3)	240 (9.1)	1.33	1.09-1.62	163 (10.2)	1.55	1.24-1.93
Total, n	2615	2626			1596		
Missing, n	41	47			32		

Pakistani							
10-90 centile (ref)	2551 (78.1)	2794 (77.1)	1		2562 (74.6)	1	
> 90 centile	202 (6.2)	279 (7.7)	0.79	0.66-0.96	356 (10.4)	1.39	1.18-1.64
Total, n	3266	3625			3433		
Missing, n	58	80			75		
Bangladeshi							
10-90 centile (ref)	609 (80.6)	653 (78.4)	1		457 (74.4)	1	
> 90 centile	50 (6.6)	75 (9.0)	1.40	0.96-2.03	65 (10.6)	1.73	1.18-2.55
Total, n	756	833			614		
Missing, n	11	18			17		

NB. WHO General Classification used for the European group.

WHO Asian Classification for BMI used for the South Asian groups.

6.10.3 Logistic regression test of maternal obesity and macrosomia

I have ascertained the effects of ethnicity and Body Mass Index on the possibility that pregnant woman give birth a macrosomic baby using the logistic regression shown in table 6.31. A macrosomic baby was classified as one whose weight is greater than the 90th percentile at birth.

Increasing BMI level increases the risk of having a macrosomic baby, especially among the Indian and show significant differences between the obese Indian women and the reference group using the WHO Asian-specific BMI classifications (AOR=1.39 (95% CI 1.09-1.79)).

The results in Table 6.32 indicate the effects of ethnicity and body mass index on the risk for pregnant women to have a macrosomic baby, using the WHO general BMI classification and normal-BMI European women as the reference population. The risk is significantly higher for obese women across all population groups, but the risk is between

60 and 80% higher among the South Asian ethnic groups, Bangladeshi (AOR= 1.82 (95% CI 1.26-2.63)), Pakistani (AOR= 1.78 (95% CI 1.54-2.06)) and Indian (AOR= 1.66 (95% CI 1.32-2.09)) respectively. Using the WHO Asian-specific classification for South Asian ethnic groups, as shown in Table 6.33, the risk is similar among South Asian women, who have a between 70 and 80% higher risk than Bangladeshi women. Using the WHO general BMI classification, the risk is highest among obese Bangladeshi women AOR=1.74 (95% CI 1.02-2.98) compared to the other groups including the obese European mothers (AOR=1.19 (95% CI 1.10-1.27)) with normal-BMI women as reference. Similar results were obtained using the WHO general BMI classification (AOR=1.39 (95% CI 1.09-1.79)) and the WHO Asian-specific BMI classification (AOR=1.39 (95% CI 1.16-1.65)) for obese Pakistani women. The results only

the reference group, with adjusted odds ratio for Bangladeshi (AOR= 1.78 (95% CI 1.37-2.31)), Indian (AOR= 1.72 (95% CI 1.46-2.03)) and Pakistani (AOR= 1.75 (95% CI 1.55-1.96)).

Table 6.31: Logistic regression predicting macrosomia on ethnicity and body mass index (BMI) with normal BMI pregnant women as reference

Ethnicity	<u>Underweight</u>		<u>Normal</u>		<u>Overweight</u>		<u>Obese</u>	
	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)
European	159 (4.2)	0.81 (0.67-0.99)	3654 (6.2)	1	2260 (7.1)	1.14 (1.07-1.22)	1876 (7.3)	1.19 (1.10-1.27)
Indian ^a	21 (5.5)	0.67 (0.41-1.16)	321 (7.9)	1	193 (9.3)	1.17 (0.98-1.47)	81 (9.6)	1.25 (0.91-1.66)
Indian ^b	21 (5.5)	0.76 (0.45-1.30)	192 (7.2)	1	240 (9.0)	1.28 (1.02-1.60)	163 (10.0)	1.39 (1.09-1.79)
Pakistani ^a	25 (4.3)	0.62 (0.38-1.01)	340 (6.6)	1	278 (8.5)	1.21 (0.99-1.47)	219 (10.3)	1.38 (1.10-1.72)
Pakistani ^b	25 (4.3)	0.59 (0.36-0.96)	202 (6.1)	1	279 (7.5)	1.19 (0.95-1.48)	356 (10.1)	1.39 (1.16-1.65)
Bangladeshi ^a	3 (2.5)	0.62 (0.19-2.03)	85 (7.1)	1	73 (9.9)	1.63 (1.09-2.44)	33 (10.5)	1.74 (1.02-2.98)
Bangladeshi ^b	3 (2.5)	0.63 (0.19-2.11)	50 (6.5)	1	75 (8.8)	1.33 (0.85-2.08)	65 (10.3)	1.42 (0.95-2.12)

^a WHO general BMI classification

^b WHO Asian-specific BMI classification

* Adjusted for marital status, employment status, partner's employment status, Multiple Deprivation Index, housing status, smoking status, late booking, hypertensive disease during pregnancy, IUGR, macrosomia and premature birth

Table 6.32: Logistic regression predicting macrosomia during pregnancy on ethnicity and body mass index using the WHO general BMI classification (normal BMI European women as reference)

Ethnicity & BMI	n	%	Odds Ratio	95% CI for Odds Ratio		p
				Lower	Upper	
<u>European</u>						
Underweight	159	4.2	0.67	0.57	0.79	<0.001
Normal Ref	3654	6.2				
Overweight	2260	7.1	1.16	1.10	1.22	<0.001
Obese	1876	7.3	1.21	1.14	1.28	<0.001
<u>Pakistani</u>						
Underweight	25	4.3	0.69	0.46	1.03	0.069
Normal	340	6.6	1.08	0.96	1.21	0.191
Overweight	278	8.5	1.45	1.28	1.65	<0.001
Obese	219	10.3	1.78	1.54	2.06	<0.001
<u>Indian</u>						
Underweight	21	5.5	0.89	0.57	1.38	0.599
Normal	321	7.9	1.32	1.17	1.48	0.000
Overweight	193	9.3	1.58	1.36	1.84	<0.001
Obese	81	9.6	1.66	1.32	2.09	<0.001
<u>Bangladeshi</u>						
Underweight	3	2.5	0.40	0.13	1.26	0.119
Normal	85	7.1	1.13	0.90	1.42	0.285
Overweight	73	9.9	1.69	1.32	2.15	<0.001
Obese	33	10.5	1.82	1.26	2.63	0.001

Table 6.33 : Logistic regression predicting macrosomia on ethnicity and body mass index using the WHO Asian-specific BMI classification (normal BMI European women as reference)

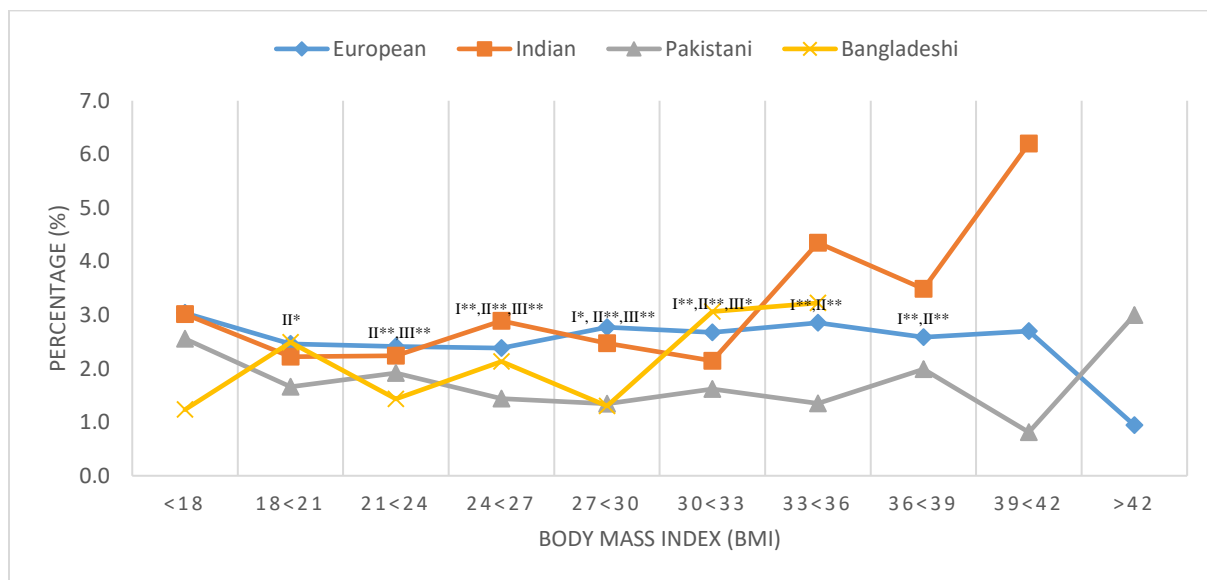
Ethnicity & BMI	n	%	Odds Ratio	95% CI for Odds Ratio		p
				Lower	Upper	
<u>European</u>						
Underweight	159	4.2	0.67	0.57	0.79	<0.001
Normal Ref	3654	6.2	1			
Overweight	2260	7.1	1.16	1.10	1.22	<0.001
Obese	1876	7.3	1.21	1.14	1.28	<0.001
<u>Pakistani</u>						
Underweight	25	4.3	0.69	0.46	1.03	0.069
Normal	202	6.1	0.99	0.85	1.15	0.890
Overweight	279	7.5	1.26	1.11	1.43	<0.001
Obese	356	10.1	1.75	1.55	1.96	<0.001
<u>Indian</u>						
Underweight	21	5.5	0.89	0.57	1.38	0.599
Normal	192	7.2	1.19	1.02	1.38	0.026
Overweight	240	9.0	1.46	1.20	1.78	<0.001
Obese	163	10.0	1.72	1.46	2.03	<0.001
<u>Bangladeshi</u>						
Underweight	3	2.5	0.40	0.13	1.26	0.119
Normal	50	6.5	1.03	0.77	1.38	0.845
Overweight	75	8.8	1.65	1.19	2.29	0.003
Obese	65	10.3	1.78	1.37	2.31	<0.001

6.11 NEONATAL INTENSIVE CARE USE (NICU)

6.11.1 Prevalence of neonatal intensive care use (NICU) cases by BMI

Based on the figure 6.7, the prevalence of neonatal intensive care use (NICU) among European was similar across the all BMI level. Due to smallest number of NICU outcome among the South Asian subgroups, the prevalence was between 1-3% for BMI less than 33kg/m². The prevalence of neonatal intensive care use (NICU) increased for BMI more that 33kg/m²among Indian women only.

Figure 6.7: Prevalence of neonatal intensive care use (NICU) by BMI



Different of Proportion (Z) Test:

I=Sig. diff between EU & Indian, I*= p<0.05, I**=p<0.01

II=Sig. diff between EU & Pakistani, II**=p<0.01

III=Sig. diff between EU & Bangladeshi, III**=p<0.01

6.11.2 Association of neonatal intensive care unit (NICU) with maternal obesity by ethnicity

Table 6.34 shows the odds ratios for the uses of NICU, comparing obese, overweight and normal-BMI women, using the WHO general BMI classification (a) for European pregnant women and the WHO Asian-specific BMI classification (b) for South Asian women. Throughout the statistical test, the odds are no different between the obese pregnant women and the normal-BMI women except among Indian women (AOR 1.74, 95% CI 1.16-2.63).

Table 6.34: Odds ratios of neonatal intensive care use (NICU), comparing obese pregnant women and overweight pregnant women, with healthy BMI pregnant women as reference

NICU	Normal n (%)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
European							
No (ref)	29,778 (95.4)	15,766 (95.0)	1		12,797 (94.8)	1	
Yes	1,422 (4.6)	838 (5.0)	1.11	1.02-1.21	701 (5.2)	0.93	0.85-1.02
Total, n	31,200	16,604			13,498		
Missing, n	28,013	15,335			12,065		
Indian							
No (ref)	1221 (96.2)	1221 (95.6)	1		701 (93.6)	1	
Yes	48 (3.8)	75 (4.4)	1.56	1.08-2.26	48 (6.4)	1.74	1.16-2.63
Total, n	1269	1296			749		
Missing, n	1387	2673			879		
Pakistani							
No (ref)	1159 (95.0)	1253 (95.6)	1		1143 (95.7)	1	
Yes	61 (5.0)	57 (4.4)	0.86	0.60-1.25	51 (4.3)	0.85	0.58-1.24
Total, n	1220	1310			1194		
Missing, n	2104	2395			2314		
Bangladeshi							

NICU	Normal n (%)	Overweight			Obese		
		n (%)	OR	95% CI	n (%)	OR	95% CI
No (ref)	277 (94.2)	329 (95.9)	1		240 (94.9)	1	
Yes	17 (5.8)	14 (4.1)	0.69	0.34-1.43	13 (5.1)	0.88	0.42-1.85
Total, n	294	343			253		
Missing, n	473	508			378		

NB. WHO General Classification used for the European group.

WHO Asian Classification for BMI used for the South Asian groups.

6.11.3 Logistic regression test of maternal obesity and neonatal intensive care use (NICU)

Table 6.35 presents the risk of needing additional care directly after the delivery. The adjusted odds ratio shows a positive association between increased BMI and increased risk of needing additional care after delivery among obese European pregnant women only (Obese: 2.8%, Normal BMI: 2.4%, AOR 1.17 (95% CI 1.03-1.33), but there is no significant difference across the South Asian ethnic groups.

The results in Table 6.36 and Table 6.37 indicate the effects of ethnicity and body mass index on the new-born's chances to be admitted at NICU after delivery, using different BMI cut-off points: the WHO general BMI classification and the WHO Asian-specific BMI classification. Among European pregnant women, an increased BMI level increases the risk of admission to NICU after birth. However, there is no significant difference at any level of BMI among the Pakistani and Bangladeshi obese pregnant women group for their baby to be admitted at NICU compared to normal-BMI European pregnant women. Indian obese women have a 59% higher chance for their baby to be admitted to NICU (AOR= 1.59 (95% CI 1.07-2.36)) than normal-BMI European pregnant women.

Table 6.35: Adjusted odds ratio for admission to neonatal intensive care on ethnicity and body mass index (BMI) with normal BMI pregnant women as reference

Ethnicity	<u>Underweight</u>		<u>Normal</u>		<u>Overweight</u>		<u>Obese</u>	
	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)
European	104 (2.8)	0.94 (0.70-1.26)	1422 (2.4)	1	838 (2.6)	1.14 (1.01-1.28)	707 (2.8)	1.17 (1.03-1.33)
Indian ^a	17 (4.4)	1.95 (0.96-3.97)	86 (2.1)	1	58 (2.8)	1.36 (0.88-2.12)	27 (3.2)	1.66 (0.90-3.06)
Indian ^b	17 (4.4)	1.95 (0.96-3.97)	48 (1.8)	1	75 (2.8)	1.33 (0.86-2.20)	48 (2.9)	1.46 (0.92-2.32)
Pakistani ^a	14 (2.4)	0.71 (0.31-1.62)	88 (1.7)	1	47 (1.4)	0.79 (0.47-1.31)	34 (1.6)	0.69 (0.35-1.37)
Pakistani ^b	14 (2.4)	0.75 (0.33-1.72)	61 (1.8)	1	57 (1.5)	0.78 (0.45-1.37)	51 (1.5)	0.80 (0.47-1.36)
Bangladeshi ^a	1 (0.8)	0.00 (-)	24 (2.0)	1	12 (1.6)	0.87 (0.35-2.14)	8 (2.6)	0.51 (0.15-1.69)
Bangladeshi ^b	1 (0.8)	0.00 (-)	17 (2.2)	1	14 (1.6)	0.55 (0.23-1.35)	13 (2.1)	0.51 (0.21-1.27)

^a WHO general BMI classification

^b WHO Asian-specific BMI classification

* Adjusted for marital status, employment status, partner's employment status, Multiple Deprivation Index, housing status, smoking status, late booking, hypertensive disease during pregnancy, IUGR, macrosomia and premature birth

Table 6.36: Logistic regression predicting NICU during pregnancy on ethnicity and body mass index using the WHO general BMI classification (normal BMI European women as reference)

Ethnicity & BMI	n	%	Odds Ratio	95% CI for Odds Ratio		p
				Lower	Upper	
<u>European</u>						
Underweight	104	2.8	1.14	0.93	1.40	0.206
Normal Ref	1422	2.4	1			
Overweight	838	2.6	1.11	1.02	1.22	0.016
Obese	707	2.8	1.15	1.05	1.26	0.004
<u>Pakistani</u>						
Underweight	14	2.4	1.34	0.78	2.32	0.285
Normal	88	1.7	1.04	0.84	1.30	0.716
Overweight	47	1.4	0.90	0.67	1.21	0.466
Obese	34	1.6	1.04	0.73	1.47	0.841
<u>Indian</u>						
Underweight	17	4.4	2.01	1.22	3.32	0.006
Normal	86	2.1	0.96	0.77	1.20	0.740
Overweight	58	2.8	1.33	1.01	1.74	0.042
Obese	27	3.2	1.59	1.07	2.36	0.022
<u>Bangladeshi</u>						
Underweight	1	0.8	0.45	0.06	3.23	0.424
Normal	24	2.0	1.11	0.74	1.69	0.608
Overweight	12	1.6	0.90	0.50	1.60	0.715
Obese	8	2.6	1.46	0.71	2.99	0.305

* WHO general BMI classification

Using the WHO Asian-specific BMI classification (Table 6.37), the findings show a similar trend to the one obtained using the WHO general BMI classification (Table 6.36).

Table 6.37 : Logistic regression predicting NICU on ethnicity and body mass index using the WHO Asian-specific BMI classification (normal BMI European women as reference)

Ethnicity & BMI	n	%	Odds Ratio	95% CI for Odds Ratio		p
				Lower	Upper	
<u>European</u>						
Underweight	104	2.8	1.14	0.93	1.40	0.206
Normal Ref	1422	2.4				
Overweight	838	2.6	1.11	1.02	1.22	0.016
Obese	701	2.8	1.15	1.05	1.26	0.004
<u>Pakistani</u>						
Underweight	14	2.4	1.35	0.78	2.32	0.285
Normal	61	1.8	1.10	0.85	1.43	0.468
Overweight	57	1.5	0.95	0.73	1.25	0.725
Obese	51	1.5	0.93	0.70	1.24	0.641
<u>Indian</u>						
Underweight	17	4.4	2.01	1.22	3.32	0.006
Normal	48	1.8	0.82	0.61	1.10	0.194
Overweight	75	2.8	1.36	0.97	1.90	0.077
Obese	48	2.9	1.43	1.07	1.93	0.017
<u>Bangladeshi</u>						
Underweight	1	0.8	0.45	0.06	3.23	0.424
Normal	17	2.2	1.29	0.79	2.10	0.318
Overweight	14	1.6	0.95	0.44	2.02	0.885
Obese	13	2.1	1.13	0.65	1.99	0.660

NB. WHO General Classification used for the European group.

WHO Asian Classification for BMI used for the South Asian groups.

CHAPTER 7

QUALITATIVE METHODS

7.1 INTRODUCTION

This chapter presents the methods for the qualitative analysis carried out among obese pregnant women and health professionals in University Hospital Coventry and Warwickshire (UHCW), Coventry.

The methods described have been used to answer the second research question in Chapter 8: that is, to explore the diet and physical activity patterns in obese pregnant women and how socioeconomic factors, culture and environment affect the food consumption and physical activity of obese pregnant women comparing first generation South Asians versus later generation South Asian and European pregnant women. They have also been used to answer the third research question in Chapter 9: to explore the views of health professionals (obstetricians, dieticians, diabetologist and midwives) related to knowledge and attitudes of obese pregnant women on diet, physical activity and environmental factors associated with obesity during pregnancy.

7.2 SETTING

A) University Hospital Coventry & Warwickshire, UHCW

UHCW is one of the hospitals that has contributed to the Perinatal Episode Electronic Record (PEER) database, managed and hosted by the Perinatal Institute. This database was the one used for my secondary data analysis in the Chapter 5 and Chapter 6.

Another reason for selecting this site is that there is a large, varied South Asian population in Coventry. All pregnant women who need additional care (categorized as a high-risk pregnancy) living in Warwickshire and Coventry, including obese pregnant women, has been referred to Obstetrician at Antenatal Clinic, UHCW.

B) Warwickshire Population

The population of Warwickshire was estimated in 2011 to be 546,600. This includes the North Warwickshire Borough (62,100), the Nuneaton & Bedworth Borough (125,400), the Rugby Borough (100,500), the Stratford-on-Avon District (120,800) and the Warwick District (137,700) (Warwickshire County Council, 2014).

The health status of people in Warwickshire is better than the average for England. The level of deprivation is lower than the average for England. However, about 13.2% (12,800) children were still living in poverty in 2012 (Warwickshire Health Profile, 2015). In 2012, 21.8% of adults in Warwickshire are classified as obese. The life expectancy for both men and women in Warwickshire is higher than the average for England. From 2001 to 2010 all-cause mortality rates have fallen, and early death rates

from heart disease, stroke, and cancer have fallen and are better than the average for England (Warwickshire Health Profile, 2013). The life expectancy for people who live in the most deprived area is lower compared to those who live in the less deprived area: 7.1 years lower for women and 7.9 years lower for men (Warwickshire Health Profile, 2015).

C) Coventry Population

In a 2015 health profiling report, there was a population of 330,000 in Coventry (Coventry Health Profile 2015). 66.6% of the population was white and 16.3% Asian/Asian British Ethnicity, and the density of the Asian population in Coventry was twice as high as the average in England (7.8%) in 2011 (Coventry Health Profile, 2013). The employment rate was also low at 64% with 13.3% in receipt of jobseekers allowance (Coventry Health Profile, 2013). The level of deprivation is also higher than the England average with 15,400 children (23.9%) living in poverty in 2015 (Coventry Health Profile, 2015).

Overall the health status of people in Coventry was also worse than the England average: the life expectancy for people who live in the most deprived area is lower compared to those who live in the less deprived area by 9.8 years lower for men and 8.5 years for women (Coventry Health Profile, 2015). In 2012, 26.2% of adults in Coventry were classified as obese (Coventry Health Profile, 2015).

7.3 PILOT STUDY

Before I set the proper protocol for my qualitative research, I did a pilot study interviewing three obese pregnant women (South Asian, British White and British African) under the supervision of Professor Siobhan Quenby to get the relevant fieldwork experience. The interviews took place in Antenatal Clinic, UHCW, on 16th September 2013.

Two findings from the interview sessions were that the pregnant women generally preferred to be interviewed in the hospital rather than at home due to the distraction of other commitments such as looking after other children and household chores. They also prefer it if the duration for the interview session is not too long, and suggested it be less than 30 minutes. I only managed to talk to them for less than 10 minutes on each session. Field notes of my discussion with the pregnant women as in Appendix I.

7.4 RESEARCH DESIGN: FACE TO FACE SEMI STRUCTURED INTERVIEWS

There are three common research design for qualitative research which may be appropriate for my research: in-depth interviews, group discussion and observation methods. The differences in the application of the methods are detailed in Table 7.1. After I did the pilot study with three obese pregnant women, and after getting feedback from them, I found that in-depth interview was the most appropriate, since I only

needed to interview one person at a time after consider the findings of pilot study. I did consider to conduct a group discussion with the health professionals. However, their duty commitments in the hospital prevented them from committing to joining the group discussion.

Furthermore, in-depth interviews are a core qualitative method which is well known as a powerful tool to generate description and interpretation of individual or social worlds (Ritchie et al, 2014). The in-depth interview is often described as a form of conversation (Brinkman, 2009). However, it is not a normal conversation, since the researcher and participants had a certain role during the conversation (Berg and Lune 2012; Silverman, 2016):

“When using in-depth qualitative interviewing...researchers talk to those who have knowledge of or experience with the problem of interest. Through such interviews, researchers explore in detail the experiences, motives and opinions of others and learn to see the world from perspectives other than their own”

(Rubin & Rubin, 2012)

There are different forms of in-depth interview: face-to-face interview; using telephone or online methods (Ritchie et al, 2014); biographical, narrative, life history and oral history approaches (Chamberlayne et al, 2000; Miller, 2000; Riesman, 2008); and walk along interview (Evans and Jones, 2011). However, face-to-face interview was the preferred method in that it gave a good rapport between the interviewer and participants,

helping create a positive environment around the respondent during the interview session (Ritchie et al, 2014).

Table 7.1: Application of In-Depth Interviews, Group Discussion and Observation

	In-depth Interview	Group Discussion	Observation
Nature of data	To generate in-depth personal accounts	To generate data shaped by group interaction – both refined and reflected	To observe what are perceived to be naturally occurring behaviors in context
	To understand the personal context	To display a social context – exploring how people talk about an issue	To expose influences and behaviors that people may not be explicitly
	To explore issues in depth and detail	For debate, creative thinking	To understand what actually happens rather than the accounts given
		To display and discuss differences within the group	To inform the understanding of a process or behavior with which the researcher may not be familiar
Subject matter	To understand complex process and issues e.g – motivations, decisions-impacts. outcomes	To tackle abstract and conceptual subjects Where enabling or projective techniques are to be used, or in difficult or technical subjects where information is provided	To understand behaviours that are subconscious or socially difficult To verify or further explore generated data
	To explore private subjects or those involving social norms For sensitive issues	For issues which would be illuminated by the display of social norms For some sensitive issues, with careful group composition and handling or online	To explore public behaviour
Study Population	For participants who are likely to be less willing or able to travel	Where participants are likely to be willing and able to travel to attend a group discussion – or online	For participants who will be engaged in a public or visible action that can be observed
	Where the study population is geographically dispersed Where the population is	Where the population is geographically clustered or online	Where the population interact in a particular setting

In-depth Interview		Group Discussion	Observation
	highly diverse	Where there is some shared background or relationship to the research topic	
	Where there are issues of power or status Where people have communication difficulties	For participants who are unlikely to be inhibited by group setting	Where participants will not be inhibited by being observed

Source: Ritchie et al (2014), p59

7.5 RESEARCH GOVERNANCE

The NHS Ethical Committee approved the interview phase of this research via Integrated Research Application System process (IRAS). The NHS ethical approval was received on 30th January 2015 from NRES Committee West Midlands-Edgbaston (REC reference 14/WM/1255) (Appendix II) and RD& I approval from UHCW (RD&I Number: NG 155315) (Appendix III) with an Honorary Research Contract (Appendix IV) for the interview phase. All participants were given a participant information sheet and were also asked for their written informed consent.

7.6 DEVELOPMENT & RECRUITMENT OF RESEARCH

7.6.1 Obese Pregnant Women

The purpose of conducting semi-structured interviews with obese pregnant women is to explore the views and behaviour of first and later generation South Asian and European women concerning their health status, food consumption, and physical activity during pregnancy. These women have been referred to the high-risk obstetric antenatal clinic at UHCW owing to being obese. The interviews explored their views and reported behaviour concerning food and physical activity before and during pregnancy through a semi-structured interview with a topic guide (Appendix V)

As advised by The NRES Committee West Midlands-Edgbaston suggested having an equal sample size for each ethnic group in this study to get balanced qualitative data between each ethnic group. This required interviewing 45-60 obese pregnant women (15-20 first-generation South Asian, 15-20 later-generation South Asian and 15-20 European pregnant women).

To recruit the participants, The Participant Information Sheet (Appendix VI) and reply slip (Appendix VII) were sent in advance to the potential participants by post through the Biomedical Research Unit, UHCW. All participants were asked for their written informed consent (Appendix VIII) voluntarily to be sent by post or brought with them to the Biomedical Research Unit/ Antenatal Clinic. They were asked if they had decided to take part but forgotten their forms by Clinical Staff/ Research Midwives. The interviews took place at Biomedical Research Unit, UHCW, directly after they had

finished their appointments with the medical doctor or within a two-hour frame of Oral Glucose Tolerance Test (OGTT) Test. I filled out the participants' forms (socio-demographic data) (Appendix IX) with the pregnant women at the beginning of each interview session.

Women were recruited according the inclusion and exclusion criteria set down in Table 7.1. The BMI cut-off points for South Asian pregnant women follow the Asian-specific BMI criteria (NICE, 2013) (Table 2.2) and for European pregnant women it follows the BMI criteria for the general population (WHO, 2013) (Table 2.1). Classification of BMI was based on the booking appointment. All the cases have been reviewed by Professor Quenby/ Research Midwives who checked eligibility for this study.

Table 7.2: Inclusion and Exclusion Criteria of Obese Pregnant Women

Criteria	Inclusion	Exclusion
Ethnicity	South Asian (Indian, Pakistani & Bangladeshi) and European (all Europeans were born in the UK)	Another type of ethnic origin.
Body Mass Index (BMI)	South Asian pregnant women with a BMI 27.5 kg/m ² or more (at booking). European pregnant women with a BMI 30 kg/m ² or more (at booking).	South Asian pregnant women with a BMI less than 27.5 kg/m ² (at booking). European pregnant women with a BMI less than 30 kg/m ² (at booking)
Age	Age 18 and older	Age less than 18

The diagram of recruitment procedure of obese pregnant women is in Appendix X.

7.6.2 Health Professionals

The purpose of conducting semi-structured interviews with health professionals was to explore the knowledge, attitude and experience of health professionals related to the dietary intake and physical activity of obese pregnant women. The interviews were arranged at a time to suit the health professionals. During the interview process, a topic guide (Appendix XI) was used to allow them to elaborate more on their understanding, experience and knowledge related to managing obese pregnant women.

The interview was scheduled at Biomedical Research Unit (BRU), UHCW at any time and place convenient for the participants. This group comprised 15 health professionals, 3 Obstetricians (from UHCW), 2 Dieticians (from UHCW) and 10 Community Midwives. The inclusion criteria of health professionals who participated in this study were based on their working experience, which was to be at least 2 years with obese pregnant women in Coventry.

The Information Sheet (Appendix XII) and reply slip (Appendix VII) was sent or given in advance to potential participants by the researcher. The potential participants who were interested were asked to send the reply slip to the Biomedical Research Unit, UHCW, and then contacted to make an appointment for the interviews. All participants were asked for their written informed consent (Appendix XIII) voluntarily. The interviews were carried out at a place and time requested by the participants. The participants filled out the participants' form (role and experience) (Appendix XIV) at the beginning of the interview session.

The diagram of recruitment procedure of health professionals is included in Appendix XV (for Obstetricians and Dieticians) and Appendix XVI (for Community Midwives).

7.7 DATA COLLECTION

7.7.1 Briefing before Interviews

Before starting the interview session, I introduced myself saying that I was currently studying at Warwick Medical School. I thanked them for that their time and also made clear five points before we started the session: information sheets, confidentiality, consent form, demographic form, and interview topic.

I ensured that all the participants had read the information sheet and had an opportunity to prompt questions about the study. Before the interview, I explained to the participants that all the information that I gathered during this study would be confidential and anonymized unless they raised any concern about their safety or other individuals' during the interview. I also explained to them that they were free to withdraw at any time from the start of the interview session until two weeks after the interview. They also had an option to either answer all the questions or not. This is important to get a good rapport with all the participants, to make sure they feel confident and sincere sharing their experiences and views.

After briefing the participants about the information sheets and the confidentiality of the research, I asked them to sign the consent form (Appendix VIII & XIII). I gave them a

few minutes to read and understand the consent form and to ask any remaining questions.

The researcher filled up the form for the obese pregnant women by asking for their background. The health professionals filled up the form by themselves. Before the start of the interview session, I explained the five main topic questions to the obese pregnant women and the six main topic question for the health professionals. These face-to-face semi-structured interviews of obese pregnant women and health professionals were digitally audio recorded, and field notes were generated.

7.7.2 Recruitment Duration

All interviews took place at the Biomedical Research Unit except for one of the health professionals, with whom I conducted the interviews in her office. The first interviews took place on 8th May 2015, and the last session was on 23rd December 2015. Thus, it took almost eight-months to finish the study. Within the first two months, I completed the interviews with all participants in the European Obese women category. It was more challenging to interview all the South Asian obese women. After discussing the matter with my supervisors, we decided to stop the recruitment of the participants if I got a total of at least 15 South Asian women, because I conducted the recruitment for more than six months and needed more time to focus on analysing and writing up the research findings.

7.7.3 Participants

During the recruitment process, two participants refused to be interviewed due over-readed the Information Sheet (these were European pregnant women), and another South Asian woman refused due to her inability to speak English very well.

A total of 43 participants took part in the research. However, one of the European women did not match my inclusion criteria since she was not born in UK. Out of the total of 42 obese pregnant women who matched the inclusion criteria, 41 of them agreed to be audio recorded during the interview session. With one of the South Asian first-generation women, I conducted the interview by taking notes.

Table 7.3: Number of Participants

Group	Sample
<u>Obese Pregnant Women</u>	
European	15
South Asian born in the UK (later generation)	6
South Asian not born in the UK (second generation)	9
Health Professionals	12
Overall	42

Among South Asian women not born in UK, one of the participants was born in the UK; however, she had returned to her country of origin when she was still very young. She had just come back to UK five years before, in order to accompany her husband who was working in the UK. Since she had spent more time outside the UK than in it, which might influence her lifestyle as a first-generation South Asian.

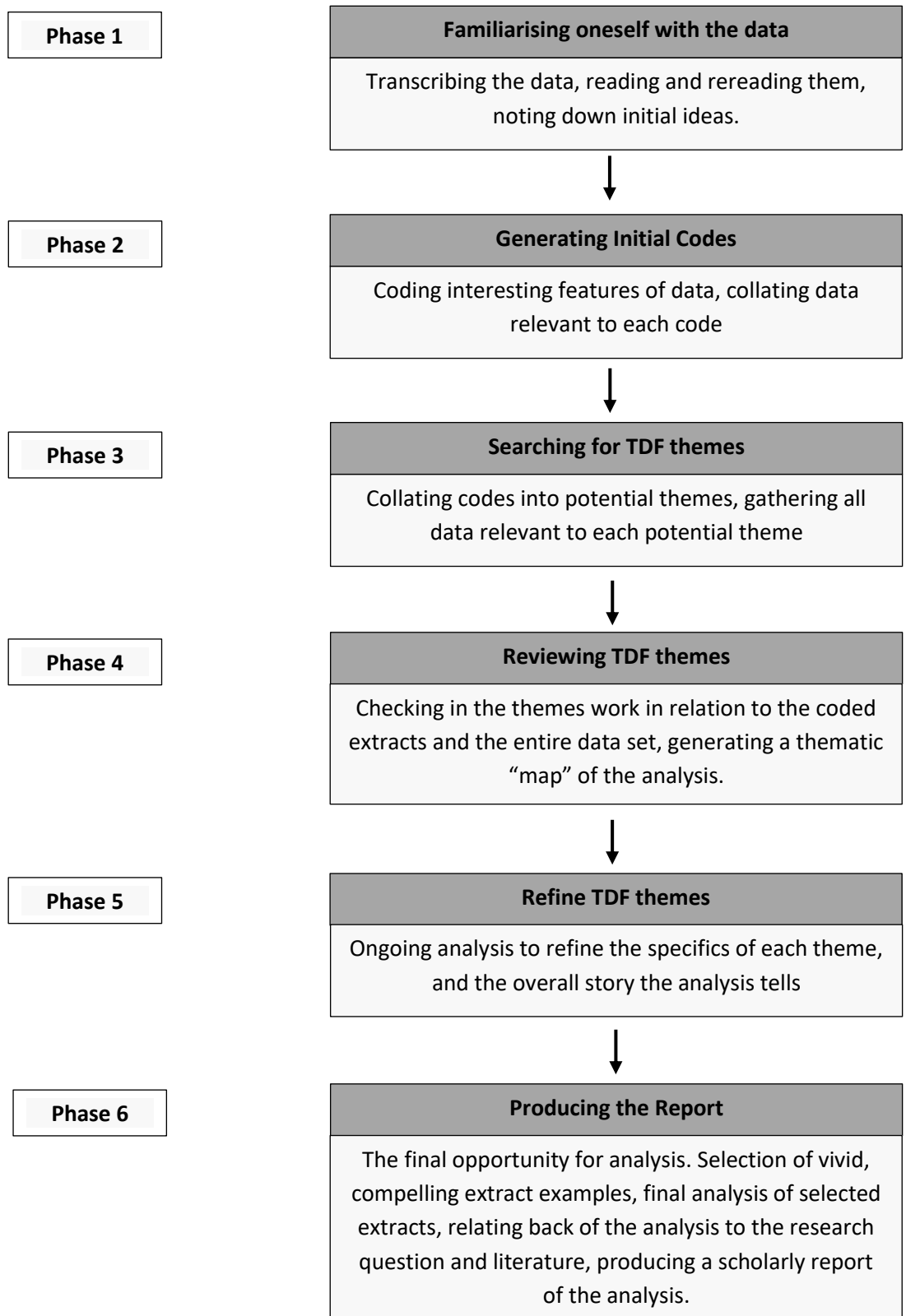
7.8 DATA ANALYSIS

All interviews have been transcribed. Data analysis involved an inductive process of thematic analysis, i.e. a method for identifying, analysing, and reporting themes (patterns) within the data (Braun & Clarke, 2006). There are advantages in using Thematic Analysis, especially for a researcher with little experience of qualitative research, since this method is flexible, easy and quick to understand and use. It can also highlight the similarities and differences across the data set and is very useful for producing qualitative findings for further policy development (Braun & Clarke, 2006).

Thematic analysis differs from other analytic methods such as Interpretative Phenomenological Analysis (IPA) and constructive grounded theory. Each approach has specific norms and rules in the application process of qualitative research (Silverman, 2016). Both Interpretative Phenomenological Analysis (IPA) and grounded theory focus on seeking patterns in the data during the analysis process and they, too, are theoretically bounded (Smith & Osborn, 2008 and Charmaz, 2014). Table 7.1 explains the six phases of thematic analysis used in this study.

NVivo version 11, a software package designed to help qualitative analysis has been used to store and manage the data, and to code the data based on the Theoretical Domains Framework (TDF) themes (explained in section 7.9).

Figure 7.1 : Phases of Thematic Analysis (adapted from Braun & Clarke, 2006)



7.9 THEORETICAL FRAMEWORK QUALITATIVE RESEARCH

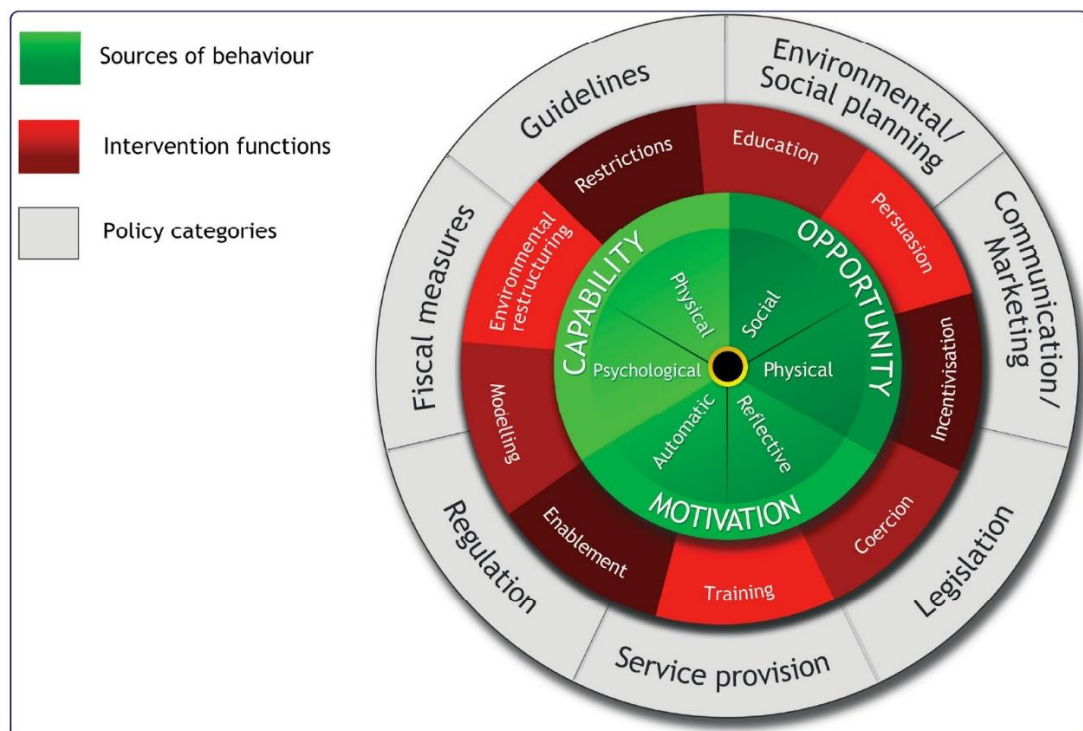
Theory is important to highlight the overall picture of the research to understand why people do or do not practice health promoting behaviours, in order to identify the reasons and gather the information to develop successful health intervention strategies (Glanz, 2008). Using theories and models can help explain behaviours more clearly and suggest how to develop effective ways to change behaviour (Glanz, 2008). In this research, I chose to combine two theoretical frameworks to help me understand the qualitative findings. The first one is Behavior Change Wheel (BCW), as in Figure 3.2, and the second is Theoretical Domains Framework (TDF). Merging both theoretical frameworks will give more robust findings, especially on the bigger scope of policy development, including suggestions on how to improve the current services.

Before I decided on BCW and TDF in my research, I considered other theoretical frameworks used in health research. I found that the Health Belief Model (Green & Murphy, 2014) and the Theory of Planned Behavior (Ajzen, 1991) do not address the important roles of habit, self-control, associative learning and emotional concern (West, 2013) among the pregnant women. The Theory of Reasoned Action (Madden et al, 1992) is very specific on behavior change (Glanz et al, 2008); instead, I was looking for a framework that gives a bigger picture from the individual to the societal and environmental perspectives and that of policy development. Another commonly used theoretical framework was the Transtheoretical Model (Prochaska & Veicer, 1997), but this model is suitable for intervention-based research only, which was not appropriate in my research.

7.9.1 The Behavior Change Wheel

The behavior change wheel has three main components; source of behavior (COM-B), intervention functions and policy categories. It was designed for behavior change intervention (Michie et al, 2011). COM-B stands for Capability Opportunity Motivation – Behavior used in Behavior Change Wheels for understanding behavior in the situation where it happens. However, only source of behavior (COM-B) and policy categories were appropriate for my qualitative study, since I have not done intervention research.

Figure 7.2: Behaviour Change Wheel



Source : Michie et al, 2011

At the center of this framework (Figure 7.2), the source of behavior involves three essential conditions; capability, opportunity and motivation also called the ‘COM-B System’ (Michie et al, 2011). Capability is defined as *‘the individual’s psychological and physical capacity to engage in the activity concerned’*. Motivation is defined as *‘all those brain processes that energize and direct behavior, not just goals and conscious decision-making’*. Opportunity is defined as *‘all the factors that lie outside the individual that make the behavior possible or prompt it’* (Michie et al 2011, p4).

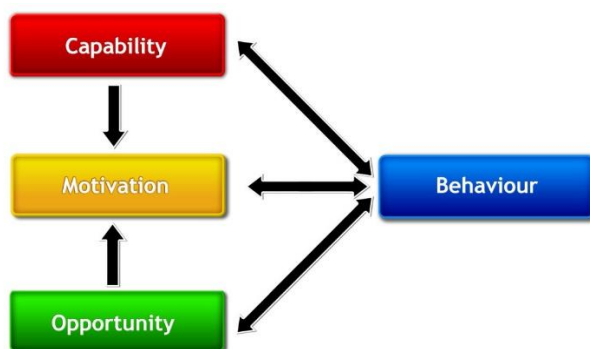
Qualitative structured interviews study using the COM-B model can identify the determinant of behavioral circumstances of obese pregnant women from two perspective; from the women itself and the health professionals as well. This model also provides simple starting points and can be a marker to specific psychological theories (Michie et al, 2014). Michie et al 2011 (p.59) make a clear framework of the relation between COM and the occurrence of the behavior (Figure 7.3). Opportunity and capability can influence motivation and enacting the behavior change. The COM-B system is helpful in this context to understand the behavior pattern of these obese pregnant women.

- a. *There must be the “capability” to do it: the person or people concerned must have the physical strength, knowledge, skills, stamina etc. to perform the behavior*
- b. *There must be the “opportunity” for the behavior to occur in terms of a conducive physical and social environment: e.g. it must be physically accessible, affordable, socially acceptable and there must be sufficient time;*

- c. *There must be strong ‘motivation’: i.e they must be sufficient strong ‘motivation’ : they must be more highly motivated to do the behavior, or to engage in a competing behavior (Mitchie et al, 2011)*

The COM-B model has been applied successfully in other studies (Alexander et al, 2014; Jackson et al. 2014; Barker et al, 2016) but not yet in maternal obesity.

Figure 7.3: The COM-B system - a framework for understanding behaviour



Each of the COMB Components has been divided into two category. Capability can be either ‘physical’ or ‘psychological’ to perform the behavior. Opportunity can be either ‘physical’ or ‘social’ while motivation can be ‘reflective’ or ‘automatic’. 7.4 provides definition on each component of COM-B Model.

Table 7.4: Definition Component of COM-B Model

COM-B Model Component	Definition
Physical Capability	Physical skill, strength and stamina
Psychological Capability	Knowledge or psychological skills, strength or stamina to engage in the necessary mental processes
Physical Opportunity	Opportunity afforded by the environment involving time, resources, resources, locations, cues, physical ‘affordance’
Social Opportunity	Opportunity afforded by interpersonal influence, social cues and cultural norms that influence the way that we think about things, e.g the words and concepts that make up our language
Reflective Motivation	Reflective processes involving plans (self-conscious intentions) and evaluations (beliefs about what is good and bad)
Automatic Motivation	Automatic processes involving emotional reactions, desires (wants and needs), impulses, inhibitions, drive states and reflex responses

Source: Michie et al, 2011

The outer layer of the Behavior Change Wheel focusing on policy is helpful in order to discuss the findings at the macro level. There is various option to correlate the behavior change and policies development. The definition for each policy explained in Table 7.5.

Table 7.5: Definition of Policies in Behavior Change Wheel

Policies	Definition
Communication/ marketing	Using print, electronic, telephonic or broadcast media
Guidelines	Creating documents that recommend or mandate practice. This includes all changes to service provision
Fiscal	Using the tax system to reduce or increase the financial cost
Regulation	Establishing rules or principles of behavior practice
Legislation	Making or changing laws
Enviromental/ social planning	Designing and/or controlling the physical or social environment
Service Provision	Delivering a service

Source : Michie et al, 2011

7.9.2 Theoretical Domains Framework (TDF)

TDF is an extension of the COM-B Component in the Behavior Change Wheel. The TDF component developed to request the implementation of evidence based practice of behavior change (Cane et al, 2012). Originally TDF was developed by 32 international experts in behavior change who identified 128 constructs from 33 behaviour changes theories before simplifying them into 12 domains (Cane et al, 2012). Cane et al (2012) validated and identified 14 domains from the originals TDF and match with the COM-B system (Table 7.6).

Table 7.6: Mapping of the Behaviour Change Wheel's COM-B system to the Theoretical Domains Framework (TDF)

COM-B Component		TDF Domain
Capability	Psychological	1. Knowledge
		2. Skills
		3. Memory, Attention and Decision Process
		4. Behavioural Regulation
	Physical	2. Skills
Opportunity	Social	5. Social Influences
	Physical	6. Environmental Context and Resources
Motivation	Reflective	7. Social/Professional Role & Identity
		8. Beliefs about Capabilities
		9. Optimism
		10. Beliefs about Consequences
		11. Intention
		12. Goals
		7. Social/ Professional Role & Identity
		9. Optimism
	Automatic	13. Reinforcement
		14. Emotion

Source : Cane et al, 2012

I used the 14 TDF domains as a themes during the thematic analysis of my interviews, before grouping them into the appropriate COM-B component. Table 7.7 provide definition and theoretical constructs for each domains in the Theoretical Domains Framework.

Table 7.7: Definition of Domain and Theoretical Construct *(Cane et al., 2012)*

No	Domain	Definition	Theoretical Constructs
1	Knowledge	The awareness of the existence of something	<ul style="list-style-type: none"> ▪ Knowledge (including knowledge of condition/ scientific rationale) ▪ Procedural knowledge ▪ Knowledge of task environment
2	Skills	Abilities or proficiencies acquired through practice	<ul style="list-style-type: none"> ▪ Skills ▪ Skills development ▪ Competence ▪ Ability ▪ Interpersonal skills ▪ Practice ▪ Skill assessment
3	Memory, attention and decision processes	The ability to retain information, focus selectively on aspects of the achievement and choose between two or more alternatives	<ul style="list-style-type: none"> ▪ Memory ▪ Attention ▪ Attention control ▪ Decision making ▪ Cognitive overload/ tiredness
4	Behavioural Regulation	Anything aimed at managing or changing objectively observed or measured actions	<ul style="list-style-type: none"> ▪ Self-monitoring ▪ Breaking habit ▪ Action planning
5	Social influences	Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours)	<ul style="list-style-type: none"> ▪ Social pressure ▪ Social norms ▪ Group conformity ▪ Social comparisons ▪ Group norms ▪ Social support ▪ Power ▪ Intergroup conflict ▪ Alienation ▪ Group identity ▪ Modelling
6	Environmental Context and Resources	Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behavior)	<ul style="list-style-type: none"> ▪ Environmental stressors ▪ Resources/ material resources ▪ Organisation culture/ climate ▪ Salient events/ critical incidents ▪ Person x environment ▪ Interaction ▪ Barriers and facilitators
7	Social/ Professional Role and Identity	A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting	<ul style="list-style-type: none"> ▪ Professional identity ▪ Professional role ▪ Social identity ▪ Identity ▪ Professional boundaries ▪ Professional confidence ▪ Group identity ▪ Leadership ▪ Organisational commitment
8	Beliefs about Capabilities	Acceptance of the truth, reality, or validity of ability, talent, or facility that a person can put to constructive use	<ul style="list-style-type: none"> ▪ Self-confidence ▪ Perceived competence ▪ Self-efficacy ▪ Perceived behavioural control ▪ Beliefs ▪ Self-esteem ▪ Empowerment ▪ Professional confidence
9	Optimism	The confidence that things will	<ul style="list-style-type: none"> ▪ Optimism

No	Domain	Definition	Theoretical Constructs
		happen for the best or that desired goals will be attained	<ul style="list-style-type: none"> ▪ Pessimism ▪ Unrealistic optimism ▪ Identity
10	Beliefs about Consequences	Acceptance of the truth, reality, or validity of outcomes of a behaviour in a given situation	<ul style="list-style-type: none"> ▪ Beliefs ▪ Outcome expectancies ▪ Characteristics of outcome ▪ Anticipated regret ▪ Consequents
11	Intentions	A conscious decision to perform a behaviour or a resolve to act in a certain way	<ul style="list-style-type: none"> ▪ Stability of intentions ▪ Stages of change model ▪ Transtheoretical and stage of change
12	Goals	Mental representations of outcomes or end state that an individual wants to achieve	<ul style="list-style-type: none"> ▪ Goals (distal/ proximal) ▪ Goal priority ▪ Goal/ Target setting ▪ Goals (autonomous/ controlled) ▪ Action planning ▪ Implementation intention
13	Reinforcement	Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus	<ul style="list-style-type: none"> ▪ Rewards (proximal/ distal, valued/ not valued, probable/ improbable) ▪ Incentive ▪ Punishment ▪ Consequents ▪ Reinforcement ▪ Contingencies ▪ Sanction
14	Emotion	A complex reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event	<ul style="list-style-type: none"> ▪ Fear ▪ Anxiety ▪ Affect ▪ Stress ▪ Depression ▪ Positive/ negative affect ▪ Burn-out

Source Cane et al., 2012

CHAPTER 8

RESULTS OF THE QUALITATIVE STUDY AMONG OBESE PREGNANT WOMEN

8.1 INTRODUCTION

This chapter presents the findings from the qualitative data analysis of the interviews with the obese pregnant women in order to answer the second research question (RQ2) by exploring the views and reported behaviour related to diet, physical activity, weight management and environmental factors associated with obesity during pregnancy.

8.2 PARTICIPANTS

The recruitment of these obese pregnant women took place between June and December 2015. In total, the participants in this study were 30 obese pregnant women including 15 European (all White British) and 15 South Asian (9 first-generation and 6 later-generation) women. The age range for the European obese pregnant women was 20-37 years old (mean 28.2 years old), a little lower than South Asian first-generation women, whose age range was 27-40 years old (mean 32.6 years old), and than South Asian later-generation women, whose age range was 29-40 years old (mean 33.8 years old).

Since the inclusion criteria for BMI for South Asian pregnant women to be considered obese were from 27.5 kg/m², the range of BMI for South Asian first-generation obese pregnant women was 27.8-39.0 kg/m² (mean 31.0 kg/m²) and 27.9-34.3 kg/m² (mean 30.1 kg/m²) for South Asian later-generation women. These ranges are lower than the

one for European obese pregnant women (range 31.5-47.0 kg/m², mean 37.8 kg/m²).

The mean for week of pregnancy was the same for European women and South Asian later-generation women (26.3 weeks), and it was 27.4 weeks for South Asian later-generation women.

As for employment status, half of the European women were working and half of them were full-time housewives. Among South Asian first-generation women, the majority were full-time housewives. This is in contrast to South Asian later-generation women, most of whom were working full time. As for level of education, the majority of the South Asian women had at least a degree, while the majority of the European women had a Diploma/ GCSE/ A-Levels or equivalent.

The details of the participants' demographical background are given in Table 8.1 (for European women), Table 8.2 (for South Asian first-generation women) and Table 8.3 (for South Asian later-generation women).

During the interview session, two of the respondents had been accompanied by their husband/partner (W12: European) and (W30: South Asian Later-Generation), and one of the European women (W1) was accompanied by a social worker. I had to exclude one of the respondents from this study (W4: European) because she did not match the inclusion criteria, not having been born in the UK.

I also had an issue regarding one South Asian woman: she was born in the UK but grew up in a South Asian country (W21). She had just moved back to the UK, following her husband, who was working in the UK. Even though she matched the criteria for "South Asian later-generation" since she was born in UK, I had to put her in the South Asian first-generation group since she had migrated to the UK recently (in 2011).

Table 8.1: Demographic data of the European obese pregnant women

Code	Ethnicity	Country of Birth	Age	BMI (kg/m ²)	Parity	Week of Pregnancy	Employment Status	Education Level	Marital Status	Health Problems	Length of interview - audio recorded (min : sec)
W1	White British	UK	26	47.0	3	28	Full-time housewife	Diploma/ GCSE/ A Level or equivalent	Single	Spina bifida, asthma, mental health	31:25 (accompanied by social worker)
W2	White British	UK	29	36.8	1	26	Full-time housewife	Diploma/ GCSE/ A Level or equivalent	Single	Depression, eating Disorder, carpal tunnel syndrome	33:59
W3	White British	UK	37	39.6	5	26	Full-time housewife	Diploma/ GCSE/ A Level or equivalent	Cohabiting/ Living together	Chronic fatigue syndrome	32:42
W5	White British	UK	36	36.3	3	27	Employed full time	Degree or higher education	Cohabiting/ Living together	No	33:25
W7	White British	UK	35	34.0	4	27	Employed part time	Degree or higher education	Cohabiting/ Living together	No	26:39
W8	White British	UK	32	45.6	0	32	Employed full time	Diploma/ GCSE/ A Level or equivalent	Cohabiting/ Living together	SPD (Pelvic Pain) / Depression	27:18
W9	White British	UK	28	39.2	1	32	Employed part time	Diploma/ GCSE/ A Level or equivalent	Married	No	32:47
W10	White British	UK	24	45.3	1	31	Full-time housewife	Diploma/ GCSE/ A Level or equivalent	Cohabiting/ Living together	No	43:05
W11	White British	UK	30	33.5	4	26	Employed part time	Diploma/ GCSE/ A Level or equivalent	Married	No	23:18
W12	White British	UK	26	40.3	1	16	Full-time housewife	Diploma/ GCSE/ A Level or equivalent	Cohabiting/ Living together	No	35:06 (accompanied by partner)
W13	White British	UK	24	31.5	2	29	Full-time housewife	Diploma/ GCSE/ A Level or equivalent	Single	No	23:31
W14	White British	UK	28	36.3	1	17	Employed full time	Diploma/ GCSE/ A Level or equivalent	Married	GDM (first pregnancy)	35:40

Code	Ethnicity	Country of Birth	Age	BMI (kg/m ²)	Parity	Week of Pregnancy	Employment Status	Education Level	Marital Status	Health Problems	Length of interview - audio recorded (min : sec)
W15	White British	UK	24	31.6	1	25	Full-time housewife	Diploma/ GCSE/ A Level or equivalent	Cohabiting/ living together	No	22:33
W16	White British	UK	25	31.6	1	26	Employed full time	Degree or higher education	Married	No	29:11
W18	White British	UK	20	34.5	0	26	Employed part time	Diploma/ GCSE/ A Level or equivalent	Married	No	24:53
SUMMARY			<u>Age</u>	<u>BMI (kg/m²)</u>	<u>Parity</u>	<u>Week of Pregnancy</u>	<u>Employment Status</u>	<u>Education Level</u>	<u>Marital Status</u>	<u>Health Problems</u>	<u>Length of interview - audio recorded (min : sec)</u>
			Mean = 28.2	Mean = 37.8	0 = 1 1 = 7 2 = 1 ≥3 = 5	Mean = 26.3	Full-time housewife = 7 Employed full time = 6 Employed part time = 2	Degree or higher education = 3 Diploma/ GCSE/ A Level or equivalent = 12	Married = 5 Cohabiting/ Living Together = 7 Single = 3	Yes = 5 No = 10	Mean = 30:22

Table 8.2: Demographic data of the South Asian obese pregnant women (first generation)

Code	Ethnicity	Country of Birth	Age	BMI (kg/m ²)	Parity	Week of Pregnancy	Employment Status	Education Level	Marital Status	Health Problems	Length of interview - audio recorded (min : sec)
W6	South Asian	India	32	39.0	2	27	Full-time housewife	Degree or higher education	Married	No	26:02
W17	South Asian	India	34	32.7	0	27	Full-time housewife	Degree or higher education	Married	Polycystic ovary syndrome (PCOD)	38:02
W19	South Asian	India	27	28.2	0	29	Employed full Time	Degree or higher education	Married	No	21:40
W20	South Asian	India	31	28.8	0	28	Full-time housewife	Degree or higher education	Married	No	26:18
W21	South Asian	India	32	27.8	1	26	Employed part Time	Degree or higher education	Married	No	21:39
W23	South Asian	India	32	33.3	2	33	Full-time housewife	Degree or higher education	Married	SPD (pelvic pain)	15:34
W26	South Asian	Pakistan	40	28.3	4	27	Full-time housewife	No qualification	Married	High blood pressure	18:47
W30	South Asian	India	30	33.3	1	27	Full-time housewife	Degree or higher education	Married	No	26:36 (accompany by husband)
W31	South Asian	India	35	32.6	2	23	Employed full time	Degree or higher education	Married	Hyperthyroidism	25:31
SUMMARY		Country of Birth	Age	BMI (kg/m²)	Parity	Week of Pregnancy	Employment Status	Education Level	Marital Status	Health Problems	Length of interview - audio recorded (min : sec)
		India = 8 Pakistan = 1	Mean = 32.6	Mean = 31.6	0 = 3 1 = 2 2 = 4 ≥3 = 1	Mean = 27.4	Full-time housewife = 6 Employed full time = 2 Employed part time = 1	Degree or higher education = 8 No qualification = 1	Married = 9	Yes = 4 No = 5	Mean = 24:28

Table 8.3: Demographic data of South Asian obese pregnant women (later generation)

Code	Ethnicity	Country of Birth	Age	BMI (kg/m ²)	Parity	Week of Pregnancy	Employment Status	Education Level	Marital Status	Health Problems	Length of interview - audio recorded (min : sec)
W22	Asian British (Pakistani)	UK	40	30.2	0	28	Employed full time	Degree or higher education	Married	Polycystic ovary syndrome (PCOD)	23:01
W24	Asian British (India)	UK	32	28.8	1	31	Employed full time	Degree or higher education	Married	Hyperthyroidism, diabetes, mellitus	34:56
W25	Asian British (Pakistani)	UK	35	29.5	2	18	Full-time housewife	Diploma/ GCSE/ A Level or equivalent	Married	No	21:04
W27	Asian British (Bangladeshi)	UK	35	27.9	2	26	Full-time housewife	Degree or higher education	Married	No	20:47
W28	Asian British (Indian)	UK	32	29.8	0	27	Employed full time	Degree or higher education	Married	No	23:47
W29	Asian British (Pakistani)	UK	29	34.3	0	28	Employed full time	Degree or higher education	Married	No	20:28
SUMMARY			<u>Age</u>	<u>BMI (kg/m²)</u>	<u>Parity</u>	<u>Week of Pregnancy</u>	<u>Employment Status</u>	<u>Education Level</u>	<u>Marital Status</u>	<u>Health Problems</u>	<u>Length of interview - audio recorded (min : sec)</u>
			Mean = 33.8	Mean = 30.1	0 = 3 1 = 1 2 = 2	Mean = 26.3	Full-time housewife = 2 Employed full time = 4	Degree or higher education = 5 Diploma/ GCSE/ A Level or equivalent = 1	Married = 6	Yes = 2 No = 4	Mean = 24:01

8.3 TRANSCRIPTION AND THEMATIC ANALYSIS BASED ON COM-B MODEL AND THEORETICAL DOMAINS FRAMEWORK (TDF)

This section summarizes the responses given by the obese pregnant women based on the themes from COMB and TDF theory as explained in Chapter 3 (section 3.4.1 and 3.4.2). Fourteen themes have been used (Table 3.7) to code all the transcriptions. This section will be divided based on the COM-B Component:

- i. “Capability”: Obese pregnant women sharing their experiences related to their capability of changing their behaviour on the themes of behaviour regulation, memory, attention and decision processes, knowledge and skills.
- ii. “Motivation”: Obese pregnant women talked about their experiences related to their motivation for changing their behaviour on the themes of emotion, intention, social/professional role and identity, belief about capability, belief about consequence, optimism and goals.
- iii. “Opportunity”: Obese pregnant women talked about their experience related to their opportunity for changing behaviour on the themes of social influence, environment context and resource.

8.3.1 CAPABILITY

This section discuss the qualitative findings on “capability” to change one’s behaviour based on the views and experience-sharing of the obese pregnant women. Increasing capability (behaviour regulation and memory, attention and decision processes, skills, knowledge) can increase obese pregnant women’s motivation to change their behaviour (Figure 3.5).

A) BEHAVIOUR REGULATION AND MEMORY ATTENTION AND DECISION

This section describes the most common ways that obese pregnant women regulate their behaviour. This has been divided into three parts: dietary intake, exercise or physical activity routine, and planning for pregnancy.

I) DIETARY INTAKE

a) Skipping meals

Women in both groups reported skipping meals, especially breakfast, before getting pregnant. However, some of the pregnant women tried to change their routine after they knew that they were pregnant:

“Not about diet, but about the things... like sometimes my eating pattern is not regular. I think that affects my health” (W6: South Asian First Generation)

“I normally skip lunch and I’ll skip breakfast. But since I’ve become pregnant I try... I haven’t skipped and I’m just eating healthy” (W22: South Asian Later Generation)

“Probably a normal sized cereal bowl, not an overly big one because I’d end up sick. I don’t normally eat in the morning. But since being pregnant that’s it, he wakes up and he wants feeding. So I have a normal bowl of cereal” (W1: European)

Most of the women became more concerned about their diet after learning that they were pregnant:

“When I’m not pregnant I don’t look after myself. I eat whatever’s there, whatever’s convenient, whatever’s around. But when I’m pregnant I have to look after myself. I have to be careful what I eat and how much I eat” (W22: South Asian Later Generation)

“Diet before was just eating what I wanted to eat” (W24: South Asian Later Generation)

“I’d drunk quite a lot of... not a lot of wine, I was drinking wine, I was having a glass or two of wine and I think it was just like trying to block things out and like probably eat a lot more rubbish, like sweets and chocolate. But obviously once I knew I was pregnant again you cut it all straight back out. But that is my main reason why I’ve put on so much weight from September” (W11: European)

However, some of the European women still continued their routine of not eating breakfast regularly even after getting pregnant. This was mainly due to their not being used to it, lack of hunger, or to the fact that they were busy looking after their children:

“I’m not a very... I just don’t eat in the mornings” (W12: European)

“Well, my average day I wake up, I normally don’t have breakfast to be honest” (W10: European)

“I don’t always have breakfast. Some days I feel hungry and I’ll have some toast. Some days I won’t have any breakfast, I’ll have maybe a biscuit and a cup of tea” (W3: European)

“I often miss meals like breakfast if I’ve worked the night before and I’m tired I will just get the girls sorted and you’re just a bit of a zombie really, so I kind of forget myself” (W7: European)

Regardless of their ethnic background, it seems common among these women to skip meals before getting pregnant. Some of them put an effort to change their routine after getting pregnant; however, some of the European women still kept on the same habit of skipping meals, especially breakfast.

b. Cravings during pregnancy

Cravings during pregnancy seem similar between the ethnic groups. Thirteen pregnant women reported to have cravings. Seven of these craved unhealthy foods, such as sweets and high-fat foods:

“Lots of junk food this time, yeah. I’m so attracted to, if I see anything down and smell it, I want to eat it bad that time only. It’s this time, yeah” (W2: South Asian First Generation)

“To be fair probably... this pregnancy I’m definitely snacking a lot more on sweet things. I just seem to be craving chocolate and peanut butter. I really seem to eat a lot of peanut butter” (W9: European)

“I’ve got just a thing for mayonnaise at the moment. Everything I eat has to have mayonnaise on it” (W15: European)

One of the South Asian women who was craving high-fat foods during her last pregnancy said that she ate as much as she wanted, adducing her pregnancy as an excuse:

“Junk food, you know, like chips and burgers and things like that, probably a lot more through that pregnancy. And I used to just think, oh I’m pregnant, it doesn’t matter, I’ll eat as much as I want” (W25: South Asian, later generation)

However, some of the pregnant women did not have any cravings during pregnancy;

“I’ve not had any craving, again, it’s just been there’s been nothing different in terms of my eating, in terms of different foods. I’ve not had any special craving, I’ve not, not like anything” (W29 : South Asian Later Generation).

“No, I haven’t had any cravings, no” (W3: European)

Three of the European obese pregnant women craved healthier foods during the current pregnancy, such as fruits and vegetables, than they did in their previous pregnancy. One of the European women (W13) replaced the unhealthy foods that she craved with healthier option after learning the consequence of consuming the unhealthy foods.

“... but with pregnancy you get, like, the cravings and I like sweet stuff, but I substituted sweets with fruit because certain sweets were giving me heartburn. So instead of just going out and buying a pack of sweets and you’re random if you get heartburn or not, I got fruit. The only vegetable-type thing I can’t eat is tomatoes because of the acid, they give me heartburn” (W13: European)

“Oh I drink a lot more water-based drinks and I don’t really snack... I don’t really crave the sweets this time” (W12: European)

“I used, in my first pregnancy I loved ice cream and I used to... that used to be my craving, but this time it was apples, so it was quite healthy” (W7: European)

Not every woman experiences craving during pregnancy. Some of them crave healthier food. Unfortunately, others are more attracted to unhealthier food.

c. Snacking habits

The snacking habit among the obese pregnant women seems related to their craving pattern. Some of the pregnant women chose to snack on healthier food such as fruit, dried fruit or nuts.

"I'm preferring to eat Greek style yoghurt and some fruits, yeah" (W9: South Asian First Generation)

"Other than that I eat dry foods, like almonds or something when I'm hungry, or a fig, dried figs" (W31: South Asian First Generation)

"I have nuts and raisins, or I have sometimes breakfast bars just to have snacks" (W28: South Asian Later Generation)

"I generally try to eat at least four pieces of fresh fruit a day; not so much the processed juice because that is bad for you if you have too much, but a lot of fresh fruit I try to get in" (W18: European)

Snacking habits were more prominent among South Asian obese pregnant women even though some of them realised it was not a good choice.

"In weekends I usually eat junk food, to be frank" (W21: South Asian First Generation)

"A bit of chocolate here and there, but not, like, every day that I have to have lots of it" (W27: South Asian Later Generation)

"I mean, if I eat crisps and chocolates and things like that, that's when I think my weight starts going up. I don't have much of that. It's always in the house for the kids, but I don't have it too much. Now and again I will pick a packet of crisps or something, or a little bit of that, you know, I normally just break off a bit of chocolate when I'm leaving the house and put a little bar in my mouth, you know, but I can't eat a whole bar or anything, that's too much" (W25: South Asian Later Generation)

However, during pregnancy some of the women surrendered to the wish of eating sweets and high-fat foods.

"I'm trying not to eat more sweets, not to eat more sweets, and cut out the amount of sweets I was eating during pregnancy" (W19: South Asian, first generation)

"Sweets, biscuits and chocolates, I try to control myself since I've become pregnant, a lot, it's controlled. Yeah, fried food and sugar foods I've controlled a lot I think. Before I would just pick it up and eat it, I wasn't that concerned about sugars and things. But since I've become pregnant I've taken more, I take more care" (W22: South Asian, later generation)

"I used to, but since I've been pregnant I've gone off sweet things. I don't really eat chocolate or anything, or cakes or anything anymore, I don't fancy them anymore, it's more meat based... I was eating a lot of sweet stuff because... because I was so low on

energy I was wrongfully eating um sweet stuff. But I'd also eat a lot of fruit, but I've gone fruit at the moment"(W3: European)

It seems more common among South Asian women to continue to eat unhealthy snacks than among European women. However, most of the women from both groups chose to eat healthy snacks and stop consuming unhealthy ones after learning that they were pregnant.

d. Fruit and vegetable intake

Most interviewees were aware of the importance of consuming enough fruit and vegetables during pregnancy. Regardless of their ethnic background, many gave priority to eating a lot of fruit or vegetables during pregnancy.

"Yeah, I eat a lot of vegetables....Yeah, like, guava is my favourite for now. And then pomegranate, sometimes pears" (W30: South Asian, first generation)

"Yeah, I eat more fruit. I like my bananas and, you know, I've got those pineapples... you know, I've been ordering, you know, the snack-pack things you get from, like, ASDA, apples and things like that, so the fruit is good. We enjoy the fruit, actually" (W25: South Asian, later generation)

"Oh I've eaten more fruit this pregnancy" (W13: European)

"Yeah, yeah, I eat loads, loads of vegetables, more than I ever have done" (W3: European)

"With each meal we will have some veg in it or we'll have some fruit in it. So compared to before I would only have, probably, two or three pieces of fruit in the day and that was it, and there would be no vegetables unless it was in the evening meal. Now lunch is vegetables with a salad, so it's fruit and veg, and I'm having at least three or four pieces of fruit in the day. And evening meal is half vegetables, and then the rest is protein pulses" (W24: South Asian Later Generation)

Four of the South Asian pregnant women stated that they ate fruits or vegetables, but probably not as much as they should.

"Fruit I'm taking, yeah, once a day. Peaches, bananas, apples. I am liking peaches the most this time" (W21: South Asian, first generation)

"No... Just one banana one and one sometimes whenever...Vegetables, like... like I cook vegetables but yesterday, like, I cooked chicken and only ate chicken, otherwise sometimes I cook, like, cauliflower and potatoes..."(W6: South Asian, first generation)

"Well, yesterday I only had one piece of fruit. Normally... I think normally it is one to two a day, it's not five. It should be five but it's normally about one to two. But I had vegetables" (W29: South Asian, later generation)

"Yeah, I have a bit of fruit every day" (W27: South Asian Later Generation)

None of the interviewees said that they did not like fruits or vegetables, or that they did not eat any fruits and vegetables during pregnancy.

e. Takeaways / eating out

The majority of the women, regardless of their ethnic background, reported having takeaway at least once a month and up to twice a week. Having a takeaway seemed to them an opportunity to eat different types of meals, or just to get a rest from cooking.

"Occasionally, probably once a month, we might have a takeaway" (W14: European)

"Maybe once in two weeks. Once in two weeks we might eat out, or buy take-away. But it's not the normal practise actually" (W23: South Asian, first generation)

"I will have a mix, so, like, say, twice a week we will have like food from outside, so we might have pizza or we might have Chinese food, so it depends, what we have, yeah" (W28: South Asian, later generation)

"My biggest downfall is when I put my mum to bed, my son's in bed and I just want to relax, I'll have... sometimes I'll order a takeaway, because my mum's bedroom is downstairs right next to the kitchen: if I want anything I have to walk through her

bedroom into the kitchen, so I think to myself, I'll just order, you know, and I'll sometimes have a takeaway" (W10: European)

A few of the pregnant women ate takeaway food or ate out on weekends as a social activity, or to change their daily routine. However, one of the European women (W18) tried not to make this a weekly habit.

"I'd say during the weekend... it has its bad days, like, we will have a takeout or we'll treat ourselves to a pub meal or something like that, but generally we try to have the same routine at the weekend as we do in the week because we don't want to get into the habit where we think, oh it's the weekend, go on blow it" (W18: European)

"It used to be easily a Friday and a Saturday, two days a week" (W24: South Asian, later generation)

"I, like, feel very bored of eating Dal and Roti. So on weekends I keep it, like, it's weekend's social, we should go out and eat burgers and stuff like that" (W21: South Asian, first generation)

Two of the European obese women stated that they had takeaways after they got paid.

"I mean, I haven't looked after what I eat; I just ate what I wanted to eat. Like, plenty of pizza, Macdonald's, fish and chips, takeaways... Not very often, like, every time I get paid. But every time I get paid I'll go and get a takeaway" (W13: European)

"Um, takeaways sometimes, once a week, depending on what week, because I get fortnightly pay" (W2: European)

Two of the South Asian first-generation women (W21) reported having takeaways at least three times per week, and even more frequently when they lived in their country of origin (W17).

"Three times also sometimes. Yeah, and the week days when we go for the shopping in the evening and I feel hungry, so I just, say, get a Subway or stuff like that, Greggs pasty, or things like that" (W21: South Asian, first generation)

"In India it would be about 4 or 5 days a week. So we would eat a lot... which would be one meal probably from outside" (W17: South Asian First Generation)

In contrast, three of the South Asian women very seldom ate takeaways, maybe just once a month. They preferred to eat home-cooked food.

“My diet is a normal diet; we don’t eat takeaways and junk foods there” (W19: South Asian, first generation)

“Yes, during this pregnancy, so I don't like to eat outside. English food is good for me because there is no garlic in it, and no spice in there. But Indian food, Asian food, yeah, you know, like, the garlic and so many spices, so, yeah, so I always prefer to eat at home” (W20: South Asian, first generation)

“We don't eat out that often, very, very... we don't like spending money outside [laughs]. It's very rare. If anything, maybe once every two months or something” (W29: South Asian, later generation).

Similarly, two of the European women stated that they chose to eat in a healthier fashion by having home-cooked foods.

“No, I think I’m better, better eating this time, I’m healthier eating this time, a lot more home-cooked food as well” (W3: European)

“I’d say it’s a lot different this time, we’re a lot more conscious about having the takeaway sort of thing now, aren’t we? We make the effort to sit and cook something rather than sit and phone someone (W12: European)

The frequency of eating takeaways seems to be no different between the South Asian second-generation women and the European group, most of them having takeaways or eating out at least once a month and up to twice a week. Two of the South Asian first-generation women eat out at least three times per week, and this was also their regular lifestyle when they lived in their country of origin. However, some stated that they preferred having a home-cooked meal instead of eating out or having takeaways.

f. Squash / juice / carbonated drink intake

When asked about their fluid intake, only one of the South Asian first-generation women stated that she consumed carbonated drinks.

“So I had a bottle of Pepsi and that's just about it, and I had my bottle of water that was with me throughout” (W17: South Asian First Generation)

In contrast, the consumption of squash, juice or carbonated drink among South Asian later-generation and European obese women was very high, and they drank it quite regularly. At least half of them drank squash, juice or carbonated drinks as part of their daily routine. One of the European women (W13) stated that she might drink up to three cans of carbonated drink per day if she has enough money to buy it.

“I would have either water or some squash” (W22: South Asian, later generation)

“Water, I've been trying to get down water but I'm not doing very well with water. And it's just, you know, tropical and, you know, the orange juice, I like that. And that's it really” (W25: South Asian, later generation)

“I don't think I drink enough water. I drink a lot of juices” (W27: South Asian, later generation)

“So I'm quite bad for drink because, juice, I drink juice a lot, but that is my downfall” (W1: European)

“I drank squash through most of the day at work, blackcurrant squash and then had more squash when I got home yesterday as well” (W12: European)

“I drink... well it depends, if I've got money I'll probably have, like, two or three cans a day, but if I haven't got money then I will have none. But if I go to my Nan's I'll have, like, a 1.5 litre bottle of coke all to myself” (W13: European)

“I mainly drink diet coke and water... I don't like milk” (W15: European)

“I have, like, maybe a bottle of Pepsi and have that throughout the day” (W2: European)

“I have squash... I had orange juice, a couple of glasses” (W8: European)

“Um, normally, to be fair, throughout this pregnancy I’m a lot more thirsty, so I am drinking a lot more fruit juices, like just squash to go with my water, or I am drinking pints of iced water because I’m just thirsty” (W9: European)

This finding shows that second-generation South Asian women and European women have a similar habit of consuming high-sugar drinks, more so than the South Asian first-generation women do.

g. Portion sizes

During pregnancy, some of the obese pregnant women chose to eat smaller portions.

Most of them changed their eating pattern, due to feeling full more quickly than usual, and decided to educate themselves about eating in a healthier way.

“Yes, I just eat small portions” (W21: South Asian, first generation)

“The portion, I think, probably, is smaller now, definitely, because I find I get full, I get full quite quickly, I can’t eat a lot. I think my stomach is much more kind of compressed. I can’t eat as much so I don’t eat... maybe that’s why I eat more in the day, spread out” (W29: South Asian, later generation)

“I’m trying to, obviously, educate myself during this, like, pregnancy, and my portion size and everything has gone completely down because I tend to be a lot fuller. So I feel a lot more in control, in general, of what I’m eating, and, like, I make a lot more better choices, so I’m quite happy” (W11: European)

They seemed to understand what counted as an appropriate portion for themselves.

“Yeah, during this pregnancy I’ve reduced my rice...Before, my normal days, I took it two times, lunch and dinner was rice” (W30: South Asian First Generation)

“I think a lot of my problem before was my portion size, I’d eat quite a lot. Whereas I don’t tend to do that anymore. Once I’m full I stop, whereas before I’d probably eat until my plate was clear. So I know I’m learning now how much I want on my plate and to know how much I’m going to eat” (W11: European)

“I think with this pregnancy... when I found out I was pregnant I lowered my meal portions because I could eat about four or five slices of toast in the morning” (W15: European)

One South Asian later-generation woman was even more creative, changing her plate size purposely to reduce her portion size.

“We've bought smaller plates, and so we think we're eating the same but we're not, we're eating less. And with the pan as well, because you see a big pan and you think it should be full of food; you automatically think, so we bought smaller pans which we use daily, even. If someone's coming, we will take the bigger pans out” (W24: South Asian Later Generation)

This is a positive change, showing that some obese pregnant women can reduce their portion sizes, affecting their daily food intake. This also shows that they are capable of changing their diet to be healthier, instead of following their instinct to eat their favourite food until sated.

h. Fad diet

When I asked the interviewees open-ended questions regarding whether they have tried to lose weight before, some of them reported following fad diets. Fad diets before pregnancy are quite common among European obese women but not among South Asian women. Only one of the South Asian later-generation women reported engaging in a fad diet. None of the South Asian first-generation women mentioned trying a fad diet.

Among of the seven obese pregnant women who had followed a fad diet, such as milkshake diet, Terri Anne diet or juicing diet, four of them stated that the diet did not help them to lose weight.

“I’ve been on numerous diets before, but I don’t think I was in the right, like, frame of mind. I’ve done stupid, like, fad diets, milkshake diet and silly little things like that, and obviously they don’t work. So I think this one... well I’m not on a diet now, I think it’s just my choices that I’m making, and obviously that’s working because it’s slowly... I’m slowly losing weight. So I’m doing something right” (W11: European)

“I did the Terri Anne diet which is no carbs, you mainly just have... it’s a bit like the Atkins diet, just meat and things like that, and then you slowly introduce those things back. And I lost about three stone, so I was getting... I was getting down to my 11 stone then, I wasn’t far off it and then I weighed myself during my period and I just lost track then because you’re heavier on your period so I lost all motivation then” (W18: European)

“I’ve gone on a juicing diet where you just have fruits and vegetables, juiced. Calorie counting... No, I can’t do it. It doesn’t work. I always fail” (W8: European)

“Like, you get like a diet where you have, like...there’s three things that you have in the day, like, you have a shake... there’s the ones that are made up of shakes, but you have a shake in the morning, you have a shake for lunch then you have maybe chicken for dinner, and those kind of diets are where it’s kind of, you don’t have anything else apart from those three things. So I’ve tried those diets and it did make me lose weight but very slowly, but then the weight goes back on very quickly because your body going from that then going to normal food, it’s not healthy... It’s good for the first two weeks and then after that it’s tough trying to push through and keep that same pattern going. It’s harder. It’s not fun, you know, it’s not... you don’t enjoy it. That’s why it never really works out in the end because you give up because it’s not... it’s not a lifestyle that you want every day, have a shake every day” (W29: South Asian Later Generation).

This shows that some of the women made an effort to lose weight, but their attempts failed, and they did not reach their goal of losing weight after using the fad diet.

II) Exercise/ physical activity

a. Exercise

Before pregnancy

Before getting pregnant, it seems quite common for these women to have engaged in regular exercise by way of joining exercise classes, exercising in the gym or swimming.

The duration of exercise was quite long and they exercised quite frequently.

“When I was not pregnant I used to go to a gym for, like, thirty minutes... Three to four times” (W19: South Asian, first generation)

“When I was not pregnant then I would go four times a week. Three times I would go to the gym and one time I would go swimming, every week, regular. That's probably for the last six months. Before then I used to go but not strictly. So up until between October and April before got pregnant I was very... always date on every Monday, every Wednesday, every Friday I would go to the gym and then at the weekend I would go swimming always, so, yeah, I was very strict” (W28: South Asian Later Generation)

“I was going to the gym two or three times a week and I'd be there for about an hour, an hour and a half. And I'd be on the treadmill and the exercise bikes, and then I'd join into the pump classes, which is like a weight class, I'd join in with those” (W2: European)

“Before pregnancy I was exercising every day, two or three classes. I'd try and fit in classes every evening Monday to Friday and I've had Saturday and Sunday as my weekend off... The classes would run from forty-five minutes to an hour, so I was exercising really regular” (W18: European)

On the other hand, a few of them said they had not exercised regularly.

“Before pregnancy I did not do any exercise” (W30: South Asian First Generation)

“Not really, no, I didn't do any exercise purposely. With my job I was having to walk a lot, so I do a lot of manual handling which is heavy lifting, a lot of heavy people or things and stuff like that” (W12: European)

Before pregnancy, it seems that the South Asian women practised yoga more frequently than the European women did. This is especially true of the first-generation South Asian women.

“Yeah, I did yoga before my pregnancy” (W20: South Asian, first generation)

“Maybe forty-five minutes, one hour, we just go for a walk. But there if it is peak summer you walk for forty minutes, it's really, really good. Here you can't do it even with two hours, you don't feel that thing, that warmth will not come. I do about twenty minutes of Pranayam, which is a traditional form of breathing exercise... Yeah, twenty minutes in the morning, fifteen, twenty minutes” (W31: South Asian, first generation)

During pregnancy

After getting pregnant, none of the women mentioned joining any exercises class, or going to the gym. The preferred type of exercise seemed to change, and the duration of exercise got shorter. Only three of the European women stated that they continued to do exercise after getting pregnant, and none of the South Asian women.

“I do swimming sometimes; not all the time, but I will occasionally take my little sister. Walking I do every day, forty minutes every day” (W18: European)

“We just work round it really. We have Tuesday nights for jogging and it was very rare that we cancelled, only if the kids were poorly” (W5: European)

“For the walk, yeah, thirty minutes, and quite a brisk walk. A couple of times... I think a couple of times a month I will go swimming, but before I would be able to do one hour of swimming; now I can do about twenty minutes, thirty minutes because I get tired a lot quicker. And I do lengths, so one after another, I don't stop. And that's obviously I go with my little sister, she can do a lot more than we now. I have to have a break” (W2: South Asian, later generation)

Some of the European women tried to increase their physical activity even though they did not do regular exercise.

“Well, obviously, even for ten minutes, like, just walking down the road or something, it’s better than nothing instead of just sitting down. There’s still... obviously exercise, walking is doing it, I think it’s good, they should do it daily. And, say, even if it’s just for ten minutes, it’s ten minutes of a bit of fresh air as well” (W15: European)

“I say I’ve not really done anything because I’m tired a lot of the time anyway. So I just try and fit things in with life and, you know, maybe walk a bit more instead of taking him in the car, I walk him to the child minders and the shops and stuff. But I’m not seeking, like, vigorous exercise at the moment” (W16: European)

Among the South Asian women, the routine of doing yoga or walking became even more common, and vigorous exercise was not practised after getting pregnant.

“So, again, I try to walk a lot, as I do not take buses, and walk as much as I can, unless I’m having a down day, then I take the bus back after I’ve walked a lot and then I’m tired. So, for example, from CV1, very close to city centre, so actually I walk one way at least” (W17; South Asian, first generation)

“Yeah, during the pregnancy I do meditation and walking only” (W20: South Asian, first generation)

“Okay, well, during pregnancy I haven’t been as active as normal. When I’ve been sick I’ve got very weak, so the most I probably would do is, like, I’ll go for a walk two or three times a week” (W28: South Asian, later generation)

“So, yeah, I do like walking generally anyway. I don’t usually get tired from walking, but obviously now I’m getting bigger, I’m getting a bit exhausted, but I still like to have the fresh air and stuff like that. But general exercising I don’t do a lot really” (W27: South Asian, later generation)

Barriers to exercise

This exercise routine became less popular after they learned that they were pregnant.

“I was trying to get back into shape. I had an exercise DVD and I was doing that for a bit. But then I found out I was pregnant and it was quite an intense one, so I stopped doing it” (W16: European)

“Be never used to do any exercise... So no walking outside or, you know, I think it was just general walking. So, walking round the supermarket, or walking around town. There was no effective exercise that makes you sweat or gives you energy, there was nothing like that” (W24: South Asian, later generation)

“No, just obviously when I’m just doing what you do on a daily basis, like walking places and... I don’t go running or go, like, to the gym or things like that” (W11: European)

One of the South Asian first-generation women stated that she chose not to exercise for the sake of the baby.

“I think I am doing lots now anyway, so I don’t think I need anything like exercise and stuff. Because of my baby, making exercise all the time, no” (W21: South Asian, first generation)

In terms of behaviour regulation among those obese women on exercise, most no longer engaged in any vigorous exercise after getting pregnant, due to being less able to move fast, illness, or not being able to afford doing a long exercise routine.

“It’s slower now, yeah, it used to be quite quick” (W22: South Asian, later generation)

“I’ve stopped since I found out I was pregnant. I was at the start, exercising and going on walks, but since I’ve got a bad pelvis it hurts me to work out” (W8: European).

“Basically I was exercising more, dancing, swimming, walking, and basically just jumping around being a bundle of energy. And then, since I’ve become pregnant, it hasn’t been like that” (W13: European)

One of the pregnant women reported that for her laziness is the biggest obstacle against doing exercise.

“I’ve always wanted to do it but I’ve never got round to actually, you know, continually doing exercise. I did it when I was quite young, and I’d love to get into it regularly, but I can’t keep it up, I’m just too lazy as well. Well not, you know, I’m active at the house, but you know, the car I’ve got, got me really lazy. So it’s just that and time, really, I think” (W25: South Asian, later generation)

Exercise became less popular after becoming pregnant for both groups, due to certain barriers, including being less capable of fast movement, illness, not being able to afford

to do a long exercise routine, laziness, or being worried about the condition of the baby. None of the women joined any exercise classes or went to gym. Some of the European women continued to do vigorous exercise but not regularly. There are differences in the preference of exercise between South Asian and European women: More South Asian women prefer to do yoga or some type of meditation exercise than European women do.

b. Physical activity/ daily routine

As well as asking all these women about their exercise regime, I asked about their physical activity or daily routine. Their daily routine was different according to whether the pregnant women were working or not. Most full-time housewives mentioned their household tasks, including cooking and cleaning, as part of their daily schedule.

“Daily routine, just cooking, cleaning and go out for a walk. Like, when my daughter goes to nursery at that time, or sometimes in the night me and my daughter go for a walk” (W6: South Asian, first generation)

“And just general walking around the house, like, doing the housework, like, I say, looking after mum, back and forwards getting her what she needs, and things like that” (W10: European)

Obese pregnant women who worked mentioned their physical challenges at work, which involves walking and moving in addition to the daily routine at home.

“Because I’m a primary school teacher, I used to leave home at seven o’clock in the morning and come home at seven, six, seven in the evening, so it was quite... doing, like, exercising was quite hard. But I was on the go, as my job, I was in reception nursery teaching, young children, and I was constantly on the go. It’s not just sitting there, you’re constantly on the go with the children. So I think I’m quite active in that sense and I was fine. I mean, even though I was pregnant, I was quite active” (W22: South Asian, later generation)

“When I’m at work there’s lots of walking involved. We have a very big warehouse so I’m up and down walking in there quite a lot, but I don’t have any time to do my own... I don’t feel I have any time to do my own exercise, once the baby’s gone to bed I’m about ready to go to bed as well...”(W14: European)

“Just walking quite a lot. I work in a nursing home so there’s a lot of rushing about, but that’s about it” (W7: European)

In terms of ethnic background, there is no difference in physical activity or daily routine among the women interviewed; differences were related to their employment status.

III) Planning for pregnancy

The majority of the women did plan to have a baby. Some of them planned to have a child after getting married, and a few of them would like to have more children.

“Well I’ve been married about a year and a half ago, so my new partner hasn’t got any children, so we decided to have some more children” (W25: South Asian, later generation)

“I wanted one more. The first one gets very lonely, feels lonely, so I thought we might get a partner to play as well” (W21: South Asian, first generation)

“Because obviously we have... I’ve got a little boy already and we thought that we wanted another one” (W15: European)

One of the European women stated that she used an implant to make sure she got the baby at the right time, once her financial status became stable.

“Yes, I had the implant to make sure we didn’t have a baby at the wrong time. I was on antidepressants. We were a lot better off financially, we were more stable, we were in a bigger house, it seemed the right time to have another baby” (W10: European)

Some of the interviewees, however, did not plan for the pregnancy, especially women who already had children.

“No, I just had a baby last year, so it wasn’t something I had planned. But now I think, I will just say it just happened” (W23: South Asian, first generation)

“No. No. I want it, but I didn’t plan, no” (W2: European)

“No. Suddenly it come” (W26: South Asian, first generation)

B) KNOWLEDGE

This section describes the interviewees’ knowledge about diet and exercise.

i. Knowledge about diet

Some of the obese pregnant women had a good basic understanding of dietary intake, including what time they should eat before sleep, the food they should avoid during pregnancy, the food they should prioritise, and types of unhealthy foods.

“Yeah, I think I have to change. Like, if I eat at 5 o'clock, and then I have four or five hours before sleep (W6: South Asian, first generation).

“It's harder for you to burn the carbs in the evening, so for healthy eating I try and keep the range. Because during the day you can burn your food off more because you're exercising and things like that. In the evening you're just going to go to sleep, so that's why” (W28: South Asian, later generation)

“Obviously I'm avoiding things that they say you shouldn't eat, like certain cheeses or certain... what other things are there, like your eggs can't be runny, can't be raw. You know, I'm aware of what I shouldn't eat, but in terms of the diet itself it's quite similar to what it was” (W29: South Asian, later generation)

“Like I said earlier, we probably could eat a lot more vegetables and fruit a day and not eat snacks, like crisps or anything like that. But you do, it's everyday life” (W12: European)

“Because I know my diet’s not healthy. Pizzas and that, you’re not supposed to eat them every day” (W13: European)

This finding explains why certain of the women chose to change their diet, eating more healthy food after learning that they were pregnant.

ii. Knowledge about exercise

In the section on behaviour regulation, it was discussed that most of the obese pregnant women did not do any exercise during pregnancy, except three European women. However, regardless of ethnic background, they realised how important it was to exercise during pregnancy, and that they should continue their routine since getting pregnant, if they are capable.

“During pregnancy it's very good, like, it keeps you healthy. It makes the mind fresh, yeah. It's good to do exercise, to walk I would say during pregnancy” (W19: South Asian, first generation)

“Obviously I feel it is important in pregnancy; I realise it is much more important to maintain it” (W29: South Asian, later generation)

“You need to exercise during pregnancy. Not a lot, but you need to do certain exercises every day to keep your body strong, really, so you don’t... well you go weak, don’t you, because you’re not using everything like you used to, so you’ve got to keep fit in some ways more than others” (W5: European)

“Yeah, it helps your body kind of progress. If you’re used to exercising before you’re pregnant, pregnancy isn’t an excuse to stop exercising, because your body is used to it, you know. I used to run; I don’t anymore, but I wouldn’t now start running, because I’m pregnant, because physically my body just wouldn’t... I don’t feel it would be able to cope with me running. But if I’d been running before I was pregnant, you know, as I was being pregnant that wouldn’t be a problem, because I’d be used to it” (W14: European)

However, these women understood how important exercise is during pregnancy. It was certain conditions, such as illness and pregnancy, which have been discussed in the section on Behaviour regulation, that became barriers against their exercising regularly.

C) SKILLS

This section describes the cooking skills most frequently mentioned by the interviewees. Eight of the women made a positive change in their cooking skills, especially by using less oil and salt in cooking, and by changing their methods of cooking, such as moving from stir frying to boiling vegetables.

"We'd cook all our food in a high volume of oil, butter and everything, and we have reduced all the things. And I ate salad more compared to cooked food" (W20: South Asian, first generation)

"Because, obviously, the way we Asian people do our cooking, we tend to add a little bit more oil than, you know, or fats, than with normal cooking. So, I think, vegetables and, I think, yeah, instead of eating cooked vegetables like stir fries and things, if we had them boiled, I think that would help a lot" (W22: South Asian, later generation)

"Because most of the time I cook with very little oil, we have less of the carbohydrates, very few times we will have something fried, so it's mostly salads, soups and other things like that, so I would say that it is fairly healthy" (W23: South Asian, first generation)

"I didn't change none of my food or nothing because I was already eating all the right food. The only thing I did change was my oil, I stopped using oil and I went onto fry light, which was absolutely awesome. You need one skirt in a pan, whereas the oil, you'd need much more. And you can cook everything in it. And if you use a halogen or something like that, that's better than using oil in the oven. You can do chips a healthy way in halogen or you can cook them in fry light. You just pre-boil them and then stick them in the oven afterwards, after giving them a shakeup." (W1: European)

"Like, before, we put too much salt in the curries and everything. Then I started using the salt less, like, one spoon. If my other members they want to put... they can put it after when they're going to eat. But when we make the curry I put less amount of salt" (W6: South Asian, first generation)

It was more common for South Asian women to state that they had changed their cooking style, especially by using less oil and by changing the methods of cooking, following British instead of Asian cooking methods.

Some of the women, especially Europeans, stated that they planned their daily meals, which helped them prepare healthy food instead of cooking high-fat food.

“We meal plan, so we know what we’re getting or what meals we’re going to make”
(W14: European)

“I don’t know because I think we eat quite well at home. We don’t eat rubbish, you know, we don’t have fried food, we don’t eat chips and my children don’t eat processed food like chicken nuggets and things like that, we don’t have any of that. To me what we have is quite healthy. So that’s what I plan my meals around, is what the children”
(W11: European)

“We actually have, like, a meal chart, a meal family planner. So we just decide what we are going to have that week, so it’s easier for us to decide what to cook. So, accordingly, that will make the shopping list” (W30: South Asian, first generation)

One of the European women mentioned that learning new recipes gave her more ideas and made her use different ingredients, instead of preparing the same meals.

“But I think learning new recipes and what I could do with different ingredients and it being fresh will help, instead of me thinking, well I know how to make spaghetti Bolognese like I do every week, I’ll just get the same ingredients for that when I, you know, I could make loads of different things that I can’t even think of. It will be nice to have that shake-up and that fresh start again” (W10: European)

Having good cooking skills helped these women to prepare healthier foods via an improved cooking technique, learning new recipes and planning their daily meals.

8.3.2 MOTIVATION

This section discuss the qualitative findings on motivation that can influence behaviour change in obese pregnant women. Increased motivation (emotion, intention, social/professional role and identity, belief capabilities and belief consequence, goals and optimism) can lead to increased opportunity and capability for obese pregnant women to change their behaviour (Figure 3.5).

A) EMOTION

Emotion has a strong influence on obese pregnant women in dealing their daily lifestyle, both before and during pregnancy. This section examines the role played by emotion in determining how women feel about body weight and size, diet, exercise and tiredness.

i) Body weight/ body size

When I asked the interviewees how they felt about their body weight, six of them declared that they were happy with their weight.

“So right now I’m very happy with it. Before pregnancy I wasn’t...Yeah, I’m not putting on enough weight for my pregnancy, that’s the only concern” (W17: South Asian, first generation)

“Because I’m quite happy the way I am” (W15: European)

“I have put on weight, but you’re not going to lose weight during pregnancy unless you’re constantly being sick and not keeping anything down. I’m happy, really, I’ve got no concerns” (W5: European)

However, the majority of the interviewees were not happy with their body weight.

Many felt embarrassed about it and would have been happier if they could reduce it.

“No, I am not happy. I want to reduce, but I can’t, I don’t know, because I’m... the thing is, I think I eat everything in less amount, but still my body weight is too much” (W6: South Asian, first generation)

“Obviously I know it’s high, you know, I’m not happy about it, but I’m not depressed about it. It doesn’t take over. I’m not, like, going to walk around being sad about it, you know, I’m quite a positive person. I would like to lose the weight but it’s not holding me back” (South Asian, later generation)

“I hate it. I find it... it’s hard. Moving, compared to how I used to move... I mean, I used to be a gymnast and everything” (W10: European)

“Not that happy with it, obviously, I’m overweight. I’d like to be skinnier, but obviously that’s why I’m trying to make changes so I can get... I know where I want to be, so if I carry on as I am I know I’ll eventually be there” (W11: European)

“It’s not nice, I’ve had some people tell me they can’t even tell I’m pregnant because it just looks like I’m fat, which hurts, I won’t lie” (W8: European)

“I don’t like it. I don’t like that I’m so overweight and my BMI is so high, I get embarrassed” (W3: European)

“I’ve never been happy with my weight, no” (W2: European)

“I don’t like being big, I guess. I don’t like how I feel, what I look like, how it probably stops me doing things sometimes” (W7: European)

One of the later-generation South Asian women stated that she was scared to weigh herself, afraid to know if her weight had increased too much.

“I’ve been scared to put weight on. I’ve been scared to check the scales myself at home. So I’ve only ever looked at it when the nurses have done the weighing. And it was worrying at the start, because I wasn’t putting any weight on, and then they had been saying, you need to put weight on in the last bit, so it’s kind of given me peace of mind” (W24: South Asian Later Generation)

Even some of the women who were happy with their current body size felt embarrassed and unsatisfied with their body weight or size, independently of ethnic background.

ii) Diet

Emotion plays an important role in influencing decisions on diet among obese pregnant women. The most common emotion they reported was that they felt bored, either because they were eating the same food or because they were emotionally tired with the environment. Boredom seems to have prompted them to eat unnecessary or unhealthy food.

“Because I was sat around doing nothing; I wasn't getting out; I wasn't thinking, I just thought, I'm bored, let's go and eat. So I do know where I went wrong, it's just a bit late to change it now, I can only eat better” (W18: European)

“This is my downfall, is night time, when I get me time because I feel so down, that's when the comfort eating starts. But yeah, I will probably get crisps, mixed nuts, chocolate. I mean, I won't eat all of it, but they're just some examples of what I do get, and it's not healthy” (W10: European)

“I, like, feel very bored of eating Dal and Roti. So on weekends I keep it, like, it's weekend's social, we should go out and eat burgers and stuff like that... Almost every week” (W21: South Asian First Generation)

“I think with me, I kind of get bored with things quite easily. It's, like, Slimming World, I was getting bored with it. I was constantly always picking the same food to eat every day and it was just... I think that's the problem with me, I get quite bored of food. Like I always stick to the same things. I'd never... I won't try anything differently” (W15: European)

Two of the South Asian women stated that they were always feeling hungry. In the following quotes, the first woman was referring to her current pregnancy and the second one to her previous pregnancy.

“With this pregnancy I'm getting a bit more hungry, so maybe I've had an extra sandwich or so, but not too much. I haven't really ate a great deal more” (W25: South Asian Later Generation)

“I didn't need any specific food. In fact any food I like to eat, because I'm hungry, hungry, hungry, that much hungry. This time I'm not that much hungry and not that much food” (W30: South Asian First Generation)

Two more women adduced miscarriages as a reason why they had put on weight. After having a miscarriage, they might eat due to feeling stressed or worried rather than because they were hungry.

“I think I usually... I put on a lot of weight since I had a miscarriage, I think I comfort ate because it was a bit of a bad timing, September and I did put on, like, nearly two stone in between then and falling pregnant” (W1: European)

“I think because of stress levels. Yeah, not about my eating habits, because I'm not eating too much. If you see my diet, I'm not eating too much, like... look on my body. But my stress level was very high at that time. My health was not good because after miscarriage I...” (W20: South Asian, first generation)

These scenarios show that emotion had a strong impact on the women, influencing them to eating unnecessary food. This included feeling bored, always feeling emotionally hungry, and feeling stressed. All these may finally contribute to putting on extra weight.

iii) Exercise

Most of the interviewees expressed positive feelings when talking about exercise. After doing exercise, the women stated that they felt very relaxed and fresh. Some of them shared their emotion about enjoying exercise and saying that exercising boosted their confidence as well.

“Yeah, I feel healthy; relaxed, healthy, yeah” (W19: South Asian, first generation)

“I feel great, I feel a lot happier in myself and feel a bit more confident” (W18: European)

“Very relaxed and calmed down, yeah [yoga]” (W2: South Asian First Generation)

“I do like exercise, I do enjoy it” (W10: European)

“It just breaks up your day and it gives you... it makes you feel better about yourself, which makes you have a more positive outlook on life, if that makes sense. You know, you just feel... I think once you feel better you feel more positive, and then, you know, it just... I don't know, it just makes you feel better about yourself” (W3: European)

However, a later-generation South Asian felt too scared to do regular exercise, even brisk walking, because she was afraid of adverse consequences for her baby. Another woman declared that she liked to exercising, but not for a long time.

“Because they say brisk walk for thirty-forty minutes. Mine was, like, slow walking for twenty minutes, and it wasn't every day. I was just scared, basically; I wanted to keep them” (W24: South Asian, later generation)

“I like exercising but I don't like exercising too long” (W29: South Asian, later generation)

Two more European women felt embarrassed about exercising in public due to their low fitness level, and were uncomfortable about being seen by another people.

“It's not that I don't want to do anything, but it's difficult to, and it's embarrassing when you go for these long walks and you're the one that's like, 'I need to sit down', you know. It is it's horrible” (W10: European)

“I like the treadmill because I don't have to be seen in public running” (W8: European)

In terms of behaviour regulation, most of the women stopped exercising after learning that they were pregnant. However, parallel to their knowledge status and behaviour regulation on exercise, most of them enjoyed exercise, but some were scared of possible adverse consequences for the baby.

iv) Feeling tired

Through the interviews, I found that some of the women declared that they felt exhausted because of their pregnancy, which affected their sleep quality, and that they were tired with the daily chores.

“Just tired. Exhausted. Since I had my hand problem I don’t sleep at night” (W2: European)

“So I am exhausted with the pregnancy and working nights and not getting enough sleep, but you do what you have to do” (W7: European)

“You get much more tired when you’re pregnant and it’s just difficult. Like, when I’ve got to lean over the bed, my belly gets in the way. You can’t lean down for things properly. It’s quite hard. And because I’ve got a bad pelvis now I’m struggling to walk at work” (W8: European)

“It was, obviously, when you get pregnant you feel more tired and because I wasn’t eating very well in the first four months because of my nausea, I would get tired. But it was fine, I got through it fine” (W22: South Asian, later generation)

This condition of tiredness may contribute to the reduced activity during pregnancy.

B) INTENTION

i) Practicing a healthy post-pregnancy diet

When I interviewed these women, most of them expressed ideas on how to change their diet: these included cutting portion size, eating dinner at least three hours before going to sleep, eating breakfast regularly and controlling their desire to eat unnecessary food.

“I’ll eat less and more often. So... and more healthy foods, yeah” (W2: South Asian, first generation)

“I need to cut down my portion sizes, because if it’s there I’ll try and eat it even when I’m full, I’ll just keep going and keep going because I probably need to cook less, that will help” (W8: European)

“Yeah, I think I have to change. Like, if I eat at five o'clock, then I have four or five hours before sleep” (W6: South Asian, first generation)

“I feel that I should eat more breakfasts in the morning. My lunch at one o'clock and then a meal at four, five o'clock, with maybe fruit and stuff in between, but I don't do that. I know what I'm meant to do, I know, but I don't do it” (W2: European)

“I think I'm just going to have to be very careful and manage it a bit better. So, even when I am hungry and if I breast feed, just not to eat too much because it did creep up again and I was... I'm the same weight now as I was before I had [a child]” (W14: European)

This shows that they have a desire to change and that they understand that they should improve their eating style.

ii) Exercising regularly after pregnancy

Similarly to their response on practising a healthy diet, the women also expressed their intention to exercise after giving birth, for example by walking and joining the gym.

“After delivery. Yes I want... I want to join the gym [laughs]” (W6: South Asian, first generation)

“Yeah, yeah, and then I'm going to go to the gym regularly. I think the walking, I would like to continue that, for sure. I mean, if I go back to India I'll take up the walking, you know, where I'm able to continue walking because I think walking really helps me” (W17: South Asian First Generation)

“I've always wanted to do some exercise to tone everything up a bit. But I'm just not getting round to it. I'm hoping that after this one I can do a bit of exercise and get it all down again” (W25: South Asian Later Generation)

“After finishing my pregnancy I'll start doing more physical activities again” (W13: European)

One of the European women did not express a strong intention to do exercise: she said it depended on whether she had got enough energy to do it.

“I do know that I am trying, but I just haven’t got the energy to go do physical exercise. So maybe if I had a bit more energy I’d do the physical exercise, but I haven’t got it, so I’m not going to put pressure on myself to do it because I’d just be upset all the time, I don’t want to do it, so no” (W9: European)

Overall, women from both groups showed a high motivation to start exercising after delivery, except this woman only, who needed extra support and motivation.

iii) Body weight management after pregnancy

Most of the interviewees expressed an intention to lose weight after giving birth. This comes across in two of the first-generation South Asian women’s statements:

“I need to lose more weight when I finish having this baby in July. So, I mean, I’m alright, I’m just waiting for the time when I can get back to the gym” (W23: South Asian, first generation)

“After my delivery I’d like to reduce my weight. I am concentrating on reducing my weight” (W30: South Asian, first generation)

To achieve the goal of losing weight after giving birth a combination of exercise and healthy eating is needed. Through the interviews, some of the women expressed an interest in practising a healthy diet combined with regular exercise to achieve their target. They seemed very prepared and eager to start practicing a healthy life-style after giving birth:

“But this time I’m, like, preparing myself before, I have to do this, I have to do exercise, I have to go to the gym. I was prepared. But before this pregnancy I was not like that. Like, I need to reduce my weight” (W6: South Asian, first generation)

“After giving birth it will definitely be a regular gym exercise again, going back to the classes and generally just eating healthily, cooking meals instead of ordering take-outs, and just generally keeping that up” (W18: European)

“But it is, like I say, I do really, really, really want to change, but it’s looking after everybody else that’s getting me. I mean, it’s all well and good... I mean, I know diet-wise I could change that without a doubt, that’s not an excuse, but it’s the physical side of it which I need as well” (W10: European)

“Probably doing a bit more exercise. You know, maybe you learn a bit more about different sorts of foods, or what could be a different, better alternative to something I’m already eating. But apart from that I think it’s just things that you learn as you’re going along” (W11: European)

“Try not to eat more sweets and junk food, and physical activity, you also need to, like, consume the energy rather than sitting here” (W19: South Asian, first generation)

However, one of the later-generation South Asian women expressed no intention of losing weight, because of her sister’s experience of failing to lose weight.

“I mean, my sister's on a diet, you know, she's been on a diet for the last fifteen years [laughs] and I always say to her, it hasn't made much difference for you anyway. But yeah, I mean, not really. I mean, I just... sometimes I just think, ‘Oh, forget it, I can't be bothered to diet’, you know. What's the point, you know” (W25: South Asian, later generation)

Losing weight needs a combination of practicing a healthy diet and exercising. Most of the women showed willingness, intention and high motivation to change their behaviour towards practicing a healthy lifestyle. However, some of them did not show any positive intention towards practicing a healthy lifestyle, for example by losing weight after delivery, due to past experiences or other factors, such as not having enough social support or being emotionally unstable.

C) SOCIAL/PROFESSIONAL ROLE AND IDENTITY

This section describes the social/professional role and identity among the South Asian population that influences the lifestyle of South Asian obese pregnant women, especially among the first generation of South Asians. There is a difference between South Asians and Europeans, especially in terms of their social and group identity, in

that since they migrated to the UK, they had adapted to a new lifestyle and at the same time kept the culture of their country of origin. This section highlights the social and cultural identity of the South Asian women as it comes across in their daily lives, either when living in the UK or in their country of origin.

First-generation South Asian women sometimes found that when pregnant they became less active, since all the house chores would be done by others.

“Yeah, everyone will do the housework for the pregnant women, yeah” (W19: South Asian, first generation)

Furthermore, some of them had domestics who help them with the household work, such as cooking and cleaning. Their daily routine had become totally different once they had moved to the UK.

“So when I was in India, first of all, I had servants who would make the food” (W17: South Asian, first generation)

“No, in India I was hardly doing any household work, but here, yeah, I do quite a lot. Because we have to do everything by ourselves, no? Yeah, in India there are maids as well... So they do most of the things. And cooking, my mum used to do it. So, yeah” (W21: South Asian, first generation)

“At home I never used to wash clothes or take the clothes out of the washing machine and put them in the dryer and then fold them, for all that I had support, I had help. We had complete support for it. And cleaning the house everything, we had complete support. But here I do everything by myself” (W31: South Asian, first generation)

Not everybody had a helper at home; this depended on their economic circumstances.

The obese pregnant women who did their house chores in their country of origin preferred to live in the UK, due to the availability of home cleaning and cooking technology. One of the women reported that she lost a lot of weight when she lived in her country of origin, due to the physical work involved in household work.

“In India I didn't need to do any exercise because I had a lot of physical work to wash my clothes. I did not put them in the washing machine, only hand wash, so that's one physical activity. And then to clean the house and everything, compared to India here really easy, India really hard, but in India I have a lot of physical work, that is the main physical exercise for me. Every day for whole day I'm doing some work in India; here most of the time I am relax, not that much work. I am doing physical... I was in India then and I'm doing a lot of physical work, so I reduced twenty kilos” (W30: South Asian, first generation)

“And the thing is, like, here all the things, like hoover and other things and in India we have to use like a mop, we have to sit and do the mop. It's, like, sitting position, sit on the floor and, like, you bend, yeah, scrubbing position and do the mop. But here with the things life is easy” (W6: South Asian, first generation)

“Yeah, there is a difference with the lifestyle. Like, in India we had to do everything by our own, like, we need to do cleaning and washing clothes by hand and everything. And here we use machines, like washing machines and hoovers and stuff like that” (W19: South Asian, first generation)

“I like here much better than in India. I was working there full-time and because my father was not there the pressure was on my hands. So, I was the only earning person there. So when I came here it was so relaxed” (W21: South Asian, first generation)

Living in a joint family is still very common in South Asian countries. This cultural features still remains in place after they have moved to the UK. One of the later-generation South Asian women felt no privacy when living with her in-laws, and declared that this affected her daily living circumstances.

“...In India we, like, all lived in a joint family; my in-laws will be always there and my brother-in-laws, sister-in-laws. Sometimes it's like... sometimes it's difficult but not all the time” (W6: South Asian, first generation)

“I didn't have a job at the time, so I was at home, and was just content. We were going out to be together and we used to go for a meal, because we used to live with my in-laws and his two brothers, so there was no privacy. So the only time of privacy was if you went out. But where do you go out? It's for a meal. And then you're just eating. So there was no exercise or anything (W24: South Asian, later generation)

One of the second-generation South Asian women who had just moved to her own house mentioned how relieved she was not living in somebody else's house anymore.

“Obviously it's more relaxed [laughs]. Very more relaxed for me, more chilled out, I can pretty much do what I want to do, so yeah. It's just peace of mind really. I was always on edge because it was somebody else's house; I had to dress a different way and, you know, certain things, so it's just much better” (W27: South Asian, later generation)

In South Asian cultures, there is a belief that body size will determine the gender of the baby. This may influence prospective mothers to put on unnecessary weight.

“I think some Asians say that when it's a boy you get double, and when it's a girl you get, like, more weight” (W21: South Asian, first generation)

In terms of diet consumption, South Asian recipes contain a lot of oil. One of the respondents changed her cooking style by using less oil after moving to the UK.

“I told you it's too much oil in Indian and everything in curries and lentils, like everything, Indian bread. And I started here so, same thing, but I think it's not worked here, we have reduced oil” (W20: South Asian, first generation)

Moving to the UK may increase weight among first-generation South Asian women.

Three of the women interviewed shared their experiences on how their lifestyle had changed after moving to the UK, such as using the car for transportation instead of walking, and the availability of cleaning technology such as washing machines.

“Yeah, actually it's not, like, exercise in India, what I will do it keeps us doing exercise. Like, if you want to, like... if you want to go to the shops, then you have to go, like, fifteen minutes' walk. Here we can go by car. And if we want to wash the clothes we had to do it manually, where here we get the washing machine. Everything is like exercise” (W19: South Asian, first generation)

“...After I came here I don't have that much weight, I didn't go to gym or I didn't do any exercise, and then my weight has increased a lot. After that, earlier at one stage, I increased my weight again more” (W30: South Asian, first generation)

Two of the first-generation South Asian women had changed their diet due to the availability of different types of confectionery and English foods.

“Yeah, here there's a lot of sweets, like, confectionery is available, so I changed some diet and I put on some weight when I came here, yeah” (W19: South Asian, first generation)

“But the thing is, like, English food we can't eat... We don't have in India this type of, like, roast chicken and other things. We eat here more fried, like, fried things on Saturdays and, like... but in India we don't eat too much fried things” (W6: South Asian, first generation)

South Asian women with a high socioeconomic status were less active when living in their country of origin because they had support for their daily house chores.

Independently of their socioeconomic status, once they got pregnant, the other family members will do the house chores for pregnant women, if they live in a joint family.

Living with other family members, such as their mother and father in law, is still a widespread practice among the South Asian population, especially among second-generation immigrants.

Among the first-generation South Asian obese pregnant women, moving to the UK can have either a positive or a negative influence on their life. Some of them put on weight after moving to the UK due to being less physically active because of the technological support for cleaning, cooking and transportation, and because of the greater availability of confectionery and English foods.

D) BELIEFS ON CONSEQUENCES

All of the interviewees were concerned for their baby more than for themselves. As shown in the discussion in the sections on behaviour regulation and memory, attention and decision making, these obese pregnant women made an effort to exercise and change their lifestyle after getting pregnant. Having a healthy baby was their main priority; this prompted them to practice a healthy lifestyle.

“Yeah. It’s not just about you anymore, it’s for the baby” (W12: European)

“Yeah, looking after myself and the baby will be my priority now. So I’ve got nothing else to do” (W22: South Asian, later generation)

“I just want to, obviously, have a healthy baby, and then worry about my weight and stuff afterwards” (W27: South Asian, later generation)

However, some of the South Asian women lack an appropriate education on matters related to body weight management and its consequences for the foetus.

“I don't do [yoga] this time, but I'm just scared about doing anything because of my bad experience, so, yeah” (W20: South Asian, first generation)

“During pregnancy, for, like, to reduce my weight, I don't want it to affect my baby. For that reason I’m not concerned about the weight” (W30: South Asian, first generation)

However, many of them also understood that exercise has positive effects not only on themselves but on their baby as well.

“Because if you’re just sitting there, doing nothing all day, it’s not good for you or the baby. I think exercise is very important if you want your baby” (W22: South Asian, later generation)

“Yeah. It's good to be exercising, keep yourself fit so that there's no issue after” (W31: South Asian, first generation)

One of the first-generation South Asian women believed that being active will give her a low risk of needing a caesarean section during delivery, which is not her preference.

"I want a normal delivery, yeah. Which is what my mother also told me, that if you don't keep yourself active you might have a c-section, and if you have a c-section you can't lose the weight, and that kind of is in the back of my mind since becoming pregnancy because I don't want it. That's somewhere in my head, something that I just want a normal delivery" (W17: South Asian First Generation).

Some of the obese pregnant women understood that they needed to change their diet and practice a healthier lifestyle to reduce the risk of developing disease during pregnancy or at least control any current disease.

"Being pregnant, and this one being healthy, and trying not to have preeclampsia again, and decreasing my chances of being diabetic again and things like that..." (W12: European)

"Normally I don't eat a lot of sugar because I don't take sugar even in my coffee or tea. Normally I don't, normally after pregnancy I've cut down my rice, once in three days or something I'm eating rice so that it helps me to control my glucose levels" (W31: South Asian, first generation)

Most of the women put an effort to practice a healthier lifestyle after learning they were pregnant, because they understood that an inactive lifestyle will have adverse effects on their baby's health and outcome.

E) BELIEFS ON CAPABILITIES, OPTIMISM & GOALS

In this section, I will discuss the interviewees' beliefs on capabilities: their self-confidence, optimism and goals as far as their lifestyle is concerned.

Women from both groups seemed confident and optimistic that they could lose weight. They understood how to achieve their goals.

"I managed to lose some weight when I went to gym and stopped sweets, yeah" (W19 South Asian, first generation)

"Like, I know I'll gain much weight now, and then I'll reduce it as well. So it's in my hands, I can control it" (W21: South Asian, first generation)

"Yeah, if you want to reduce your weight you have to do, and do exercise and do anything" (W20: South Asian, first generation)

"I know what I want and I know how to do it" (W2: European)

"Obviously, I know it's always been my choice to eat what I want to eat before, so it wasn't anyone's fault but my own. So there's only me that can change it" (W11: European)

"So, as soon as this child is born I'm going to be, you know, trying to do what I can to get it down again" (W7: European)

Another two of the women opined that they needed more willpower to practice a healthy lifestyle and lose body weight.

"Yeah, meditation and, I think, more willpower... Yeah, if you want to reduce your weight you have to do, and do exercise and do anything. Like, will power like that, I want to do this, then you can do it, I think so" (W20: South Asian, first generation)

"If I had more willpower to do it, yes. If I had better willpower to do it, to stick with eating no sweets and no chocolate and no crisps and stuff like that..." (W12: European)

A European woman stated that she would only achieve her target if she could become more disciplined:

"As I say, just eat a bit less and to exercise a bit more. It sounds really simple when you put it like that, but if the people around me were a bit more conscious of what they were buying, that would help. And for me to just have a bit more discipline with myself" (W16: European)

Some of the obese pregnant women mentioned their previous goals on losing weight before getting pregnant, which unfortunately they did not manage to achieve. One of the women understood the reasons why she failed to achieve her goal and knew what she should do in the future.

“Yeah, I did last year. And then I did lose some weight, but I couldn’t reach my target and then I fell pregnancy again, so...” (W23: South Asian, first generation)

“Yeah, before, but that goal was a wrong goal because it involved doing wrong things. Now it’s not...I know what I want and I know how to do it. Join a gym, eat three times a day, proper food not junk, and just be more active” (W2: European)

“It’s too high. But obviously I was losing weight anyway, so I didn’t reach my goal, my target, so I still need to lose more weight when the baby’s born” (W8: European)

It seems that most the women made a plan and set their sights on losing weight after giving birth.

“After I’ve given birth I know that I do want to... I do want to try and eat more healthily because obviously I’m going to have two kids to look after now, so I will need more energy” (W15: European)

“If I’m not pregnant my plan is, go to a gym, regular walks and eat regularly and healthy, that’s my main goal. I have a goal already and he’s not even here” (W2: European)

“Maybe reduce by another five kilos or six kilos, I would be happy, that’s it. I don’t want to become skinny. I would look odd being skinny. I don’t want to be skinny or thin, I just want to reduce by some... I don’t want to massively reduce. I’m seriously feeling I don’t want to massively reduce and look like a patient. No I don’t want to. I want to look healthy and maybe go down a few kilos, that’s enough for me. As long as I’m healthy it’s fine” (W31: South Asian, first generation)

“It was steady. It was... it stayed to about sixty, sixty-one kilos, I wouldn’t... it wasn’t going higher and it wasn’t going lower. I needed to get it down. And my aim was the get to eight and a half stone...” (W24: South Asian, later generation)

Based on the women’s behaviour regulation during pregnancy, most of them stopped exercising when they learned that they were pregnant. However, they were very optimistic and believed they were capable of achieving their goal to reduce their weight by practicing a healthy diet.

8.3.4 OPPORTUNITY

A) ENVIRONMENTAL CONTEXT AND RESOURCES

The definition of environmental context and behaviour is “*Any circumstance of a person’s situation or environment that discourages or encourages the development of skills and abilities, independence, social competence and adaptive behaviour*” (Michie et al., 2014). There are four main components of this related to this section: availability of programmes to lose weight, advice from health professionals, money, time and moving to UK.

i) Programmes to Lose Weight

Various opportunities are available to help obese women lose weight in the private sector. The two most common programmes were Slimming World and Weight Watchers.

“It was obviously looking at how unhealthy. I’d cook food as well, and obviously, as I say, my portion sizes. So I cut down on portion sizes and stopped cooking everything in oil and got that Fry Light stuff and it all still just tastes the same. Because I thought... I always used to think, ‘Oh, if it’s healthy it’s going to taste crap’, but it doesn’t” (W15: European)

“Um, it probably could be better, probably could be eating a lot more fruit in my diet. And wholemeal bread and things, so I probably could change it that way. But I know it’s better than what it was because before was pregnant I was on Slimming World, so I’ve kind of got into that frame of mind of how to cook my foods and what not to add to foods. So it’s better than what it was” (W3: European)

“I used to try Weightwatchers but I don’t like watching exactly... like, reading calories. I think over the years, because I’ve learnt a lot about what’s good for you and what’s healthy, for me, personally, what makes me put on weight, I’ve learnt it because every so often I’ve started dieting. So, then, because of that I know how to lose weight. I know I have to go to the gym and have to exercise, have to keep the up, I have to stop

eating fast foods, stop eating sweet things, have more protein, have more vegetables, less carbs, and things like that” (W: South Asian, later generation)

The obese pregnant women who had joined these programmes before getting pregnant identified knowledge and skills that they learnt throughout the programme. These include knowing the appropriate portion size for themselves, improving their cooking skills, choosing healthier food, counting calories and joining an exercise programme.

ii) Advice by Health Professionals

Four of the obese pregnant women shared their experience of how health professionals influenced them to improve their lifestyle. The usual advice given by health professionals to the women may encourage them to practice a healthy diet and to exercise.

“In 2013 in June/July, we went to the doctor and they suggested to me to ‘reduce weight if you plan for pregnancy’ or something. Then I started this... planned my diet this way, I started yoga and walking, and hopefully I... yeah I reduced my weight eight kilos” (W20: South Asian, first generation)

“The doctor did say to me, you know, ‘you shouldn't be trying to diet, like diet drastically, you should be eating healthily’. So... but then I'd stopped doing the diet thing quite a while ago because I didn't believe it would work. So my main thing is just trying to eat normal” (W29: South Asian, later generation)

“Yeah, and before. Yeah, I did want to start going more because my doctor told me, you know, it would help my hips, it would take the weight off” (W10: European).

“To make sure that they were healthy because that was one of the things, because I got told by the dietician, with the diabetes, to exercise on a regular basis. And then the midwife, she also said... so everyone was saying, ‘exercise’. So it kind of makes you think, okay, if it's just one person telling you then you kind of ignore it, but if everyone is telling you, you think, ‘okay, it's something I need to do’... That's worked and then, obviously, we did a different centre and we had different consultants. New medication as well, I think it's all mixed but the healthy eating, it was more drummed in this time” (W24: South Asian Later Generation)

The present availability of health professionals' services gave a positive opportunity for these women to change their behaviour.

iii) Money

Some of the interviewees, especially among the later-generation South Asians and the Europeans, stated that healthy foods such as fruit and vegetables were much more expensive than a ready meal and processed food. This reportedly affected their ability to buy fresh food and healthier food options.

"It's expensive as well, you know, fresh fruit, it's a lot cheaper to buy biscuits" (W8: European)

"Yeah, I mean, the more fruit you buy, the more expensive it is. I've noticed that. If you go for the healthy option it's more expensive. And if you go for the not so healthy, like crisps, biscuits, it's cheaper. So fruit costs more expensive, vegetables cost more expensive. Having processed foods, like fish fingers and pasties, ready-made stuff is cheaper. That's... it does affect your... Money-wise, I think, if you're earning more, you can, you've got a better lifestyle, you can buy more fruit and vegetables, but if you're not earning that well, normally people go for the cheaper option" (W22: South Asian, later generation)

"Sometimes. I would like to buy organic fruit and veg but sometimes it's very expensive, so we just get normal fruit and veg. I think that's the only thing, really. Yeah, nothing else really makes a difference. If we need to get something that costs a little bit more we will because it's better for us" (W28: South Asian, later generation)

"I mean, I always... the way I shop now is the way I've always shopped. I always look at offers, you know, I don't buy expensive things, I buy medium, you know. So I don't think my spending has changed. And of course it must have... I mean, obviously, everyone's money affects what they buy in terms of, you always want to budget. I mean, I've always been like that, I've always budgeted" (W29: South Asian, later generation)

One of the European women stated that money did not affect her food choices because she was very careful in her spending habits, buying products on offer:

“Not really, because we're quite careful with our money anyway, so we do buy, like, Tesco Value, we don't tend to buy brands and stuff. And if there's things on reduced, that are, like, meats and stuff that we can chuck in the freezer, we'll get those. Money's not a big issue for us really” (W16: European)

Another European women stated that she had a food budget and that she plans for each meal, in order to control her expenses.

“Not really, because we know where we're going and we know... I can generally know how much things are going to cost. We have a food budget that is there and that works out throughout the month. Again, because I meal plan I know what is happening, and where the meals are going, and how much each meal will cost, and plan the cost per portion. So I'm quite savvy with what's happening with the meal budget. If we didn't have the money there then I'd be upset that we didn't have the money and I'd wonder where it had gone. But generally it's, we buy it because we want it and we don't want, you know, the stuff... I've found that when I have bought fruit and veg from the supermarket it seems to go off quicker, so I'd much rather just carry on with what we're doing” (W14: European)

Even some of the women who have a food budget and who buy items on offer find it difficult to follow their meal plan because the offers in stores keep on changing. The fact that fast food or ready meals always have a good price may influence them to buy those foods instead of cooking from scratch.

“But when you go out and you go food shopping, one week a tin of beans could be thirty pence, the next week they will be seventy pence, it's ridiculous. And they do chop and change with their prices. If they was to keep things the same instead of keep upping and switching things, thinking that everyone's rich, it wouldn't be a problem to people to eat normal food. And that is why people go to the fast food section, it is because you'll have a fast food meal there that will take two minutes in the microwave and they can sit and indulge in grease. When they could probably go and get two pounds' worth of veg and do a nice meal with it, and they just can't be bothered, because the government's got so low with money” (W1: European)

Another two of the European women stated that they chose to go shopping in certain stores because they were cheaper than others.

“So, yes, money does affect... like, things like cheese, I didn’t realise how expensive cheese is, so I’m more likely to go for, like, discount shops like Aldi and Iceland and Lidl because it’s way, much cheaper than the big name brands” (W9: European)

“Because Iceland is cheaper” (W13: European)

This shows that economic status plays a significant role in influencing healthy food buying and consumption.

iv) Time

Most of the interviewees adduced lack of time as a reason why they did not do any regular exercise.

“Even if it’s a walk around or, you know, you should, but I just don’t have much time, that’s all” (W25: South Asian, later generation)

“More time in the day [laughs], so I can go to the gym and... because I do enjoy doing things like that, it’s just I don’t have the time” (W7: European)

“I don’t get time, to be fair, just like... yeah, to be fair, I don’t get time as well and I feel, like, already tired with my baby and the household work, so I don’t really get...” (W21: South Asian, first generation)

There are two main reasons why they had very limited time to exercise. The first one is that they were very busy with the house chores, such as looking after other children.

“I don’t know, really. I mean, I think I need a bit more time as well. I’ve got a lot going on with my children and my hands are full at the moment, to be honest, so a bit more free time” (W25: South Asian, later generation)

“Probably if I didn’t work as much, but then I might end up staying at home or... I don’t know, a bit of extra time, really, and energy” (W16: European)

“Just taking time out probably, making the space to do it. I mean, I’ve just got to cook, clean, look after my daughter and do things, so it’s trying to make some space in the day to do it, probably” (W27: South Asian, later generation)

“Having more hours in the day perhaps... So you know, it’s a bath, pyjamas, bedtime story and bed. So more hours in the day would mean that I could go and do something that I wanted to do. So, you know, I could get up earlier I suppose, but half five is already quite early so I don’t want to give up any more time in bed than I have to” (W14: European)

Another reason is that some of them were working, and so instead of going out to exercise, they had to do the house cleaning, cook and look after their children.

“More time, probably. Yeah, sometimes I come home from work and there’s housework to do, so I don’t have time. So if I had more time I could” (W8: European)

“Time [laughs]. Time is a big thing, you know. I’d have to give up work at office. You can’t deny anything, it becomes like that when you grow up as an adult and you have a family running, you have to run the family, you have to exercise, you have to do so many things... Everything is important, I can’t deny anything, but you have family, taking care of them, taking care of everybody is my priority and you have to make some time” (W31: South Asian, first generation)

“Having the time basically. If I’m not working, then I will have the time (W22: South Asian, later generation)

“If I didn’t have to work full time [laughs]. If I didn’t have to work, then I think it just frees up my time because it’s just me and my husband, I have to do everything in the house and I work full time so it’s just... and I don’t have my immediate family here, so I don’t have help from anybody, so everything it seems... I just seem... it just seems more hectic when you’re married” (W29: South Asian, later generation)

Two of the later-generation South Asian women stressed the importance of time management. They made time to exercise by following a strict schedule.

“You haven’t got a choice, you have to make time” (W22: South Asian, later generation)

“I think sometimes your routine helps. I mean, I do long hours, so I do a lot of travelling, so I have to be very strict and I have to make time for exercise. Whereas some people, when they’re busy they don’t make time. And I think you’ve got to enjoy it as well, and when you do it with your friends and other people that helps as well” (W28: South Asian, later generation)

These women seemed to lack of time for themselves, being too busy with their daily routine, doing the house chores and looking after the children. They were even more burdened if they were working.

The availability of programmes and advice to lose weight provided by health professionals has a positive impact on these obese pregnant women's ability to improve their lifestyle. Lack of money and of time are the two main barriers which discourage a positive lifestyle among these women.

B) SOCIAL INFLUENCE

The definition of social influence is *“those interpersonal process that can cause individuals to change their thought, feelings or behaviors”* (Michie et al, 2014). This section analyses the influences, whether coming from individuals (children, husband/partner, parents or other family members and their circle of friends) or from social support structures, that may influence obese pregnant women to regulate their behaviour, for example to practice or not practice a healthy lifestyle.

Children

Having children plays a significant role in influencing obese pregnant women's lifestyle. To some extent, this issue has been discussed in the section on environmental context and resources, which cited lack of time and the necessity to look after their children as the main reasons why these women do not exercise.

“Well, really, I just need some help with my kids, so usually my husband looks after my children for a while, so I can just go to the gym and come back” (W23: South Asian First Generation)

“Just I don't have time and I'm not that hungry, I suppose, I'm just rushing sometimes as well, with my daughter, and stuff like that” (W27: South Asian Later Generation)

Looking after children, then, gives rise to a contradiction. Although some of the women did not take any regular exercise, they might increase their physical activity by playing with the children or looking after them.

“Yeah, we play football, like, he will run around after me and things like that. I'm quite active, really, in terms of that” (W16: European)

“I could do it during the weekend, like, I do tend to take the kids out on weekends, go out on the bikes and stuff. And obviously we do things, family things, like that. So to me that's exercise. I'd rather do it with my children than go and stand in a gym” (W11: European)

“Probably my children because I'm running round after them, so you know, I've got to be up and about and getting things done” (W3: European)

“I think it's having the children; they keep me energetic, don't they? I'm always on the go” (W5: European)

Having children prompted them to eat healthily because they needed to make sure that their children consumed a proper diet and to be a good example to them.

“But with having a child our eating habits have changed in that there's more fresh fruit and vegetables in the house than there was previously, which I didn't think was possible... So this time round it's just making sure that we are eating healthily still, or maybe even trying a little bit harder with introducing different veg's and different fruits to our little girl, just so she can see” (W14: European)

“I'd say it was a bit more frequent last time. I think we were a lot easier going then. We didn't have specific times to be at home; like, now we have to be home at a specific time because [the daughter] needs to get home, have dinner and have a bath and then bed. Whereas before it was, we could be out at 8 o'clock at night doing whatever, and then go, oh I'm hungry I need to eat something, so it was easier to just get a takeaway than it was...” (W12: European)

Women with children need spent more time looking after their children instead of exercising. However, playing with the children may have increased their daily physical activity and prompted them to consume a healthier diet, since they needed to prepare a healthy meal for their children and be a good example to them.

Husband/ Partner

The presence of a husband or partner also played an important role in supporting these women in focusing on looking after themselves and on practicing a healthy diet.

"I would say yes, but my husband always complains, you're not eating healthy. Because he forced me to eat more, but I couldn't... Yes, more foods, more healthy food, more lentils for protein, more salad, more milk or something, but I couldn't" (W20: South Asian, first generation)

"My husband put on weight after we got married, he put a stone and a half on. So he needed to lose... he just felt he needed to lose weight as well... and I think if my husband is doing it as well, or if you've got competition or something, it makes you want to do it because you think you don't want to put weight on" (W24: South Asian, later generation)

"I know I should eat better. I know that there's room for, like, cutting out cakes and, like, chocolates and things. My husband works as Tesco so he tends to, like, get the reduced cakes and he'll bring them home and that's a problem. Yeah, I know that there's, like, healthier options and I'm not in the best shape that I have been, like, over the years, so I would like to get back to a decent size, but as I say, after the pregnancy probably, not now" (W16: European)

A positive influence from the husband/ partner will help their wife or partner sustain a healthy lifestyle, but a negative influence may have the opposite effect.

Parents / Other family members

Most the later-generation South Asian women and European women have a good support and help from parents and other family members.

“Yeah, they come round quite often. Because I'm the youngest of the family, so they're quite worried about me, especially on my own now, living by myself. Well obviously with my husband, but he's at work. Because I've had scares before the pregnancy, but yeah, they came down a couple of weekends and gave me some food, home-cooked food. It's nice to have your mum's home-cooked food, so she gave me a lot of food to, like, put away in the fridge and put some away in the freezer so I don't have to cook, I can just get it out and warm it up” (W27: South Asian, later generation)

“Yeah, they [her parents] don't really eat it [take-away food]. So they prefer if you go to my parents and his parents, both parents, they both prefer to eat home cooking rather than getting a takeaway” (W24: South Asian, later generation)

“We're all pretty close really. They help out with... my parents and [her partner's] parents help out a lot with our little boy because we both work full time. We got married last year, so we're newlyweds” (W16: European)

“Yeah, we've got a lot of support. I've got my dad; I'm one of seven you see, so I've got my dad and my siblings, obviously, I've got older brothers and sisters and I've got one younger sister. I've got great friends, great colleagues at work. I see a lot of them, always wanting to help. Not when the baby comes, though [laughs]” (W5: European)

In contrast, first-generation South Asians who had just recently moved to the UK lacked family support and some of them felt lonely after relocating.

“Yeah, I need somebody... like, I was alone here...” (W20: South Asian, first generation)

“Obviously in [the home country,] because I had more social life, I could go out at a time when I wanted. I mean, you know that odd time when you want sometimes, you just want to leave the family aside and then give one evening for yourself. That was very easy; here it's very difficult. I don't blame it, but the circumstances are like that” (W31: South Asian, first generation)

However, the social support from the parents might give disadvantages to them as well, being less physically active, and consuming extra calories because more food was served.

“Yeah, in India during pregnancy everyone will take care of us, like, every pregnant woman. So in [her home country] if I am pregnant there I don't think I would do this much walking and exercise because everyone is concerned about you and 'you need to take rest', like that” (W19: South Asian, first generation)

“Yeah in [her home country] my mum did a lot of different types of food, and my relatives, they bring some new special food for me” (W30: South Asian, first generation)

Friends

First-generation South Asians not only get less support from family members, but have less social life with friends than while they lived in their country of origin.

“I don’t have many friends here, though. But, yeah, I spend my time with family. It’s, like, good time, yeah. Great time” (W21: South Asian, first generation)

“India more a social life. Here the social life is very restricted. I mean, you have to make effort here to become social with people. Social life in the UK is very difficult” (W31: South Asian, first generation)

Among the second-generation Asian and the European women, most had a good circle of friends who gave them support when necessary.

Friends, I’ve got a few friends that are quite close, and then I ask them for help, like, when I’ve been a bit tired they’ve helped bring some food over and stuff (W24: South Asian, later generation)

“My relationships with my friends are fine, I see them when they’re not at work and that, and we go out, we go shopping, take out kids to the park as well and just do what friends do, just hang out” (W15: European)

However, based on the testimony of one of the European women, having a good support from friends may lead to consuming unnecessary food and increase calorie intake.

“I need to tell people at work to stop bringing food in, because I don’t tend to take much stuff in, but if it’s there I will eat it. I think it helps when you get in a culture where, you know, everyone at work brings things in like that, you do tend to... you do tend to eat more” (W16: European).

Community / Family Negative Perspective

Some of the women mentioned that they experienced having unnecessary comments regarding their body weight problems from family members or the community.

“Vile words coming from people, close people. I’m fat and I’m disgusting and, yeah, I don’t like my body weight, never have” (W1: European)

“Because of people staring, people making comments. I will push him on the swings and stuff and I’ll walk round with him, but I won’t... if this was me five years ago I’d have been up on the climbing frame with him, I’d have gone down the slide with him, I’d have been on the swings with him, you know, I wouldn’t have cared what anyone else thought because I was happy. But now I’m so embarrassed to even try it because we’ll be at the park and it always seems to be my partner who is off playing and I’m just kind of sat there. Which isn’t me. It’s really not me” (W10: European)

“Just getting tired in the body, getting fed up, nothing looks right. My parents even say, ‘you’ve put weight on’, every time you see them” (W24: South Asian, later generation)

Such negative comments may have an adverse effect on the women involved, and may lead to their feeling isolated and stressed.

Having a good positive social support and influence may help these women to control their weight and to practice a healthy lifestyle. However, stigmatism on the part of family, friends and the community at large, as well as an unhealthy culture, may have adverse effects in these women’s social life and prevent them from improving their lifestyle.

8.4 SUMMARY

This chapter presents the qualitative findings on obese pregnant women's views on their current behaviour related to “opportunity”, “capability” and “motivation” to change their behaviour towards practicing a healthy lifestyle. All transcription interviews were coded on the basis of COM-B Model and TDF themes, as explained in Chapter 3 (section 3.4.1 and 3.4.2)

A) CAPABILITY

The two most common themes under the “capability” component are (1) behaviour regulation and (2) memory, attention and decision. They highlight the subjects' capability related to current and past behaviour in terms of practicing or not practicing a healthy lifestyle.

Before getting pregnant, regardless of ethnic background, it seems common among obese pregnant women to skip meals, especially breakfast. After getting pregnant, these behaviours are still prominent among European obese women. Some of them also surrender to eating unhealthy foods, such as sweets and fatty foods. In terms of giving priority to fruit as a snack there are no differences between women of different ethnic backgrounds. They also ate smaller portions to suit their needs.

Most of the pregnant women mentioned that they ate takeaways or ate out at least once a month and up to twice a week. This does not vary with ethnic background. Two of the first-generation South Asian women mentioned that they ate takeaways very frequently, that is, more than three times per week, and that this had been actually more frequent when they lived in their country of origin.

Another unhealthy habit very common among obese pregnant women is drinking squash/ juice or carbonated drinks during pregnancy. This behaviour seems very dominant among later-generation South Asian and European obese women. A similarly unhealthy behaviour is using fad diets to lose weight; this is quite common among later-generation South Asian and European obese women, but not among the first-generation South Asian obese women.

In terms of exercise routine, it seems to contrast with following a healthy eating pattern. Exercise becomes less popular after getting pregnant. Among the South Asian women, doing yoga or walking is preferred before pregnancy and becomes more frequent during pregnancy. Most of the women stop doing any vigorous type of exercise after getting pregnant. However, those women showed an understanding of how important it is to exercise during pregnancy, which contradicts their actions and choices.

B) MOTIVATION

Emotion seems to be a strong influence on obese pregnant women to consume a healthy diet. Boredom, stress, feeling always hungry and tired may influence them to pick unhealthy foods or eat more than necessary.

In terms of behaviour regulation, most of the women stopped exercising after learning that they were pregnant. This was in contradiction with their knowledge status and feeling on exercise, in that most of them enjoyed exercise; the only barrier was that they were scared of adverse consequences on the baby.

Emotion has a strong connection with social influence. Social support from family members, friends and the community can have a positive or negative impact on practicing a healthy lifestyle. Most of the women showed a high motivation to change their behaviour, practicing a healthy lifestyle, especially after giving birth. However, the lack of social and emotional support demotivated some of the women to change their behaviour.

Some of them also have a high motivation to change their lifestyle, especially in terms of consuming a healthy diet after learning that they were pregnant, because they understood the adverse effects on their baby even though they might not have cared about looking after themselves.

South Asian women of a high socioeconomic status were less active when they lived in their origin country because they had support for their daily house chores. Once pregnant, everyone will do the house chores for them, since they live in a joint family, regardless of their socioeconomic status. Among the first-generation South Asian women, moving to the UK can have a negative influence on their life. Some of them put on weight after moving to the UK because they were less physically active due to the technological support for cleaning, cooking and transportation, and the greater availability of sugary and fatty foods.

The obese pregnant women also showed that they were very optimistic, confident and capable of achieving their goal to reduce their weight by practicing a healthy diet and eating healthily after giving birth.

C) OPPORTUNITY

Later-generation South Asian and European obese women who had experience of joining programmes aimed at losing weight highlighted the benefit they got from joining these programmes. This is a positive environmental, context and resources for the obese pregnant women to continue practicing a healthy lifestyle during pregnancy and after giving birth by learning what the appropriate portion sizes for themselves are, improving their cooking skills, choosing healthier food and learning about calorie counting.

Lack of money and of time are the two main barriers which discourage a positive lifestyle among the obese pregnant women. Low socioeconomic status is a huge barrier against consuming more healthy food, especially among the later-generation South Asian and European women, since healthier food is more expensive than high-fat or high-sugar food, or ready meals.

Women with children need to spend time looking after their children instead of exercising. However, playing with the children may increase their daily physical activity and prompt them to consume a healthier diet, since they need to prepare a healthy meal for their children and be a good example to them.

Having a positive social support and influence may help these women to control their weight and to practice a healthy lifestyle. However, stigmatism may have an adverse effect on their social life and their ability to improve their lifestyle, which leads them in turn to feeling isolated from family members and the community.

CHAPTER 9

RESULTS OF THE QUALITATIVE STUDY AMONG HEALTH PROFESSIONALS

9.1 INTRODUCTION

This chapter presents the findings from the qualitative data analysis of the interviews with health professionals. In doing so it addresses the third research question (RQ3) by exploring the views of health professionals related to the knowledge and attitudes of obese pregnant women on diet, physical activity and environmental factors associated with obesity during pregnancy.

9.1.1 Participants

The recruitment of health professionals took place between June and November 2015. All respondents verbally agreed to share their demographic background and all data was kept confidential.

All twelve respondents were female; the majority were White British (eight), two were Asian British-Indian, one was Indian and one was Asian-White British. seven were community midwives, three were obstetricians, one was a diabetologist and one was a dietitian. The average duration of their work with pregnant women was 13 years (range 3 to 29 years). The average length of the audio-recorded interviews were 21 minutes and 39 seconds. Details of the demographic background of each participant are given in Table 9.1.

Table 9.1: Demographics of the health professionals

Code	Occupation	Experience	Length of interview - audio recorded (min:sec)
H1	Community midwife	18 years	20:50
H2	Obstetrician	7 years	32:04
H3	Community midwife	15 years	15:58
H4	Dietician	15 years	43:24
H5	Community midwife	7 years	16:18
H6	Community midwife	29 years	15:26
H7	Diabetologist	3 years	16:23
H8	Community midwife	11 years	28:01
H9	Obstetrician	10 years	24:03
H10	Obstetrician	4 years	13:12
H11	Community midwife	16 years	20:20
H12	Community midwife	20 years	12: 20

9.2 THEMATIC ANALYSIS OF THE PARTICIPANTS' VIEWS OF OBESE PREGNANT WOMEN'S BEHAVIOUR

This section uses thematic analysis to summarize the responses given by the twelve health professionals around their views of obese pregnant women's lifestyle (Figure 7.1). It uses as the theoretical framework COMB and TDF as explained in Chapter 3 (section 3.4.1 and 3.4.2). Fourteen themes have been used (Table 3.7) to code all the transcriptions. All health professionals gave their views on the "Opportunity" for changing behaviours (social influence and environmental context and resources). Other common topics which occurred were "Capability" (knowledge, skill, memory, attention, decision process and behaviour regulation) and five aspects of the "Motivation component" (social/professional role and identity, emotion, intention, belief about consequences and belief about capabilities).

9.2.1 OPPORTUNITY

This section discusses the findings on the opportunity to change the behaviour of obese pregnant women. Increasing opportunity (social influence and environmental context and resources) can increase the motivation of obese pregnant women to change their behaviour (figure 3.5).

A) Social Influence

Most of the health professionals interviewed reported their belief that South Asian women, including obese pregnant women, receive more support from their family members than European women do.

“I would say Asian families tend to have a better support network as regards to extended family than say European” (H6: Midwife).

“Well I guess it’s possible that within the Western European group that they may not have a formed family unit, and in that way may not have as much support” (H2: Obstetrician)

“Generally maybe the ladies from other ethnic communities other than Europe maybe are more supported in their family environment. I know the ladies from Pakistani and Indian places have basically got more backup at home probably a lot of those ladies and family supporting them and you know, preparation of meals and that sort of thing. So possibly they get a little bit more support, so are maybe healthier. But you still get overweight ladies definitely. Whereas the European background, you know, you get a lot of the young unmarried teenage pregnancies, we probably get more of those in the European background, and you know, those girls tend to struggle with the coping with life generally on a low income, maybe not working, dysfunctional families, you know, they don’t see their relatives and, you know, they’ve not got the same sort of backup. So struggling to look after themselves and then on top of that having a baby as well to look after” (H1: Midwife).

One of the health professionals mentioned that European obese pregnant women may get more support from friends instead of family, especially in the younger groups.

“Probably, I mean, a lot of the obese sort of English girls, especially the younger ones, you know, their support network tends to come from their friends rather than their family. Whereas I think Asian families tend to network more in a family unit, don’t they?” (H11: Midwife)

Four of the health professionals opined that South Asian families still live as a united family in one house, especially the second generation living in the UK. This type of

culture suggests that Asian pregnant women receive more social support from other family members than European women do.

“Asian families tend to be large extended families, they all live together” (H6: Midwife)

“So most second generation people, they continue to live in joint families. They continue the same... that has not really changed because I've seen a lot of second generation women who are... who are born here but who still live with their mother-in-laws and maybe joint family with sister-in-laws, etc. So I think the family structure is not so different from what is back home in Asia” (H7: Diabetologist)

There are advantages and disadvantages in having a lot of support from family members. Family members play a big role in helping the obese pregnant women to improve their lifestyle.

“If you have a family unit who understand the importance and realises the impact of obesity in pregnancy, hopefully they'd be able to help them change, you know, lifestyle changes because that is most probably the most important thing for these babies” (H2: Obstetrician)

On the other hand, they may influence the obese pregnant women to eat an unhealthy diet without realising it. The culture of living in extended families in the South Asian population may be an obstacle for obese pregnant women, as well as making it difficult to choose or practice new healthy lifestyles. This is due to the lesser amount of privacy available to those who live with their mother-in laws and other family members.

“They're probably feeding a lot of people, do you know what I mean, because, as you and I both know, Asian families tend to be large extended families, they all live together and they don't necessarily always eat a healthy diet, especially if they're cooking for plenty. They tend to have a high fat diet and don't necessarily, especially the first generation, won't necessarily think that our advice is considered to be suitable” (H6: Midwife)

Obese pregnant women may also receive unwanted advice from other family members living in the same house.

“But obviously some South Asian women it's not a welcome support, they perhaps don't want... you know, say for instance if it's the mother-in-law, they might feel a little bit as though they don't want that support, they don't want to be living with the in-laws etcetera, they want their own space. So you know, for some women that's quite difficult”. (H12: Midwife)

Furthermore, there still exists in South Asian culture a tendency for other family members to keep feeding food to pregnant women, without concern for the food being healthy enough for them. This may be due to the misconception that pregnant ladies must gain a lot of weight.

“I think some older family members still worried about pregnant women trying to reduce food intake or control her weight in pregnancy” (H8: Midwife)

“I think force-feeding by husband, mother-in-law is quite a lot, quite common in Asians. Because if you don't put on a lot of weight they think you are unhealthy and so for a healthy pregnancy they make sure the lady gains a lot of weight; she eats excessively. So that's a misconception.” (H7: Diabetologist).

A few of the health professionals mentioned that support from other women in similar situations is an opportunity during pregnancy and may impact positively on them, increasing their motivation to change their behaviour and to practice a healthy lifestyle.

“Maybe doing group classes with other pregnant women in a similar situation. Because if, you know, you can't tell her to go to the gym because she would find it so hard to exercise and she will get demotivated and come home. While if you get a few obese pregnant ladies together who are all of similar fitness levels then it's a little bit easier” (H10: Obstetrician)

Even though there are both advantages and disadvantages in social support, health professionals argue that these women really need social support to achieve their desired goals.

“You do find in terms of losing weight or keeping, you know, keeping to your targets, so your goals, these women most probably would need support in some form. And if there is no particular family around to give that support then most probably you’d be looking at other ways of doing that for them” (H2: Obstetrician)

B) Environmental Context and Resources

Besides having an encouraging social influence, having a positive environmental context and resources is also important for obese pregnant women to bring about a positive change of behaviour, and in particular to practice healthy lifestyles. The three main categories that emerged as playing an important role in providing an opportunity to practice a healthy lifestyle were identified as socioeconomic status, education and genetic factors.

Socioeconomic status

Socioeconomic status impacts on the lifestyle of pregnant women. Pregnant women who come from lower socioeconomic status, especially among the first-generation South Asian obese women, have higher chances of eating unhealthy food than those belonging to the higher-status socioeconomic group. According to a diabetologist:

“South Asians living here, born and brought up here, I think they're still quite varied depending on how their socioeconomic status is. So the lower socioeconomic status people who are living here who don't work, they probably tend to eat more unhealthily. People in the upper socioeconomic who are second generation British, they are probably - definitely - more healthy. They are more similar to upper socioeconomic white Caucasian people” (H7: Diabetologist)

Financial conditions seem to be a crucial element. The healthier food such as fruit and vegetables are much more expensive than ready meal food or fast food. Obese pregnant

women who have a good financial support may have an advantage in that they are able to purchase and consume healthier food. A good financial situation also enables them to access to exercise equipment and services.

“If you've got a partner that's earning and you can buy decent food and you've got the time to cook it and, you know, it's just very different circumstances, I think, have a lot to play in, you know, people's lifestyles and their health eating habits” (H1: Midwife)

“It's much cheaper to get fast food in comparison to fresh food and, you know, healthy fruit and vegetables, and the lack of education, and it's probably the fact to do with the poverty surrounding that as well” (H9: Obstetrician)

“The more wealthy people might be able to have gym equipment in their homes, but the people who haven't got much money are not going to be able to go down that route” (H11: Midwife)

However, there is the opportunity for low-income obese pregnant women to apply for the Healthy Start Scheme, which, if they are eligible, provides free vouchers for healthy foods such as fruits, vegetables and milk (NHS, 2016).

“I mean, the Healthy Start Scheme is a good one, and if they're eligible for that, then, you know, we can get... we can sign them up for it and then they get vouchers for milk and fruit and vegetables, and there's some incentive then to buy those because they can only exchange them for those particular foods. So the Healthy Start Scheme is a good one but it's only for those on a low income” (H11: Midwife).

There are also a few services or exercise group for obese pregnant women to join in.

Certain activities are free but others, such as “Just for Mums” and “Slimming World”, require a fee.

“...Slimming World, but they have to subscribe to that and pay per week, but Slimming World have got a pathway for pregnant ladies. So if they want to they can access that as well, that's quite good actually, they do get lots of sensible advice with that. So there are pathways and channels out there (H11: Midwife)

“We have ladies in Coventry that run yoga classes and exercise classes for pregnant women. So if they want, you know, to go somewhere to get more advice on exercise they can” (H3: Midwife)

“We do in Coventry also have some... there's a Just for Mums group which we would refer people into if they're willing to give it a go, and they encourage extra, you know, physical activity, and talk about a healthy diet for ladies who are overweight and pregnant. So any that could go into that group we would refer into that as well, and that's a free service for them” (H4: Dietician)

Education

Education may influence individuals in their practice of a healthy lifestyle. A higher level of education increases awareness among the pregnant women and prompts them to choose a healthy diet and to be more physically active. Two of the health professionals mentioned that South Asian first-generation women were less educated than South Asian second-generation women and European women.

“I would say the second generation, particularly if they're born here, are probably better educated with regards to diet. It doesn't mean to say we wouldn't get obese second generation, but you'd probably, on the whole, probably be less... that's in my professional opinion. But it doesn't... I would say on the whole they're better educated as to diet” (H6: Midwife)

“I think white Caucasians are a bit more careful in what they eat. South Asians who live here, second generation, are also a bit more careful. They know; they have some awareness, but Asians who come from the first generation, I don't think they're very aware of healthy eating in pregnancy. They end up eating all sorts and they end up gaining a lot more weight as well during pregnancy, and that's okay for them because they think, yes we should gain this much weight. And so to gain weight and to eat well is considered to be healthy in South Asian first generation women.” (H7: Diabetologist)

Genetic Factors

Some of the health professionals thought that genetics also plays a big role, leading to weight problems during childhood which continue into adulthood and during pregnancy. One of the health professionals said the South Asian second-generation

women had a higher risk of having a weight problem due to genetics and the difficulties of adjusting to a new environment once they have relocated in the UK.

“So I think most women that come that are obese in pregnancy, they've usually had obesity since childhood, and a lot of the time what you do find is that they come with their family members who are also overweight, and so it's obviously, you know, my views are that it's genetics and environmental factors that lead to the whole family being obese” (H10: Obstetrician)

“I don't think so. I think it's getting worse for the second generation, the fact being, say if I come from India, I still have the lifestyle or the good habits from my country, so my risk is higher compared to white person. But when my children grow up here they have... they invite the local um sort of western lifestyle may be helping in some aspects but their food cupboards may not be as healthy so they become even more high risk. And they were more equal to the local population, so yes the second generation have a higher risk. Because a) they had the genetics of the South Asian and b) they had the other influence of the rest of the population. (H9: Obstetrician)

9.2.2 CAPABILITY

This section will discuss the qualitative findings around “Capability” to change the behavior among obese pregnant women. Increasing Capability (skills, knowledge, behaviour regulation and memory, attention and decision process) can increase the motivation of obese pregnant women to change their behaviour (Figure 3.5).

A) Skills

The physical skill mostly discussed by health professionals was the lack of cooking skills to prepare healthy food, especially among the European women. Four of the health professionals were very concerned with their cooking skills, food preparation and shopping skills. One of the health professionals opined that some pregnant women do not have appropriate cooking skills due to a lack of guidance from their parents when growing up.

“I think most of the Asian ladies would be quite happy to prepare food; what I sometimes see in European ladies is, especially the young women, their preparation skills sometimes just aren't there, they've not grown up in families that prepared food. They wouldn't know what to do with, you know, a pile of vegetables; they wouldn't know how to peel and cook them and what to do with them. So cooking skills are quite a difficulty, one which I think I see more in Europeans, you know, people who have been brought up in (place), they sometimes don't know how to prepare food to feed their own kids because they've not seen food prepared, really, very much in the home. South Asian ladies tend to actually acquire those skills so maybe in some ways it's easier to encourage a bit more healthy eating sometimes in that population anyway.”
(H4: Dietician)

“Families are so fragmented now, and I think, you know, there's a lot of discussion about the loss of the skills, children don't see parents cooking and that sort of thing nowadays, and they don't then carry that on in their own life and for their own children. Whereas I think that family values probably in my opinion are still fairly strong in the Asian population” (H1: Community midwife).

“The one thing that we know generally is that people's cooking skills perhaps are quite poor, their budgeting shopping skills also come into that. So it's actually being able to help them understand what they can actually” (H8: Community Midwife)

There is a difference between the South Asian women and the European women on the psychological skills especially on a daily diet. English diets are high in sugar compared to the South Asian diet, which is high in carbohydrate, and the source of it is normally from flour and rice. However, both types of diet can lead to an increase in body weight. One of the health professionals also thought that first-generation South Asian women are less aware of whether they consume a healthy diet than second-generation women, because they think they can eat what they want and do not have the idea that there is an upper limit to the weight gain they should have during pregnancy.

“I think with English diet, it tends to be more sort of sugar based, whereas I think an Asian diet, it's, you know, it's quite often higher in carbohydrates but not necessarily the refined sugars, so you tend to get more sort of flour-based and rice-based dishes and fried things “ (H10: Midwife)

“South Asians tend to think that they can eat... they're allowed to eat a lot more, allowed to eat junk food, they're allowed to eat anything they want in pregnancy; because they are pregnant, they can eat what they want. But I think white Caucasians are a bit more careful in what they eat. South Asians who live here, second generation, are also a bit more careful” (H7: Diebetologist)

Besides cooking skills, good language skills play a big role in helping South Asian women, especially in the first generation, to improve the healthiness of their lifestyle. Those in the South Asian group who have a difficulty in speaking English may feel isolated and find it difficult to access the current services and information related to healthy lifestyle during pregnancy.

“European pregnant women, that can be really variable as well, can't it, but I think that anybody who can sort of speak English fluently and read English fluently is going to be at a greater advantage to access services and get help when they need it, and are more able to communicate if they have problems, either socially or medically. You know, their access to all the services is so much greater. The South Asian population, if they don't have good language skills, I think, can become very isolated, so you

worry that actually there are some, you know, concerns that they can't actually express” (H4: Dietician)

B) Knowledge

Most obese pregnant women have a basic knowledge of diet, physical activity and healthy lifestyle, but they may not clearly know what they should do to improve it or understand the relation between obstetric outcomes and obesity during pregnancy.

“I think a lot of women in pregnancy find it hard to know in terms of health what they can do in terms of exercise, what they need to change in their diet” (H2 : Obstetrician)

“Some of them come in not understanding why, or the relationship between raised BMI and developing gestational diabetes, high blood pressure, all these other problems that you have in pregnancy” (H2: Obstetrician).

“They don't understand the physiology of pregnancy either – or maybe they don't want to; none of us do when we're pregnant – that actually we don't need any extra calories really up until the very last trimester, and then it's only a tiny increase” (H4: Dietician)

Three health professionals suggested that obese pregnant women will have more motivation to improve their lifestyle if they know the negative effect to their baby. They believed that knowledge can increase their motivation and make a significantly different change.

“The only reason they're going to do that is if they know what harm it's doing to the baby”. (H5: Midwife)

The health professionals also reported that misconception still occurs, especially among South Asian obese pregnant women, where there is still a belief of the concept of “eating for two” instead of taking additional calories during pregnancy.

“South Asians, most people think that if you are pregnant you have to eat for the baby and you have to eat for yourself, so that I tell is a myth, it's a misconception.” (H7: Diabetologist)

“I’ve got a baby so I need to eat for two” (H4: Dietician)

They may also lack knowledge and be unclear about which foods are categorized as healthy or not.

“One thing that I have really noticed with South Asian patients, both male and female, and of course, you know, pregnant females, is the amount of fruit juice that they will consume. There’s a great deal of fruit juice being drunk and, you know, I think it’s perceived to be a healthy way to get one of your five a day, but of course it’s so rich in sugar, it affects the blood glucose so much, it’s so high in calories.” (H4: Dietician)

Apart from having a good capacity for knowledge, the opportunity of having positive social support plays an important role to implement knowledge, share it and turn it into practice. This is true across cultures.

“It’s about knowledge and understanding so if they have good knowledge and understanding in the family, so someone within the family has suffered weight issues or has had their own issues and can transfer that knowledge, then that helps a lot. But then if other people have never really got to grips with their own weight issues or haven’t got the same nutritional diet attitude – and I think that can be the same with both cultures – so that depends really on what the family experience has been I think.” (H8: Midwife)

C) Behavioral Regulation & Memory, Attention and Decision Process

Some health professionals said that obese women struggle to control their weight during pregnancy. The women still carry on with their lifestyle as it was before pregnancy.

According to the diabetologist:

“It’s no different from pre-pregnancy, so they carry on the same lifestyle that they had before pregnancy, and they carry on the same. Obese before, then obese in pregnancy, and in pregnancy they do exactly the same things, they don’t really change it very much.” (H7: Diabetologist)

Some of the health professionals also reported that some of obese pregnant do not spend time exercising.

“They don't do exercise. They don't spend separate time for exercise, they just do household, and they think that is enough. And their image is... they think that is exercise and that's enough. So they have very, very poor concept of physical activity.”
(H7: Diabetologist)

According to health professionals, there are a lot of barriers to improving obese pregnant women's lifestyle. Normally, they cannot concentrate on practising a healthy lifestyle and give many reasons as to why they cannot commit to improving their lifestyle. They always face time management issues, especially with regard to exercise. The dietician mentioned a few times during the interview how her patients (obese pregnant women) fail to exercise regularly and practice eating healthy food.

“There's always going to be barriers; there's always going to be, well no I can't leave the house because I've got all these other children to put to bed, I've got this to do and that to do. So just individual, you know, patients will maybe be grateful for the advice and think it will help them; others will not, they will put up barriers. Or, you know, there are some people who won't really say an awful lot when you talk to them about it, but you feel that probably they're not really thinking that it's really relevant to them. They feel that they do enough already is often, you know, well I'm really busy, I've got all this to do and all that to do, how can I fit in some more? So yeah, it's very variable.” (H4: Dietician)

“I think it could be... a lot of eating is actually not needed, it actually is just, you know, maybe through boredom. It's really your brain that's involved with this, it's often boredom leads you to overeat. And then the habits creep in and you know, eating lots of snacks and things just makes you want to eat lots more snacks the next day and the next day, so the habits grow.” (H4: Dietician)

In terms of diet, health professionals also highlighted that South Asian women choose a lot of high-fat food during food preparation. However, habits such as eating fast food are common both among the European and the South Asian population.

“Well I think with the South Asians, they're more likely to actually be cooking and preparing food, but it's the type of foods and preparations that they are doing. Because a lot of Asian food is rich and so lots of cream, oil, that kind of thing, so that... it's making them understand that that does contribute. Looking at portion size

and how often they eat. Whereas it's possible that the other groups would be more sort of fast food" (H2: Obstetrician)

"And then I always go through other things after taking their history and say, well do you ever have, you know, biscuits, cakes, chocolates, any takeaways at all? And you usually see them just smile and say, yeah. And actually I'm shocked that they [South Asians] will perhaps be having a takeaway virtually every lunchtime or nearly every evening meal, and it's always something like, you know, the chicken and chips, which is quite hefty, you know, the batter round the chicken and the chip portion. So they're having quite a lot of carbohydrate and fat in there." (H4: Dietician)

Four of the health professionals said that it is still common for pregnant women to give as an excuse that they are eating for two to fulfill their hungry feeling.

"Some of them will just be quite dismissive of the fact that they've put on a lot of weight, and say well it's excusable because I'm pregnant, and they will use the common terms of, you know, but I'm eating for two." (H10: Obstetrician).

Two of the health professionals mentioned that these habits can develop during childhood and may affect their future lifestyle.

"Quite often they come from families who are already obese, and so it's very much sort of a habit that they've acquired from childhood and from families and the diet that they've been used to eating. So it's very much a lifestyle thing and you know, it's ingrained and entrenched in their psyche and it's very difficult to break habits like that because, you know, they're just so used to it, it's the norm for them, you know, to have bigger portions" (H11: Midwife)

"There's a difference between people who have perhaps had a certain level of activity in sports when they were young and then they've had children and gained weight and are working to get back to their pre-pregnancy weight. But then there are those that have not ever really had particularly healthy lifestyle and are obese as a result of that. So I think it does really vary with women. (H8: Midwife)

Health professionals commonly receive a negative response when giving advice to the obese pregnant women. They have a weight problem but continue with their current lifestyle and do not see the need to change.

"I know there's a number that they don't really perceive they've got a problem. And I've had a few ladies with really quite high BMI who I'm sure have no perception that they've got a weight problem particularly and they're quite happy to be that size. And they're certainly not willing to listen." (H11: Midwife)

9.2.3 MOTIVATION

This section discusses the findings regarding motivation and ways in which it that can influence behavior change in obese pregnant women. Increased motivation (social/professional role and identity, intention, emotion, belief capabilities and belief consequence) can lead to increased opportunity and capability of obese pregnant women to change their behavior (Figure 3.5).

A) Social/ Professional Role & Identity

There are differences in terms of social identity and culture between the South Asian and the European population. It still not the norm for South Asian women, especially the first generation, to exercise in public. It becomes a barrier against practicing an activity or joining one of programs available for pregnant ladies.

“Some of the South Asians, in terms of culture, especially first generation, may not feel as comfortable going out to gyms or going out walking or running in public, maybe because of the type of attire they have to wear. So these are all barriers to getting fit. And some would prefer looking for women-only gymnasiums or swimming pools, and there’s not as many of these around. On top of that, again, it depends on the general culture within the family unit, whether it’s acceptable for the woman to be going out and doing these activities.” (H2: Obstetrician)

“I think I’ve noticed with Asian ladies, they often don’t want to do anything that involves going to a gym or strip off and go swimming. It doesn’t seem to be something that’s, you know, culturally acceptable to them, so that tends to be avoided” (H11: Community Midwife)

Many first-generation South Asian women used to have a heavy physical workload in their country of origin, but their daily routine has changed after moving to UK, in which they are less active.

“It's cultural, I think, isn't it? Back home in India or any of the Asian countries, I mean, fitness hasn't... I think because Asians are hardworking people who work in the fields, they are poor, low socioeconomic status, so they had very hard lives, so they didn't need to go out and exercise. But that has changed now, but they continue to think the same” (H7: Diabetologist).

B) Emotion

Emotion plays a large role in decision-making processes regarding daily lifestyle, especially amongst pregnant women. It seems that some pregnant women use food to comfort themselves, especially when they are depressed, or feeling insecure. The feeling of insecurity will trigger them to eat more high-fat and sugary food, though this eventually increases their body weight.

“A lot of the emotions happening in pregnancy, you know, a lot of other factors that really influence making these clear decision about what to eat, getting caught up in emotional issues of everything, so, yeah, it's not straightforward. There's no easy fix, I think it's going to be a multifaceted sort of approach.” (H8: Midwife)

“We do recognise if you are depressed you've got no motivation actually to look after yourself, you slouch around, you comfort-eat, you don't get your exercise (H4 : Dietician)

Having an opportunity such as social support from family members is really important to help those pregnant women to be motivated to look after themselves and practice a healthy lifestyle.

“Anybody that's got supportive environment, you know, partner and family that are there, they're going to feel secure and happy and safe. And often people turned to food for security and, you know, it's well known that food can be used for emotional support. And if somebody is a single parent struggling for money with other children

at home and perhaps isolated, they tend to go and eat for comfort, you know, eat for boredom and what they're eating is often high fatty, sugary foods because it's cheap and it's easy to prepare.” (H1: Midwife)

C) Intention

Having a positive intention is really important as a first step to change lifestyle and practice healthy behaviour. However, most of the health professionals reported that some of the pregnant women do not have any intention of changing their behaviour and show a negative response after being given advice, especially on exercise. Instead, they continue their behaviour as it was before pregnancy.

“Some ladies, they know it needs to happen and they understand the medical reasons why the advice and they try and take it on board. Other people, they look at you and you can just know, they sort of roll their eyes and you think, no, they're not going to do this, they don't intend to walk here. And others say, no, no exercise, no” (H3 : Midwife)

“Some will initially say it's hard and they can't see themselves finding the time. Or they're too busy and they say that's what their family eats and, you know, trying to change what they eat would mean having to change what the whole family eats and that sometimes can be difficult” (H2 : Obstetrician)

D) Beliefs about Consequences

Understanding the consequences of being obese has an impact on obese pregnant women to change their behavior, as suggested by the health professionals. Four of them observed that obese pregnant women are motivated to improve their lifestyle for the baby's sake, once they have understood the health risks of being obese during pregnancy. Having a healthy baby is a reward to looking after themselves during pregnancy.

“I think they change for the baby, they don't change for themselves; they change for their baby” (H5: Midwife).

“I think they're quite motivated in pregnancy especially, that's a good time to catch, you know, like any person really, because they're quite motivated, they want to do what's safe for the baby” (H9: Obstetrician)

“I think, maybe, understanding the risks that it puts on the baby, because they've got to change and change quickly, the only way, or the only reason they're going to do that is if they know what harm it's doing to the baby. Because they're obese and they've been obese for however many years, and in their eyes they're normal, they're okay, all of a sudden when they're carrying a baby they don't want to do any harm to the baby” (H5: Midwife).

Two health professionals thought that obese pregnant women may have positive motivation if they have health problems before or during pregnancy which may encourage them to change their lifestyle.

“I think sometimes, as I say, like, if they've got a medical problem that comes from being obese, perhaps they're a bit more focused and a bit more motivated to do something, say, like, if they develop diabetes during their pregnancy, then they'd be more motivated to stick to a diet and not put the weight on. But if they think that they're fine and they don't see it as a problem, then they're not going to be very motivated to do anything.” (H12: Midwife)

E) Beliefs about Capabilities

Beliefs about capabilities are really important to achieve individuals' goals. Their self-confidence, self-efficacy, self-esteem and an optimistic mindset will contribute to whether they will practice a healthy lifestyle or not.

“I think it just depends on how focused they are and how determined, really” (H12: Midwife)

“I think, regardless of your background, whatever, I think if you're motivated to lose weight, you will lose weight” (H6: Midwife)

“So they have to help themselves along with the health professionals helping them. So the ones that are motivated and want to make a difference in their life take this opportunity and change”(H9 : Obstetrician)

9.3 THEMATIC ANALYSIS OF HEALTH PROFESSIONALS' SERVICES

This section summaries the responses given by health professionals to questions related to their current services and experience working with obese pregnant women. Better service given to obese pregnant women increases their motivation to practice a healthy lifestyle. All transcriptions were coded under the Environmental Context and Resources (Opportunity) themes of Theoretical Domains Framework (TDF). The themes are organized into four categories: Advice given, tools, gaps and limitations, and suggestions.

9.3.1 Advice on Weight Management, Diet & Physical Activity

Throughout pregnancy, obese pregnant women will receive advice relating to weight management when they have an appointment with their midwife, obstetrician or dietitian. Advice on healthy diet during pregnancy is given verbally. This covers low GI foods, what types of food are good for them and what types of food they should avoid, the misconception on the matter of “eating for two”, and healthy sources of nutrients as well.

“Again, try and focus on low GI foods, try not to overeat. Eat for one and a little bit more, don't eat for two [laughs]. Cut down fatty foods, sugary foods” (H12: Midwife)

“Other than what's currently available in our, you know, in our booking packs, but then, you know, we do give quite a good information on diet; foods to eat and foods to avoid” (H6: Midwife)

“We talk about a healthy balanced diet; always encourage nice healthy sources of protein at meals to fill them up. And encourage lots of vegetables and salads and try and decrease on just those sort of empty calories from, you know, sugary and starchy foods, just, you know, keeping the amounts to just moderate amounts, really, to give balance to the diet. And, hopefully, try to increase their awareness of which foods

actually are really good for them and what they can eat a lot more of without causing too much trouble” (H4 : Dietician).

Basic advice on exercise is also given by health professionals to the obese pregnant women, such as doing more walking, swimming, and being as active as they can.

“Oh yeah, I mean, I certainly promote exercise and tell them, you know, walking is really good exercise, swimming is good exercise. Any exercise is good exercise” (H12: Midwife)

“To increase their activities, even just around the house, you know, to make two journeys up the stairs instead of carrying a big load of things once. Just to generally increase their activities” (H3: Midwife)

“We advise them to try and keep as active as they physically can. We encourage swimming a lot and the use of water, and trying to walk rather than use the car, you know, when you're doing journeys that you can do that” (H5: Midwife)

“I'd advise them to start gentle walking first, because, obviously, if they're obese, they've got, you know, it's going to be a gentle form of exercise. I do suggest swimming, because that is a great form of exercise in pregnancy. And also aqua-natal, that's specifically for pregnant women. So I would start off the more gentle, but at least it's a form of exercise; I wouldn't expect them to be pounding the streets or anything like that, but I would suggest swimming” (H6: Midwife).

Weight management advice consists in a combination of healthy eating and routine exercise during pregnancy. This advice is given with the purpose of containing their weight gain within the ideal range, so as to avoid further complications either to the pregnant women or their baby.

“Well, by healthy eating and exercise I mean, really, it's got to be a combination of the two. And eating the right foods, the right diet” (H11: Midwife)

“Yeah, just to watch what they're eating; make a conscious effort not to put on a lot of weight. So they have to really watch what they're eating and try and improve their exercise, or whatever they can. And, as I said, the general weight gain is about 10-12 kg, we tend to advise them to keep within that” (H9: Obstetrician)

“Support them throughout their pregnancy with healthy eating advice and moderate exercise to help them not to gain too much weight throughout the pregnancy, because

obviously obese ladies are probably leading reasonably unhealthy lifestyles with their eating habits, so they're probably more likely to gain more weight throughout their pregnancy. So if we just... you know, if we can slow down that weight gain to prevent them becoming morbidly obese in pregnancy then, you know, that's going to help the, the pregnancy and the outcome for the baby (H1: Midwife)

Health professionals also identify pregnancy as the best time to give obese pregnant women advice related to healthy lifestyle and motivate them to changing their behaviour.

“I think they're quite motivated in pregnancy especially, that's a good time to catch, you know, like any person really, because they're quite motivated, they want to do what's safe for the baby. They take the advice on board and sometimes it's just, they didn't know about it, and they make an effort to change it to the positive, yeah” (H9: Obstetrician)

“They're quite receptive, and I think pregnancy is a time when you can change their mindset. They can't exercise, they can't start going to the gym in pregnancy, but maybe after delivery they will think about their fitness seriously. But it's a time they do take it and they're quite receptive” (H7 : Diabetologist)

9.3.2 Tools

Most of the health professionals, especially the midwives, highlighted that they do not have any specific tools to broach the topic of healthy lifestyle in their consultations with obese pregnant women. The currently available leaflet contains generic information to all pregnant women.

“Obviously we have a leaflet from the university hospital, a leaflet on... it's a generic leaflet for all pregnant women” (H12: Midwife)

“No, we haven't got any tools, we just again advise them you know, to stay away from sugary and fatty foods and to think about their diet and try and make it as healthy as possible” (H5: Midwife)

One midwife reported that there is a leaflet available inside the booking packs, which gives a list of available services nearby; however, some of these activities were not free.

“There are certain private groups around as well, and we've got leaflets within our booking packs that we give out to them to say, these are other services where you can get tailored advice, whether it's pilates, whether it's walking in the park. So we do give them information about different groups, but a lot of those groups they have to pay for” (H5: Midwife)

Dieticians who focus on pregnant women with gestational diabetes mellitus use specific tools, such as photographs of food plates, to educate pregnant women about the size of portions.

“Asian population in particular, consumption of rice and chapati are really high, both in the men and the women. There's a heavy reliance on having quite a lot of at meals, and I do always check it out. We look at photographs of food plates, and the amount of rice and chapati can be huge for some people. So it's a case of re-educating. This obviously is driving the, you know, the problems with the gestational diabetes and the Type II diabetes and making it very difficult to control, so we do a lot of work with re-educating on portion sizes. But that's where I tend to find the overeating coming in, in the starchy carbohydrates” (H4: Dietician)

9.3.3 Gaps and limitations

The majority of the health professionals were not involved in any pre-conceptual services. Most of them only have a chance to meet the pregnant women once they have made an antenatal booking.

“No, we don't do any pre-conceptual services at the moment with the community midwives” (H5: Midwife).

“I haven't given any pre-conception advice. The advice I've given is once they're pregnant, early pregnancy at my postnatal... at my antenatal clinic” (H6: Midwife)

However, most of the health professionals agreed that pre-conception health was really important, and that the best way to advise obese pregnant women to control or lose weight is before pregnancy. Only health professionals who work in the fertility unit get

a chance to give advice on pre-conception health, and they believe that this opportunity is more effective than a consultation about weight during pregnancy.

“We don't generally see them pre-pregnancy, we will see them once they're, like, 12, 13 weeks. Usually for pre-conception counselling they go to their GP, and I think that is something that is addressed by the GP” (H10: Obstetrician)

“I've worked in the sub-fertility unit as well, so this is where you see women before they get pregnant, and anyone who is overweight you do... unfortunately we can't really offer them lots of management... advise them about dietary and exercise. And this is when you particularly talk about Slimming World or any of these options for them, or Weight Watchers to try and control their weight. So that's the time, and usually we tell them that it's easier for them to fall pregnant as well once they've lost their weight and they feel healthier. And I do find that that works better than trying to tackle it in pregnancy itself” (H2: Obstetrician)

During the antenatal check-up, health professionals have a limited time to advise on exercise and healthy diet, since at each appointment they need to cover all the other aspects of health during pregnancy. They only have a generic leaflet about healthy lifestyle to give to obese pregnant women to read.

“It's a clinic appointment that looks to discuss everything in pregnancy, it's not just about weight loss. So there could be lots of better ways to provide that kind of information to patients, but unfortunately in the clinic setting there's not the time and we don't see them enough, too” (H2 : Obstetrician)

“I think when we do give them their advice, it's usually at their first appointment that we give all of the advice, then we reiterate bits as we go along. That first appointment takes approximately an hour and there's a lot of information given there. So it's probably not the best time; however, all their other appointments are only 15 minutes, so the time isn't really there to have a lengthy discussion at another appointment, which is why we do it at the first one. And I think it's a little bit of information overload, so they probably don't digest it all as easily as they could do” (H3: Midwife)

“All the medical history, obstetric history; so there's lots and lots of things. We arrange the scan, we arrange the consultant appointment, arrange the blood tests” (H3: Midwife)

The dietician plays a big role in giving advice on practicing a healthy lifestyle, especially regarding exercise and healthy diet, to the obese pregnant women. However, in the current system only pregnant women who have had Gestational Diabetes Mellitus will be referred to the Dietician.

“If they develop diabetes they see a dietician but otherwise on a routine basis they don't see a dietician” (H7: Diabetologist)

“We don't routinely refer all the obese women to the dietician either, it's something that if the patient feels herself that she would like some help, then we could refer them on. We don't routinely refer them to a dietician” (H10: Obstetrician)

One midwife reported that in the previous system there was a dietician in the surgeries, but that, unfortunately, the service has been stopped.

“We used to have the dietician in the surgeries, but you know, with all the cutbacks they've been stopped. So that used to be a really good resource, you refer people to the dietician” (H12: Midwife)

Furthermore, current weight management services for pregnant women are only available during pregnancy not before pregnancy or during the postnatal period.

“Well, we discharge them after 10 days; so 10 days after they've delivered we don't see them, so I don't know whether they continue or not” (H5: Midwife)

When asked whether they take notice of the background of the South Asian population, in particular of whether they are first-generation or second-generation immigrants, most health professionals reported that they did not take notice of it.

“I don't always know who has been born here and who has actually come over, because, actually, maybe language skills may be a giveaway, but not necessarily. There are some people who actually do speak very good fluent English who have actually not lived here all their lives. So not always... I don't always get to read the in-depth sort of background in the notes, or get to know that” (H4: Dietician)

9.3.4 Suggestions by Health Professionals

Health professionals gave various suggestions on how to improve the quality of the current service, with a view to helping proper weight management for obese pregnant women. Since there are no proper pre-conception services, half of the health professionals suggested that pre-conception clinic or services are a good option for obese pregnant women to get advice about how to lose weight before pregnancy.

“I think certainly if a woman comes to see her doctor and says, I'm planning to become pregnant, there should be a pre-conception clinic that she can go to, to get advice in advance. Because if we can get the health risks reduced before the pregnancy, there's less chance of, you know, having to manage problems during and after the pregnancy. And if she's interested, you know, people get an interest then, that's the best time to approach it” (H3: Midwife)

Having dieticians involved before and during pregnancy is really important to focus on disseminating advice on healthy eating and exercise.

“Dieticians, we need to involve them in the pregnancy period” (H2: Obstetrician)

“No they won't see the dietician or anybody else. And I think if you saw somebody and somebody went through healthy eating, weight gain in pregnancy and how to manage it, then that might be helpful for them” (H7: Diabetologist)

“I think, maybe, even if you run group sessions, so one dietician with four or five women and once a week, so we'd talk through healthy eating and exercise; that might be useful” (H7: Diabetologist).

Currently, there are no specific leaflets for obese pregnant women. More specific information is needed so it will be easier for health professionals to highlight weight-related issues during antenatal check-ups or specific appointments.

“We don't have any set leaflets to give to them at the moment; that would be a good idea if we could give them a leaflet that says, these are the do's and don'ts of exercising in pregnancy” (H3: Midwife)

One of the health professionals opined that more practical information ought to be given to obese pregnant women. This information would have to focus on improving their cooking, shopping and budgeting skills, instead of only giving general advice on healthy foods.

“More practical information, I think, about actually pulling things together in a meal. So, I think, we give them a lot of advice about five-a-day, carbohydrate/protein balance, but I think for some women they still find that... and the one thing that we know generally is that people's cooking skills, perhaps, are quite poor, their budgeting shopping skills also come into that. So it's actually being able to help them understand what they can actually go out and buy and put in a meal. Which is different often to saying, you should have this, you should have that, or you should cut down and what have you” (H8: Midwife).

A few of the health professionals argued for the need for more specific classes or meeting groups for obese pregnant women. These may have a positive impact on them by prompting them to support one another through the pregnancy period.

“Access to exercise classes, swimming, specifically for them as well. And meeting groups where pregnant women can go because they're all together as a group to motivate each other. That's another. I think if you've got more ladies together they could actually motivate each other, more so than we could, probably” (H6: Midwife)

“Maybe doing group classes with other pregnant women in a similar situation. Because if, you know, you can't tell her to go to the gym because she would find it so hard to exercise and she will get demotivated and come home. While if you get a few obese pregnant ladies together who are all of similar fitness levels then it's a little bit easier” (H10: Obstetrician)

9.4 SUMMARY

This chapter presents the qualitative findings on health professionals' views on the current behaviour of obese pregnant women related to “opportunity”, “capability” and “motivation” to change their behaviour towards a healthier lifestyle. It also considers , the current services of health professionals as an “opportunity” for obese pregnant women to increase their motivation and change their behaviour.

Michie et al., 2011 described the COM-B Model as “*Changing the incidence of any behaviour of an individual, group or population involves one or more of following: Capability, Opportunity and Motivation relating either to the behaviour itself or behaviours that compete with support it*”. Increasing the “Opportunity” or “Capability” can lead to increase “Motivation” to change the behavior (Michie et al, 2011).

Having encouragement and support from the family can put obese pregnant women at an advantage or a disadvantage when it comes to practicing a healthy lifestyle. South Asian obese women get more family support than European obese women do. However, their culture of living in close family groups may become a barrier against their changing their lifestyle, and thus become a disadvantage. Having a good socioeconomic, educational and healthy genetic status may also increase their opportunity to change their behaviour. Having good financial skills and higher education gives them an extra opportunity to consume healthier food and exercise regularly.

Obese pregnant women who are in a positive environment “capability”-wise may have higher chances to change their behaviour and to practice a healthy lifestyle. European obese pregnant women were found to lack the cooking skills to prepare healthy food compared to South Asian women. However, during pregnancy South Asian women tend to increase their calorie intake too much and to eat more junk food, because they believe that they are allowed to eat whatever they want. In contrast, European women are more careful on the types of food that they eat. Having difficulties in communicating in English, especially among South Asian first-generation immigrants, can also become a disadvantage for them when attempting to change their behaviour.

Having a good knowledge of healthy lifestyles is really important to enhance obese pregnant women’s capability to change their behaviour and to have a clear understanding of how to choose healthy food. Health professionals report that misconceptions still occur, especially among the South Asian obese women, on the concept of “eating for two”, which may influence those obese pregnant women to consume extra unnecessary calories. In terms of behaviour regulation and decision process, the lifestyles of some obese pregnant women are not different between the period before pregnancy and pregnancy itself; they also fail to maintain healthy food habits and to exercise regularly.

Obese pregnant women who have a higher motivation have a higher chance to change their behavior. However, there are a few barriers that may discourage them from doing so. The South Asian population, especially first generation immigrants, have a restricted culture in which it is not normal for a woman to exercise in public. This culture will discourage them from joining a public exercise programme, whether or not it is free. Some health professionals reported that some obese pregnant women “use food” to

comfort themselves. Social support can be an opportunity for obese pregnant women to be motivated to change their behaviour. Obese women can also be influenced to change their behaviour once they have been made aware of the consequences of weight problems on their baby, and of related illnesses.

Health professionals give appropriate advice on weight management, diet and physical activity. However, there are no specific tools for advising obese pregnant women. They also think that pre-conceptual services would be really important for obese pregnant women, but they do not have a chance to provide them, since they only meet the obese pregnant women after an antenatal booking. They also have a very limited time to talk with obese pregnant women about issues related to weight management, in that they need to cover all other aspects of pregnancy as well.

Health professionals suggest that having pre-conception services on offer would be very important for obese pregnant women. Having dieticians in service is necessary, since in the current system only obese pregnant women who have had or develop a disease such as gestational diabetes mellitus will be referred to a dietician. A provision of specific leaflets would also be really important, instead of the current provision which only gives them generic information. This provision would convey more practical information and present specific classes for obese pregnant women, in order to motivate them to change their behaviour.

CHAPTER 10

DISCUSSION & CONCLUSION

10.1 INTRODUCTION

This thesis has explored the association of maternal obesity and the lifestyle of obese pregnant women with obstetric outcomes. This study compared European women with minority ethnic groups in the UK, comprising South Asian women either born in the UK or not and the South Asian subgroups; Indian, Pakistani and Bangladeshi.

Furthermore, I compared two BMI classifications for obesity; WHO General BMI Classification ($\text{BMI} \geq 30 \text{ kg/m}^2$) (WHO, 2016) and WHO Asian Specific BMI Classification ($\text{BMI} \geq 27.5 \text{ kg/m}^2$) (NICE, 2013) for South Asians, in order to examine any differences when using the latest guidance from NICE for the South Asian population.

The objectives of the research are summarized in Boxes 10.1 and 10.2. This chapter discusses the overall findings, the methodological strengths and limitations of the study, and gives suggestions for further research and implications to public health and obstetric practice.

Box 10.1 Quantitative Research Objectives

- i. To examine the prevalence of maternal obesity over the four years period from 2009 – 2012 in the West Midlands among first generation South Asians compared to later generation South Asians population versus European reference population and among Indian, Pakistani and Bangladeshi versus reference population
- ii. To examine maternal and neonatal complications associated with maternal obesity in the West Midlands obstetric population among first generation South Asians compared to later generation South Asians population versus European reference population and among Indian, Pakistani and Bangladeshi versus reference population

Box 10.2 Qualitative Research Objectives

- iv. To explore the food consumption of obese pregnant women first generation South Asians versus later generation South Asians and European pregnant women from the views of obese pregnant women and health professionals
- v. To explore the factors affecting physical activity of obese pregnant women and compare the experiences of first generation South Asians versus later generation South Asians and European pregnant women from the views of obese pregnant women and health professionals
- vi. To explore the socioeconomic, cultural and environmental factors that affect the food consumption and physical activity of obese pregnant women comparing first generation South Asians versus later generation South Asians and European pregnant women from the views of health

10.2 DISCUSSION OF MAIN OUTCOMES QUANTITATIVE STUDY

10.2.1 Prevalence of Maternal Obesity

Findings from this research showed that the prevalence of obesity defined as a BMI $\geq 30 \text{ kg/m}^2$ was 21.2% for European women which is and are lower compared to the previous research (Huda et al., 2006, Flegal et al., 2012). South Asian women had a lower prevalence of obesity for both women who were born in the UK (later generation) (15.5%) or not born in the UK (first generation) (11.6%) when compared to the European women using WHO General BMI Classification. The prevalence of maternal obesity was also significantly lower than the European women for each of the South Asian subgroups.

However, when using the South Asian Specific BMI Classification for obesity (BMI $>27.5 \text{ kg/m}^2$) suggested by NICE (2013), the prevalence of obesity was higher in South Asian women who were not born in the UK (25.5%) and also higher for the South Asian women who were born in the UK (29.3%) in comparison with the European reference population (21.2%) (BMI $\geq 30 \text{ kg/m}^2$). Thus based on this database (Perinatal Episode Electronic Database in the West Midlands, 2009-2012), using the new BMI cut off points specific for South Asian women increased the number of South Asian women being obese by an additional 1482 and 1267 women, for first generation and later generation, respectively.

Maternal obesity will increase the health service cost, 39% more among obese women compared to the healthy weight women, costing an additional £1,171 for each obese women (Morgan et al., 2014). Overweight and obese women also had 30% higher mean number of days stay in the hospital and 15-20% more usage of all hospital services (Morgan et al., 2014). Thus, in this study using the South Asian Specific BMI

Classification to define obesity, the additional cost for managing South Asian obese pregnant women in West Midlands would be £3.2 million.

The incidence of obesity from 1995 to 2007, was consistently higher among Bangladeshi, Indian and Pakistani populations than among white women using the WHO Asian-specific BMI (Obesity BMI $>27.5 \text{ kg/m}^2$) for South Asian women (Heslehurst et al., 2012). Finding in this study showed the prevalence of obesity was increased 12.5% among Pakistani, 13.4% among Bangladeshi and 10.8% among Indian in comparison with the European reference population after using the new BMI South Asian specific classification. Based on the NHS Maternity Statistics (2015) there is 636,643 total deliveries in England in 2015. Therefore based on the estimation using the live births by ethnic group across the whole England (Office for National Statistics, 2015), the number of referrals will be increased to 3183 of Pakistanis, 2131 for Indians and 1194 for Bangladeshi after using the new BMI threshold (Obesity $\geq 27.5 \text{ kg/m}^2$).

Bryan et.al (2014) who did the similar study comparing Pakistani with European women born in Bradford, UK, did not support using the new classification due to no different risk of adverse perinatal outcomes after applying the South Asian Specific BMI Classification. However, this research cannot apply to the whole South Asian group since the study only included Pakistani women. Using the BMI classification is important for policy purpose including triggering the policy action, to facilitate prevention programmes, and to measure the effect of interventions (WHO, 2004). The findings in this study suggest the use of the new South Asian Specific BMI Classification for public health action and awareness.

Therefore, more studies should be done from different perspectives before using the new BMI South Asian Specific classification in a clinical setting.

10.2.2 Maternal obesity and Obstetric Outcomes

This large population-based observational study clearly demonstrates that being obese increases the risk of adverse maternal outcomes (Gestational Diabetes Mellitus, Hypertensive Disease during pregnancy, Cesarean section) and neonatal outcomes (having macrosomia baby and low birth weight) and neonatal intensive care use as summarised in Table 10.1 and Table 10.2.

Finding in this research indicate that South Asian obese women not born in the UK (first generation) had the highest risk of GDM followed by South Asian obese women born in the UK (AOR 8.82, 95% CI 7.53-10.33) and five times the risk among obese European women (AOR 5.54, 95% CI 5.03-6.10) to exhibit gestational diabetes, when compared to European with normal BMI as reference. A systematic review with a meta-analysis of 70 population studies also showed an increased risk of GDM in obese pregnant women (OR 3.76 (95% CI 3.31-4.28) when compared to healthy weight women (Torloni et al., 2009). Among the South Asian subgroups, Bangladeshi women had the highest risk of developing GDM (AOR 16.64, 95% CI 13.2-21.1). Research by Savitz et al. (2008) showing similar findings that Bangladeshi women had the highest risk of GDM compared to the other ethnic group. South Asian women also had a higher risk of developing GDM compared to other ethnicities whether or not their BMI level was greater or less than 26 kg/m² (Hunsberger et. al, 2010) due to high central or visceral fat (Pi-Sunyer, 2004).

European women had the highest prevalence (10.3%) and chance to develop hypertensive disease during pregnancy (AOR 2.34, 95% CI 2.20-2.48). South Asian first generation had 23% more risk (AOR 1.23, 95% CI 1.01-1.47) but no significant risk between South Asian later generation when compared to European normal BMI as reference. Among the South Asian subgroups, obese Indian women had 32% more

chance to develop hypertensive disease during pregnancy but not significant among Pakistani and Bangladeshi obese women. Findings from this study showing a similar trend of increasing BMI, increased the odds of having hypertensive disease during pregnancy (Callaway et al., 2007, Chu et al., 2008, Scott-Pillai et.al, 2013). However, the odds were much higher in systematic reviews (Salihu, 2012) in which obese women were 4.5-8.7 times more likely to develop gestational hypertension. Hypertensive disease during pregnancy caused 15.7% of maternal deaths (Chang et al., 2003).

The risk of having a caesarian section during delivery increased with increasing BMI level for all ethnic groups. The increased risk was quite similar with a range of 72-78% increased odds of having a caesarian section between European women, South Asian women born in the UK and South Asian women not born in the UK compared with the reference group (normal BMI European). The risk was lower among Pakistani women who were obese (AOR 1.49, CI 95% 1.38-1.61) but Indian women who were obese had 2.4 more chance (AOR 2.37, CI 95% 2.14-2.62) to go through the caesarian section as a delivery method when compare to normal BMI pregnant women. Those finding shows similar results with another study with an odds ratio of between 1.8 - 2.4 (Chu et. al, 2007, Molyneaux et al., 2007, Scott-Pillai et al., 2013) of obese women experiencing caesarian section when compared to women with healthy weight. However, the odds of migrant South Asian women having a caesarian section was a bit lower (OR 1.28 (CI 95% 1.22-1.35)) when compared to the reference group (Merry et al., 2013). This study was done among the South Asian population in Australia, Canada, Finland, Italy, Norway and Switzerland (Merry et al., 2013) but not in the UK.

Due to the increasing risk of caesarean section with increasing BMI category, the results contrast with other instrumental delivery methods including Ventouse, Forceps and Breech which reported decreased use with increasing BMI category. However another

study showed a different trend, with obese women being found to have a 12% increase in ventouse extraction (Gaillard et al, 2013).

European obese pregnant women had 30% more risk to have a low birthweight baby (AOR=1.30 (CI 95% 1.18-1.31)) and the risk was similar among South Asian obese pregnant women who were born in the UK (later generation) (AOR=1.22 (CI 95% 1.10-1.35)) when compared to the reference group. Among obese South Asian women who were not born in UK (first generation), they were 14% less likely to have low birth weight baby. The finding in this research for European and South Asian women born in the UK contradicted with another study in which maternal obesity had a negative correlation with having a baby with a low birth weight (Heslehurst et al. 2008, Yu et al. 2013, Scott-Pillai et al., 2013).

South Asian women who were not born in the UK (first generation) had the highest risk of having macrosomic baby (AOR=2.13 (CI 95% 1.14-1.28) compared to South Asian women born in the UK (first generation) (AOR=1.34 (CI 95% 1.16-1.54) and European (AOR=1.21 (CI 95% 1.14-1.28)). Among the South Asian sub groups, Indian, Pakistani and Bangladeshi women had 72-78% more risk when compared to the European normal BMI as reference group. Overall, these findings are a bit lower except among South Asian first generation women when compared with other studies in which maternal pre-pregnancy obesity had at least twofold higher risk of delivering a large size for gestational age infant or macrosomia baby (Heslehurst et al., 2008, Yu et al., 2013, Gaudet et al., 2014).

In this research, the findings shows positive association between obesity and increased risk of the need for additional intensive care after delivery among obese European pregnant women (AOR 1.15 (95% CI 1.05-1.26)) and among obese Indian women

(AOR 1.43 (95% CI 1.07-1.93)) which match with the findings of a systematic review by Heslehurst et al. (2008). After comparing the babies of women with a normal pre-pregnancy BMI, the children of obese women were at a 38% higher risk (OR 1.38, CI 95% 1.16–1.64) to be admitted into NICU (Heslehurst et al. 2008). Several observational studies have reported that maternal obesity was associated with referral to neonatal intensive care unit (Poston et al, 2011).

In these findings, South Asian women had higher risk of developing Gestational Diabetes and the risk increased with increasing BMI category. Thus, using the specific BMI cut-off points for South Asian population is important to support South Asian women undergo lifestyle change before getting pregnant and preventing the development of Gestational Diabetes during pregnancy. Preventing Gestational Diabetes contributes to reducing macrosomia and caesarean section rates (Kc et al, 2015).

Table 10.1: Summary of the Association of obesity with Obstetric Outcomes among South Asian born in UK, South Asian not born in UK (Obese: BMI > 27.5 kg/m²), European (Obese: BMI >30 kg/m²) versus European normal BMI as reference

Obstetric Outcome	European Normal BMI (ref = 1)	European Obese (BMI ≥30 kg/m ²)		South Asian Born in UK Obese (BMI ≥ 27.5 kg/m ²)		South Asian not Born in UK Obese (BMI ≥ 27.5 kg/m ²)	
		%	AOR (95% CI)	%	AOR (95% CI)	%	95% CI
Gestational Diabetes	1	5.4	5.54 (5.03-6.10)	8.5	8.82 (7.53-10.33)	14.0	15.48 (13.54-17.71)
Hypertensive Disease	4.4	10.3	2.34 (2.20-2.48)	4.6	0.96 (0.79-1.18)	5.8	1.23 (1.01-1.47)
Caesarean Section	20.9	31.8	1.78 (1.72-1.84)	31.7	1.76 (1.62-1.91)	31.2	1.72 (1.58-1.87)
Low Birth weight baby (<10 th centile for weight)	13.9	17.3	1.30 (1.25-1.35)	16.6	1.22 (1.10-1.35)	12.3	0.86 (0.77-0.97)
Macrosomia (>90 th centile for weight)	6.2	7.3	1.21 (1.14-1.28)	8.1	1.34 (1.16-1.54)	12.4	2.13 (1.89-2.40)
Neonatal Intensive Care Use	4.6	5.2	1.15 (1.05-1.26)	4.5	0.98 (0.73-1.30)	5.3	1.16 (0.86-1.55)

Table 10.2: Summary of the Association of obesity with Obstetric Outcomes among Indian, Pakistani and Bangladeshi (Obese: BMI > 27.5 kg/m²), European (Obese: BMI >30 kg/m²) versus European normal BMI as reference

Obstetric Outcome	European Normal BMI (ref = 1)	European Obese (BMI ≥ 30 kg/m ²)		Indian Obese (BMI ≥ 27.5 kg/m ²)		Pakistani Obese (BMI ≥ 27.5 kg/m ²)		Bangladeshi Obese (BMI ≥ 27.5 kg/m ²)	
		%	AOR (95% CI)	%	AOR (95% CI)	%	AOR (95% CI)	%	AOR (95% CI)
Gestational Diabetes	1	5.4	5.54 (5.03-6.10)	11.5	11.95 (10.01-14.24)	10.9	11.24 (9.82-12.87)	15.3	16.64 (13.12-21.12)
Hypertensive Disease	4.4	10.3	2.34 (2.20-2.48)	5.5	1.32 (1.06-1.67)	4.5	0.98 (0.82-1.18)	4.6	1.09 (0.74-1.62)
Caesarean Section	20.9	31.8	1.78 (1.72-1.84)	38.6	2.37 (2.14-2.62)	28.3	1.49 (1.38-1.61)	32.9	1.85 (1.56-2.19)
Low Birth weight baby (<10 th centile for weight)	13.9	17.3	1.30 (1.25-1.35)	15.7	1.10 (0.92-1.26)	15.0	1.01(0.91-1.11)	15.0	1.02 (0.82-1.29)
Macrosomia (>90 th centile for weight)	6.2	7.3	1.21 (1.14-1.28)	10.2	1.72 (1.46-2.03)	10.4	1.75 (1.55-1.96)	10.6	1.78 (1.37-2.31)
Neonatal Intensive Care Use	4.6	5.2	1.15 (1.05-1.26)	6.6	1.43 (1.07-1.93)	4.3	0.93 (0.70-1.24)	5.2	1.13 (0.65-1.99)

10.3 DISCUSSION OF MAIN OUTCOMES QUALITATIVE STUDY

Based on the COM-B Model (Michie et al. 2014) the inner circle of The Behavior Change Wheel explained that having a positive capability and opportunity may increase the motivation of obese pregnant women to change their behaviour hence developing a healthier lifestyle. This section discusses the findings of the qualitative research based on the COM-B component (Capability, Opportunity and Motivation).

Capability

Based on the findings, the lifestyles of some obese pregnant women are no different between the period before pregnancy and pregnancy itself; they also fail to maintain eating healthy food and exercise regularly including skipping meals. However, some of the pregnant women showing positive effort consume healthier snacks. South Asian later generation women had adopted more Western lifestyles (Gilbert et al., 2008) which similar to this finding. Both South Asian later generation and European women had a high intake of sugary drinks and had experience of using fad diets to lose weight before pregnancy which may have resulted in increased weight. High intake of sugar-sweetened drink is associated with weight gain and obesity (Malik et. al, 2006, Pan et al. 2013) and is indicative of a low quality diet (Piernas et al., 2014).

Wyke & Landmman (1997) and Church et al. (2006) reported that South Asians' diets are found to be high in fat, when compared to the diets of the general population. Based on the finding, few South Asian first generation women reported eating takeaways at least three times per week but most of them preferred to eat home-cooked food. This contrasts with a Dietician's experience, who believed that some South Asian women

have takeaways almost every day. The difference may be due to different types of assessment during interview and Ilana et al. (2012) had suggested that single 24 hour diet recall is not suitable to use as assessment.

Although NICE (2010) does not recommend weight loss during pregnancy, obese pregnant women should control their gestational weight gain (IOM, 2009). Some of the pregnant women seem to find it more challenging to control their diet during pregnancy due to snacking and craving unnecessary food with high sugar and fat content.

However, some women showed improvement in fibre intake through increasing their consumption of vegetables and fruits intake. Based on a systematic review by Mesas et al. (2011), there is little and inconsistent evidence of an association between skipping breakfast, irregular meals, eating takeaways food and eating fast foods with excessive weight gain and suggested a more systematic approach is needed to understand this area. Health professionals report that cultural beliefs still occur, in particular among the South Asian obese women, on the concept of "eating for two", which may also influence those obese pregnant women to consume extra unnecessary calories.

Among the pregnant women in this study, exercise becomes less popular after getting pregnant. Most of the women stop doing any vigorous exercise after getting pregnant. Poudevigne and O'Connor (2006) reported similar findings that the duration and intensity of physical activity decreased during pregnancy and almost 60% of pregnant women were found to be inactive during pregnancy which is similar to this study. Due to the various benefits of exercise, Blair et al., (2004) suggested that obese women should be motivated by health professionals to exercise 10 minutes three times a day and increase the duration to 30 minutes, starting with light activities and slowly increase duration and intensity. However, this study found that health professionals had very limited time to discuss this topic during the appointment. Three systematic reviews

found that second-generation South Asians are more physically active than first-generation South Asians; both groups are less physically active than the White British population (Fischbacher et al. (2004), Babakus & Thompson (2012), Bathnagar et al. (2015). However, findings in this qualitative research could not conclude any difference between these three groups except that South Asian women preferred to do more yoga during pregnancy.

Knight-Agarwal et al. (2015) found that obese pregnant women often lack knowledge about the impact of obesity during pregnancy and this study unearthed very similar findings. Women in this study showed good understanding of dietary intake, however, there seemed a lack of knowledge on weight management and physical activity during pregnancy. This may be related to lack of knowledge and understanding of giving advice and support on weight management during pregnancy among health professionals, a point supported by Smith et al. (2010). Again, overall this may be related to the non-specific recommendation from the guidelines such as NICE (NICE, 2010).

Health professionals' in this study seemed to believe that some of the obese women lack cooking skills, especially among the European women due to a lack of guidance and support from their parents when growing up. Having good cooking skills helped these women to prepare healthier foods via an improved cooking technique, learning new recipes and planning their daily meals. Previous research found that South Asian women were keen on modifying their traditional recipes to suit a healthier diet (Bush, et al., 1997; Leung & Stanner, 2011). However, modifying recipes was not acceptable because of the changes in taste (Chowdhury et al., 2000)

Smith et al. (2011) reported that in relation to inequalities, one of the main barriers preventing obese pregnant women from engaging in their current health is language barriers. Based on the views of health professionals here, South Asian women especially the first generation group who have difficulty in speaking English may feel isolated and find it difficult to access the current services and information related to a healthy lifestyle during pregnancy. However, all of the South Asian participants in this study were capable of speaking English fluently and had a high level of education, and so, this is not an issue among South Asian obese women in this study to access healthcare services.

Opportunity

Lack of money and time are reported as the two biggest obstacles to healthy lifestyle choice among the obese pregnant women. Low socioeconomic status is a huge barrier to consuming healthier food, in particular among the later-generation South Asian and European women since healthier food is more expensive than high-fat or ready meals. However, this could not be generalized to the whole since most of the South Asian women in this qualitative study had high education level, in contrast with another study (Leung & Stanner, 2011). Health professionals similarly thought that having a high socioeconomic and educational status increased opportunities for behavior change. Later-generation South Asian and European obese women who had experience of joining weight loss programmes experienced various benefits from joining these programmes including an increase in their knowledge and skills related to weight management. Smith et al. (2011) reported similar findings that financial problems, environmental factors, transport, housing are barriers to engaging with the health service.

Lacking time becomes a barrier amongst obese pregnant women to practice healthy lifestyle especially to exercise regularly and there is no difference between South Asian first generation, South Asian later generation and European women. Most of the women gave priority to their family first, especially looking after the children, rather than giving more time for themselves, to avoid the stigma of being selfish and bad mothers (Swanton, 2008; Warin et al., 2008). Devine et al. (2000) reported that pregnant women are having a conflict between family commitment and desire to losing weight post-pregnancy. Thus, in this situation, a mother with multiple children may need slightly different support compared to the first time mother.

Health professionals' in this study believed that South Asian obese women get more family support than European obese women. Obese pregnant women are more easily influenced by family and friends than health professionals about practising healthy lifestyle during and post-pregnancy (Caplan, 1997). However this qualitative study found that South Asian women living with extended family may have more pressure and less privacy to make their decision on practicing a healthy lifestyle. Thus, further research is required to explore the advantages and disadvantages of having social support and understanding what types of support that obese women find most helpful.

In term of support from health professionals, there is very little in the way of advice on weight management, diet and physical activity to pregnant women. Furthermore, there are no specific tools for advising obese pregnant women and no specific information including for South Asian obese women. Brown & Avery (2012) reported that obese pregnant women only received brief information on weight gain, diet and physical activity. Lacking support and advice from health professionals, pregnant women may risk receiving un-regulated information (Brown & Avery, 2012). Therefore, based on

these findings, support from family and health professionals is crucial for women to improve lifestyle by following structured diet and exercising and this is supported by other studies (Toole et al., 2003 & Blum et al., 2004).

Motivation

The finding in this study described that emotion seems to be a strong influence on obese pregnant women to consume a healthy diet. Boredom, stress, always feeling hungry and tired may influence them to pick unhealthy foods or eat more than necessary. Some health professionals reported that some obese pregnant women use food to comfort themselves, which becomes worse if food is easily accessible (Stein & Fairburn, 1996). Hurley et al. (2006) reported that psychological factors such as stress and anxiety might influence pregnant women to eat more high fat and oily foods, sweets and snacks and decreased intake of vitamins. They were also described as “emo-eaters” (Hurley et al., 2006). NICE (2010) suggested more research and interventions should be focused on this area.

Most of the obese pregnant women in this study enjoyed exercise; the only barrier was that they were scared of adverse consequences on the baby. However, Madsen *et al.* (2007) suggest that only high-impact exercise increases the risk of miscarriage in the early stage of pregnancy. NICE (2010) only encourage high-intensity exercise for pregnant women who had a high level of activity before pregnancy. Furthermore, a recent cohort study among pregnant women with gestational diabetes found that vigorous intensity exercise will reduce the odds of excess gestational weight gain (GWG) (Samantha et al. 2016). Thus, appropriate information related to physical

activity during pregnancy should be given not only to the pregnant women but also to the family and the community to increase the awareness of exercising during pregnancy.

The health professionals reported that some of the pregnant women do not have any intention of changing their behaviour during pregnancy. However most of the women showed willingness, and were confident of changing their behaviour towards practising a healthy lifestyle post-pregnancy. Findings by Smith et al. (2011) concluded that during pregnancy is the best time to be motivated and positive around changing lifestyle. This suggested that proper weight management and weight loss post-pregnancy is crucial to reduce further adverse obstetric outcomes, in particular among the South Asian first generation.

10.4 INTEGRATION OF QUANTITATIVE AND QUALITATIVE FINDINGS

To date, there is no study has been done to examine the association of obstetric outcomes and maternal obesity and explore the lifestyle of pregnant women especially comparing South Asian first generation and later generation with European women and at the same time using WHO Asian specific BMI Classification. Thus, this study provides unique insight into the views and experience of obese pregnant women and health professionals related to lifestyle during pregnancy.

Based on both research strand findings, there is no direct link between the quantitative and qualitative study, since qualitative research respondents did not have a similar background including educational level and health problems compared to participants recruited for the quantitative element. However, certain findings from the qualitative research may support the findings of the quantitative findings indirectly and may give a suggestion for further intervention and policy implication of the similarities and differences related to obstetric outcomes among the South Asian population.

South Asian women who live in their country of origin had a high prevalence of the metabolic syndrome (Pandit et al, 2013) due to increasing urbanization, nutrition transition, and reduced physical activity (Misra & Khurana, 2008). The lifestyle of women in the South Asian country reported becoming more sedentary due to increasing usage of computers, indoor entertainment and mechanisation in workplaces and at household work (Misra & Khurana, 2008). Thus, this impacts on the lifestyle of South Asian first generation women when moving to the UK, where they have more sources of cleaning and cooking technology specifically. Furthermore, comparing to Europeans

meals, Asian Indians consume higher carbohydrate and this leads to the development of hyperinsulinemia, postprandial hyperglycemia, high serum TG, and low HDL levels associated with insulin resistance (Burden et al, 1994). These correlate with the findings that South Asian first generation women had the highest risk of developing gestational diabetes mellitus (GDM) and having a macrosomic baby when compared to South Asian later generation and European obese women, with European normal BMI women as reference.

From observation by health professionals, South Asian second generation women had a higher risk to be obese due to genetics and difficulties of adjusting to a new environment in the UK. Furthermore, based on the quantitative findings, the South Asian populations (especially the first generation) were living in the most deprived areas. This is supported by Nazroo (2003) in that those who have better socioeconomic positions having improved chance of better health and the inequalities in social circumstance have a substantial impact on the health experience among ethnic minority groups. Minority people who have lower incomes generally have poorer quality housing, and among the unemployed they have been unemployed longer, compared with white people (Nazroo, 1997). A longitudinal survey of 10,390 residents in England found that residents with lower education had the least health status at baseline and the smallest improvements, while higher education residents more likely to adapt positive behavior change including participating in training and finding employment (Stafford et al, 2008). The ethnic minority group who faced deprivation also more likely to involve more than material disadvantage including face alienation and racial harassment that gave negative impact to health status (Nazroo & Karlsen, 2001).

South Asian first generation women had the highest prevalence of maternal obesity when compared to South Asian later generation after using the WHO BMI Asian Specific Classification and European women using the WHO BMI General Classification. Thus this study suggested that South Asian ethnic group, especially the first generation, may require more medical treatment and care during pregnancy and in the post-partum period, for both the maternal and lifetime health consequence of the child. Findings in the qualitative research stated that health professionals believe that obese pregnant women are not aware of the adverse outcome of obesity during pregnancy and this is consistent with other research (Gardner et al., 2011; Keenan and Stapleton, 2010, Knight-Agarwal et. al, 2015).

Recent systematic reviews show the positive effects of dieting and physical activity interventions in pregnancy on reducing maternal weight gain, pre-eclampsia, gestational hypertension and GDM, caesarean deliveries and having a baby over 4kg (Thangaratinam et al., 2012, Morisset et al., 2010 & Skouteris et al. 2014, Muktabhant et al., 2015). Reducing by one BMI unit between two pregnancies shows a decreased risk of macrosomia in the second pregnancy (Villamor, 2006). Thus to improve the obese pregnant women's lifestyle, it is important to understand their current practice, attitude, beliefs and their behaviours (Flynn et al., 1999; NICE, 2010).

10.5 METHODOLOGICAL STRENGTHS OF THE STUDY

The main strength of this research is that it used a mixed-methods approach.

Quantitative (Chapter 5 and Chapter 6) and qualitative (Chapter 8 and Chapter 9) methods were used together in an attempt to produce more complete knowledge and answer the research questions (Johnson & Onwuegbuzie, 2004). The quantitative research had a large sample size of 143, 286 completed pregnancies, with more than 98% of women having BMI recorded at booking (before 16 weeks of gestation) in line with the current recommendation (CMACE/RCOG, 2010) for each ethnic groups. The quantitative study also incorporated a wide range of health problems and obstetric outcomes in pregnant women.

Another strength of this research is using two BMI classification; WHO General BMI Classification (WHO 2016) for all population and WHO Asian Specific Classification Classification (NICE, 2013) to categorise the South Asian population. Furthermore this study splits the South Asian groups to not born in the UK (first generation) and born in the UK (later generation), in fact, to our knowledge, this is the first UK study to look at this in relation to obesity. Moreover, this analysis did multiple comparisons of South Asian ethnic subgroups (South Asian not born in the UK, South Asian born in UK, Indian, Pakistani and Bangladeshi) with European as a reference.

10.6 MAIN LIMITATIONS OF THE STUDY

10.6.1 Limitation of Mixed Methods Research

This study used a mixed methods convergent parallel design in which both quantitative and qualitative elements happened in parallel. Therefore, there was no opportunity for the quantitative study to inform the sampling in the qualitative study.

10.6.2 Limitations in Quantitative Research

The data has been collected for four years only from 2009 to 2012, thus this database is not suitable to present the trends of maternal obesity and correlation with obstetric outcomes. Both maternal obesity and excessive gestational weight gain (GWG) seem to have strong effects on various obstetric outcomes, childhood outcomes and adult outcomes (Gaillard et al., 2014 & Gillard 2015). However, in this quantitative dataset, there is no data on GWG. NICE (2006) recommends to combine the BMI classification with the waist circumference to assess the health risk for patients with BMI less than 35 kg/m², especially among the South Asian population who had a higher waist circumference (Leung & Stunner, 2011) and high percentage body fat at any level of BMI when compared to the European population (Harding, 2008). Again, this dataset does not have data on pre-pregnancy waist circumference or percentage body fat. Therefore, this study solely relied on BMI classification to measure the adiposity.

There is also limited numbers available for outcomes especially for Bangladeshi women where the sample was relatively small only 1.7% off the total population. These represent of the specific pregnant women distribution in the West Midlands in 2009-2012. Thus in Chapter 6 the data could not be split between those born in the UK or not

born in the UK for Indian, Bangladeshi and Pakistani women. It also gave a lot of layer findings in quantitative analysis due to small numbers especially after split for obstetric outcomes category.

10.6.3 Limitations in Qualitative Research

The researcher identified a number of challenges associated with recruitment in this study. At the beginning of the study period, the researcher did a pilot study and found that time would be a challenging factor to fit in the interview alongside women's hospital appointments. Health professionals who were on duty in the hospital had limited time to participate in this research. There were a few interruptions during interviews and four of the health professionals cancelled their interview appointments which they had agreed to, due to other commitments and urgent matters.

The researcher was also depending on Research Midwives to help recruit the potential participants since she was not allowed to approach any pregnant women directly. Furthermore, since the weight and height measurement of pregnant women was measured by midwives at booking; followed the standard NICE Guidelines (NICE, 2010) thus researcher only relies on the reported information for the BMI calculation.

Moreover, the Research Midwives in the Biomedical Research Unit tended to approach potential participants who can speak English since all the Research Midwives at Biomedical Research Unit are White British and spoke English to avoid any misleading or misunderstanding regarding the research involved. Therefore, all potential non-English speaking participants were inadvertently excluded from participating in this

research at an early stage of recruitment, even though participant information sheets had been translated into Urdu, Hindi, Bengali, Punjabi and Gujarati. The consequences of this are that there is a bias on socio-demographic background especially on the educational level and income status of pregnant women. Most of the South Asian women had a degree or higher education compared to European women who had Diploma/ GCSE/ A level or equivalent. Therefore, those South Asian women are not truly representative of the population that they were intended to represent. The issues and theories discussed may only be relevant to this higher educated and high income group of South Asian women. Therefore, future research should be conducted among South Asian low socioeconomic status population.

At the beginning of the study, there were different inclusion criteria between South Asian and European for BMI classification. South Asian women who had a BMI of 27.5 kg/m² were eligible to participate in this study (Tables 2.1 & 2.2 in Chapter 2), compared to European women who had to have a BMI of 30 kg/m² or above. Thus, the mean BMI was lower among South Asian first generation woman (BMI 31.6 kg/m²) and South Asian later generation woman (BMI 30.1kg/m²) compared to the European women (BMI 37.8 kg/m²).

Due to time and resource limitation, the research had to stop as scheduled. This limited recruiting more eligible South Asian women participants into this study (including the Pakistani and Bangladeshi) and the health professionals as well. Among the South Asian who was not born in UK, only one person was Bangladeshi and the rest was Indian. Thus, the correspondent in qualitative study does not reflect the ethnicity distribution in quantitative study. Recall bias exists among health professionals since

some of them could not notice either their previous patients were South Asian first generation or second generation, they just consider them as from a South Asian ethnic group. Thus, it is hard to gather information related to South Asian background either first generation or later generation from health professionals views.

10.6.4 Limitations in Qualitative Analysis

The framework for the analysis of the interviews was based on the TDF framework, chosen because it was felt to be a comprehensive and useful framework to draw attention to the factors that may be influencing behaviour in relation to obesity in pregnancy. However, the sole use of the TDF framework for the analysis did not allow for themes that did not fit with the framework. On reflection, I could have been less rigid with the analysis and instead used a combination of the TDF framework and thematic analysis, allowing for codes or themes to emerge that did not fit with the TDF framework. For example, I did note that there was some discussion around problems with fertility that were influencing obesity which did not fit well into the TDF framework.

Some code fit in few themes and more dominant than others. Based on the codes of health professional's transcripts, one big section has been code under the Environmental Context and Resources theme discussed about health professional services. However, among pregnant women transcription, Behavior Regulation, Memory Attention and Decision Theme was the most dominant discussing on diet, physical activity and lifestyle of obese pregnant women.

10.7 IMPLICATION FOR PUBLIC HEALTH PRACTICE

In this study, the prevalence of maternal obesity was higher among South Asian first generation and among Pakistani and Bangladeshi women when compared to the European women if using the WHO South Asian BMI Specific Classification. However, from the qualitative findings, most of the health professionals were not aware whether the pregnant women were first generation (not born in the UK) or later generation (born in the UK). This suggests that it is important to know the specific ethnic background of the pregnant women that may give more relevant information regarding their lifestyle.

Most of the health professionals agreed that pre-conception health was really important and that the best way to advise women to control or lose weight is before pregnancy. However, currently, there are no proper pre-conception weight management services for obese pregnant women. Thus, the developments of weight management programmes and resulting interventions especially for women who are obese are crucial. This is consistent with the current guideline for weight management before, during and after pregnancy (NICE, 2010) which does highlight that obese women should lose weight before pregnancy and Hanson et.al (2016) suggested interventions for the prevention of maternal obesity should start before conception.

Many health professionals mentioned that they have very limited time to give advice related to healthy lifestyle. They suggested that more involvement from dieticians as necessary. However, in the current system the experience of health professionals is that

not all obese women have a chance to meet a dietician for weight management either before, during or after pregnancy except if they have gestational diabetes mellitus or any chronic disease. Guillinckx et al. (2007) believes it is important for obese women to have a regular meeting with a dietician who is an expert in dietary and physical activity management for obese pregnant women and most of the health professionals in this study have the same views.

Power (2006) reported almost 53% of obstetricians consider their training on weight management as 'inadequate' or 'non-existent'. Furthermore, obese pregnant women often experienced stressful, confusing and judgmental opinionated communication with healthcare professionals (Knight-Agarwal, et al., 2015). Thus their expectations are often not met (Martins & McNeil, 2009, Padmanabhan et al., 2015, Lavender & Smith, 2015). Most qualitative research concludes that it is really important to empower the knowledge and improve communication skills training among healthcare professionals (Lindhard et al., 2013) and give support to the pregnant women within the limited time and resources (Brown et al., 2013). Therefore, since most pregnant women have very limited chance to meet dieticians, other health professionals including obstetricians, general practitioners and midwives need to increase their skills in giving appropriate advice on diet and physical activity to those pregnant women.

Health professionals in this study stated that there are no specific leaflets for obese pregnant women from the South Asian ethnic groups. Cramp & Bray (2009) reported that written instructions influenced and increased motivation to change towards positive behaviour. Health professionals also believe that more practical information should be

given to the obese women. Previous research suggested that current antenatal education is insufficient (Keenan and Stapleton, 2010; Heslehurst et al., 2007). Some research shows a positive link between antenatal education classes and the improvement of healthy lifestyle especially in diet and physical activity (Koehn, 2002; Sims-Jones et al., 1998). Even the evidence is limited; which suggests that health professionals' advice and support with an appropriate antenatal class, using specific tools may increase the potential to motivate obese women to control their weight and practise healthy behaviours. Therefore, the health policy makers need to develop appropriate evidence-based UK gestational weight gain (GWG) guideline for ethnic minority groups including the South Asian population.

10.8 SUGGESTION FOR FUTURE RESEARCH

10.8.1 Quantitative Research

Based on the quantitative and qualitative findings in this research, the researcher could not examine the specific dietary intake such as total calorie intake and percentage of fat intake. Thus it was hard to differentiate specific dietary issues between each ethnic group's related to maternal obesity. The data capture need to be improved on the dietary intake for obese pregnant women. Similar research should be conducted to calculate the physical activity level and total daily energy expenditure to improve the weight management and physical activity recommendation of obese pregnant women, especially among the South Asian ethnic group.

Due to the limitations of this dataset including unavailable data on gestational weight gain, waist circumference and body fat which has a strong association with maternal obesity, further studies are needed to gather more detailed measurement of body composition and other components including nutritional status, physical activity level, total daily energy expenditure, blood profile of obese pregnant women and fetal growth. Excessive gestational weight gain during pregnancy increased the risk of retained weight after delivery and more complications in future pregnancy (Bogaets et al., 2013, Cnattingius & Villamor, 2016). Cohort studies are needed to understand the association between excessive weight gain and obstetric outcomes with related health problems throughout the life-course. Further research also needs to examine the association of maternal obesity with childhood and adult outcomes among these ethnic groups through follow-up studies.

10.8.2 Qualitative Research

Health professionals believed that preconception health is crucial. There is no specific weight management guidelines for preconception health and NICE in 2010 reported that there are no qualitative studies carried out in the UK related to diet, physical activity and weight management among South Asian women who were planning to become pregnant (preconception health), and or the views of health professionals related to this issue (NICE, 2010). Thus, a study could be conducted, to explore the views and experience among South Asian ethnic group before getting pregnant. An intervention study could be conducted to examine the effectiveness of weight management, behaviour and lifestyle among South Asian women especially related to diet and physical activity.

10.9 CONCLUSIONS

If the WHO Asian Specific BMI Classification for obesity of BMI 27.5kg/m^2 is applied to the South Asian population, this would increase the prevalence of maternal obesity among the first generation women and later generation South Asian women.

Furthermore, it seems that being obese has a significant impact on increasing the risk of gestational diabetes, hypertensive disease during pregnancy, caesarian section, low birthweight and , macrosomia but not of admission to the neonatal intensive care unit among South Asian women. However, the risk was different between the ethnic groups.

Thus, it may increase the number of women referred to specialist antenatal care and increase the health cost, however, based on the qualitative research findings not all obese women has been referred to the specialist except with clinical problems.

Therefore using the new BMI classification may prevent health services from underestimating the potential risk among South Asian population especially among the South Asian first generation and Pakistani and Bangladeshi women.

South Asian obese women need to increase their capability with regard to taking proper diet, exercise regularly following the recommendation, increased knowledge related to weight management, diet and physical activity to increase their motivation to practice positive behaviour related to healthy lifestyle. Pregnant women will need full positive support from the family, friends and health professionals as well to achieve this.

Better opportunity for those of lower socioeconomic status, time management, and social influences and support may increase the chances of practicing a healthy lifestyle as well. Thus, health professionals need to give specific advice based on women's needs. Moreover, it appears that women and health professionals require specific guidelines, tools, more specialist involvement especially from dieticians, better facilities

including having pre-conception services, to help them giving proper advice and support to manage weight problems among South Asian women

To improve the current service for South Asian obese women, a specific guideline on weight management before, during and after pregnancy is necessary for the South Asian ethnic group. Based on the qualitative findings, I could not differentiate the dietary requirement and physical activity among South Asian first generation, South Asian later generation and European women. Thus future research is needed to understand the specific dietary requirement and physical activity status among obese women to improve the current service and guideline which may benefit not only the mother but the children as well.

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APPENDICES

APPENDIX I: FIELD NOTES FROM DISCUSSION WITH PREGNANT WOMEN

Location: Antenatal Clinics, UHCW

Date: 16 September 2013

Time: 10.00 am -12.45 pm

Supervisor: Professor Siobhan Quenby

Purpose of visit : To have experience of an NHS antenatal clinic for obese pregnant women. To identify wheather Prof Quenby's clinic at UHCW is a suitable site for recruitment of participants for the qualitative study.

Clinics Attendance: 16 new patients a day (Monday morning) of whom roughly 50% were obese.

Rooms: There are two consultation rooms in Prof Quenby's clinics. However there is another room that is available which I can use for my research purpose.

Clinics Procedure: All pregnant mothers come to the clinic with an appointment. They will wait in the waiting area before being seen by the nurse then by the doctor.

Procedure of interviews: Prof Quenby asked 3 women if they would be willing to have a brief chat with me.

Talking Notes with obese pregnant mothers.

Case	Ethnicity	Pregnancy Condition	Detail
Case 1	South Asian (British Indian)	2 nd pregnancy, history of labour macrosomia baby, the same trend for the current pregnancy, 3 rd trimester, and current gestational weight gain > 10 kg. Booked date for caesarean.	<p>She has tried to change her diet compared to the first pregnancy, reduce her salt and sugar intake, no more chips or cookies for her snack. She ate a lot of fast food during first pregnancy but she has cut down the frequency of having the fast food now.</p> <p>She is a working mother and working until late, normally going back home at 6 -8 pm. Because of that she eats her dinner late around 8 – 9 pm every day. However, she does not use any fat source from animal (example: ghee) in her cooking, now using vegetable oil. She used to eat chapatti for her dinner.</p> <p>She does not do any regular exercise / join any exercise class during pregnancy. She considers herself really active as a working mother, doing a lot of household work and looking after her 2 year old daughter.</p> <p>She is frustrated with her current condition after a lot of effort that she has put in, it seems nothing has changed. Since she is working, she prefers to be interviewed in the clinic rather than at home. She has so many other tasks at</p>

Case	Ethnicity	Pregnancy Condition	Detail
			<p>home that she may not have even 5 minutes to be interviewed.</p> <p>She came alone to the clinic during the consultation day. (~10 minutes interview)</p>
Case 2	British White	1 st pregnancy, current gestational weights gain only 6 kg (90kg to 96 kg), third trimester, and baby growth normal. Prof Quenby referred her back to community midwife.	<p>She had weight problem before pregnancy and at that time, she did not care about her health condition, eating a lot of fast food or huge portions of food.</p> <p>She had nausea (morning sickness) and lost her appetite in early of pregnancy, so then she started eating in small portions but frequently.</p> <p>She changed her diet once she got pregnant. She wants to do the best for her baby to make sure her baby always stays healthy.</p> <p>She eats a lot of vegetables (loves tomatoes and cucumber), does not eat frozen food (always fresh food), and has reduced her intake of fast food (still eats fast food some time but in a small portion).</p> <p>She did not do any regular exercise but she said that she is really active walking at her workplace and did a household job at home.</p> <p>She came to the clinic with her mother. (~10 minutes interview)</p>
Case 3	British African	3 rd pregnancy, GDM (first time), 40 years old. Glucose level was control. Baby growth normal.	<p>She needs to meet dietician regularly at UHCW.</p> <p>At early pregnancy, she was craving a lot of fruits, for example she ate 10 oranges at one time.</p> <p>She was really frustrated, need to control her diet especially when need to reduce intake of her rice. She ate a lot of vegetables. She did not like to eat British foods and she ate African food all the time.</p> <p>She also did not do any regular exercise and complain of having a pelvic pain.</p> <p>She is working mother and really busy with other two kids and prefer to be interviewed at the hospital.</p> <p>Furthermore during her visit at the antenatal clinics, she also need to visit the diabetic clinic.</p> <p>Very limited time to talk with her since she said she was so hungry and need to rush before next appointment. (~5 minutes interview)</p>

Conclusion:

Interview should be done at Antenatal Clinics, UHCW since all mothers preferred to be interviewed at the hospital compared to their house. However, the reason for this may be because all pregnant mothers that I met were working mothers.

APPENDIX II : NHS ETHICAL APPROVAL LETTER



Health Research Authority

NRES Committee West Midlands - Edgbaston

The Old Chapel
Royal Standard Place
Nottingham
NG1 6FS

Telephone: 0115 8839695

30 January 2015

Ms Nor Asyikin Abd Ghafar
Division of Health Sciences
Warwick Medical School
Coventry
CV4 7AL

Dear Ms Abd Ghafar

Study title:	QUALITATIVE INVESTIGATIONS INTO THE FACTORS ASSOCIATED WITH BEING OVERWEIGHT IN PREGNANCY AMONG SOUTH ASIAN AND EUROPEAN WOMEN
REC reference:	14/WM/1255
IRAS project ID:	147676

Thank you for your letter of , responding to the Committee's request for further information on the above research and submitting revised documentation.

The further information has been considered on behalf of the Committee by the Chair.

We plan to publish your research summary wording for the above study on the HRA website, together with your contact details. Publication will be no earlier than three months from the date of this favourable opinion letter. The expectation is that this information will be published for all studies that receive an ethical opinion but should you wish to provide a substitute contact point, wish to make a request to defer, or require further information, please contact the REC Manager, Helen Poole, at NRESCommittee.WestMidlands-Edgbaston@nhs.net

Under very limited circumstances (e.g. for student research which has received an unfavourable opinion), it may be possible to grant an exemption to the publication of the study.

Confirmation of ethical opinion

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised, subject to the conditions specified below.

Conditions of the favourable opinion

The favourable opinion is subject to the following conditions being met prior to the start of the study.

You should notify the REC in writing once all conditions have been met (except for site approvals from host organisations) and provide copies of any revised documentation with updated version numbers. The REC will acknowledge receipt and provide a final list of the approved documentation for the study, which can be made available to host organisations to facilitate their permission for the study. Failure to provide the final versions to the REC may cause delay in obtaining permissions.

Management permission or approval must be obtained from each host organisation prior to the start of the study at the site concerned.

Management permission ("R&D approval") should be sought from all NHS organisations involved in the study in accordance with NHS research governance arrangements.

Guidance on applying for NHS permission for research is available in the Integrated Research Application System or at <http://www.rdforum.nhs.uk>.

Where a NHS organisation's role in the study is limited to identifying and referring potential participants to research sites ("participant identification centre"), guidance should be sought from the R&D office on the information it requires to give permission for this activity.

For non-NHS sites, site management permission should be obtained in accordance with the procedures of the relevant host organisation.

Sponsors are not required to notify the Committee of approvals from host organisations

It is the responsibility of the sponsor to ensure that all the conditions are complied with before the start of the study or its initiation at a particular site (as applicable).

Ethical review of research sites

NHS sites

The favourable opinion applies to all NHS sites taking part in the study, subject to management permission being obtained from the NHS/HSC R&D office prior to the start of the study (see "Conditions of the favourable opinion" below).

Approved documents

The final list of documents reviewed and approved by the Committee is as follows:

Document	Version	Date
Covering letter on headed paper [Cover Letter (Version 2)]	2	20 January 2015
Interview schedules or topic guides for participants [Topic Guide A (Pregnant Women)]	1	11 July 2014
Interview schedules or topic guides for participants [Topic Guide B (Health Professionals)]	1	11 July 2014

Letters of invitation to participant [Letter of Invitation (Pregnant Women)]	1	28 August 2014
Letters of invitation to participant [Letter of Invitation (Health Professional)]	1	28 August 2014
Other [CV Professor Gillian Hundt]	1	10 July 2014
Other [CV Dr Wendy Robertson]	1	11 July 2014
Other [Reply Slip (Version 2)]	2	20 January 2015
Other [Protocol Qualitative Research (Version 2)]	2	20 January 2015
Participant consent form [Consent Form for Pregnant Women]	2	20 January 2015
Participant consent form [Consent Form for Health Professionals]	2	20 January 2015
Participant information sheet (PIS) [Information Sheet Pregnant Women]	2	20 January 2015
Participant information sheet (PIS) [Information Sheet Health Professionals]	2	20 January 2015
REC Application Form [REC_Form_14112014]		14 November 2014
Summary CV for Chief Investigator (CI) [CV Nor Asyikin Abd Ghafar]	1	26 September 2014
Summary CV for supervisor (student research) [CV Professor Siobhan Quenby]	1	10 July 2014

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

After ethical review

Reporting requirements

The attached document "*After ethical review – guidance for researchers*" gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Adding new sites and investigators
- Notification of serious breaches of the protocol
- Progress and safety reports
- Notifying the end of the study

The HRA website also provides guidance on these topics, which is updated in the light of changes in reporting requirements or procedures.

User Feedback

The Health Research Authority is continually striving to provide a high quality service to all applicants and sponsors. You are invited to give your view of the service you have received and the application procedure. If you wish to make your views known please use the feedback form

available on the HRA website:

<http://www.hra.nhs.uk/about-the-hra/governance/quality-assurance/>

HRA Training

We are pleased to welcome researchers and R&D staff at our training days – see details at

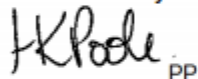
<http://www.hra.nhs.uk/hra-training/>

14/WM/1255

Please quote this number on all correspondence

With the Committee's best wishes for the success of this project.

Yours sincerely

Handwritten signature of Paul Hamilton in black ink, with the letters 'PP' written below it.


Mr Paul Hamilton
Chair

Email: NRESCCommittee.WestMidlands-Edgbaston@nhs.net


Enclosures: "After ethical review – guidance for researchers"

Copy to: Mrs Jane Prewett
Mrs Ceri Jones, Head of Research, Development and Innovation, UHCW NHS
Trust

APPENDIX III : RD&I APPROVAL LETTER



RDI
Research
Development
& Innovation

University Hospitals 
Coventry and Warwickshire
NHS Trust

Research, Development & Innovation Department
University Hospitals Coventry & Warwickshire NHS Trust
1st Floor Rotunda, (Opposite Cardiology)
University Hospital
Clifford Bridge Road
Coventry
CV2 2DX

Commercial enquiries: 02476 964995
Governance/Non-commercial enquiries: 02476 966195
Innovation & Communication enquiries: 02476 964748
Research Funding & Grant enquiries: 02476 964958
Email: RD&I@uhcw.nhs.uk

21 April 2015

Nor Asyikin Abd Ghafar
97 Dillotford Avenue,
Cheylesmore
CV3 5DT

Dear Nor Asyikin

Study Title: Qualitative investigations into the factors associated with being overweight in pregnancy among South Asian and European women
R&D no: NG155315

Thank you for submitting the above study for consideration by the Research Development and Innovation Office. I am pleased to inform you that your study has been approved.

Performance Data:
The Government wishes to see a dramatic and sustained improvement in the performance of providers of NHS services in initiating and delivering clinical research. The Trust is required to submit performance data to the NIHR on the 70 day benchmark (valid research application to first patient recruited) and the delivery of commercial contract trials to time and target.


You are requested to inform RD&I@uhcw.nhs.uk of the **date of first patient recruited**.

Date of first patient recruited (70 day benchmark)*:	30/06/2015
Recruitment target:	45
Agreed date (by which the last patient will be recruited):	-

*Please note that that date of first patient recruited is the date that the first **eligible** patient was **consented** into the study, not the date the patient was randomised. Consented patients who then fail screening should not be counted.

Approved Documents:
The documents approved for use in this study are:

Document	Version	Date
Topic Guide A – Pregnant Women	1	11 July 2014
Topic Guide B – Health Professionals	1	11 July 2014
Letter of Invitation – Pregnant Women	1	28 August 2014
Letter of Invitation – Health Professionals	1	28 August 2014
Reply Slip	2	20 January 2015
Protocol Qualitative Research	2	20 January 2015
Consent form – Pregnant Women	2	20 January 2015
Consent form – Health Professionals	2	20 January 2015
Participant Information – Pregnant Women	2	20 January 2015
Participant Information – Health Professionals	2	20 January 2015



We Care. We Achieve. We Innovate.

Conditions of Approval

- Should you wish to make any changes to the documents listed above, you must obtain R,D&I approval prior to use.

Sponsorship & Indemnity

Non-Commercial (Not sponsored by the Trust)

Your research sponsorship & Indemnity is provided by The University of Warwick.

Standard Operating Procedures

Current versions of all RD&I SOPs are available to view on the Trust intranet as follows:

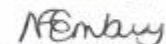
http://webapps/intranet/departments/research_and_development/SOP's.asp

Your project may be subject to ad hoc audit by our department to ensure these standards are being met.

May I take this opportunity to remind you that, as a researcher, you must ensure that your research is conducted in a way that protects the dignity, rights, safety and well-being of participants. Trust RD&I Approval assumes that you have read and understand the Research Governance Framework and accept that your responsibilities as a researcher are to comply with it, the Data Protection and Health & Safety Acts.

The Trust wishes you every success with your project.

Yours sincerely



Natassia Embury
RD&I Business Manager

Mrs Jane Prewett, Sponsor Representative, The University of Warwick
Professor Siobhan Quenby, Academic Supervisor, The University of Warwick

APPENDIX IV: HONORARY RESEARCH CONTRACT



University Hospitals **NHS**
Coventry and Warwickshire
NHS Trust

Research, Development & Innovation Department
University Hospitals Coventry & Warwickshire NHS Trust
1st Floor Rotunda, (Opposite Cardiology)
University Hospital
Clifford Bridge Road
Coventry
CV2 2DX

Commercial enquiries: 02476 964995
Governance/Non-commercial enquiries: 02476 966195
Innovation & Communication enquiries: 02476 964748
Research Funding & Grant enquiries: 02476 964958
Email: RD&I@uhcw.nhs.uk

21 April 2015

Nor Asyikin Abd Ghafar
97 Dillitford Avenue,
Cheylesmore
CV3 5DT

Dear Nor Asyikin,

Honorary research contract issued by University Hospitals Coventry and Warwickshire NHS Trust

Study Title: Qualitative investigations into the factors associated with being overweight in pregnancy among South Asian and European women.
RD&I Number: NG155315

I am pleased to offer you an honorary research contract in **University Hospitals Coventry and Warwickshire NHS Trust**. I should be grateful if you would sign the attached three contracts, keep one yourself and return the other two to Sonia Kandola. We will send a copy of the contract to your substantive employer.

The contract if accepted by you begins on **21 April 2015** and ends on **20 April 2018** unless terminated earlier in accordance with the clauses in the contract. Please note that you cannot start the research until the Principal Investigator has received a letter from us giving permission to conduct the project.

If you have a physical or mental health condition or disability which may affect your research role and which might require special adjustments to your role, if you have not already done so, you must notify your employer and **Ceri Jones, Head of Research, Development and Innovation** prior to commencing your research role at the Trust.

We will not reimburse any expenses you incur in the course of your research unless we have agreed to do so by prior arrangement. Similarly, we accept no responsibility for damage to or loss of personal property.

Your Research Passport Form may be subject to random checks carried out by us within the lifetime of the project. The information it contains must therefore remain up to date and accurate.

If your circumstances change in relation to your health, criminal record, suitability to work with adults or children, professional registration or any other aspect that may impact on your suitability to conduct research, or your role in research changes, you must inform your employer through its normal procedures. You must also inform your nominated manager in this NHS organisation.

You must not undertake regulated activity if you are barred from such work. If you are barred from working with adults or children this honorary research contract is immediately terminated. Your employer will immediately withdraw you from undertaking this or any other regulated activity and you **MUST** stop undertaking any regulated activity immediately.



We **Care**. We **Achieve**. We **Innovate**.

Once you have signed and returned two of the attached contracts, you should contact the R,D&I department of this organisation, who will arrange for you to be issued with an ID badge.

Yours sincerely


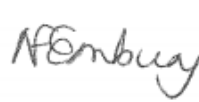


Natassia Embury
RD&I Business Manager

cc: HR Department, University of Warwick
Wendy Robertson, Associate Professor in Public Health, University of Warwick



(A copy of the signed honorary research contract must be sent to the substantive employer/academic supervisor. Where relevant, "Trust" or "PCT" should be replaced by "Board".)

HONORARY RESEARCH CONTRACT BETWEEN	
NHS organisation(s): University Hospitals Coventry and Warwickshire NHS Trust	
AND	
Name:	Nor Asyikin Abd Ghafar
Employer:	
OR Place of Study:	The University of Warwick
Report To:	
(Principal Investigator/Head of Department)	Professor Siobhan Quenby/Ceri Jones, Head of RD&I
PERIOD of AGREEMENT	
From:	21 April 2015
To:	20 April 2018
SIGNATURES	
Researcher:	
Date:	21/4/2015
Name:	Nor Asyikin Abd Ghafar
On behalf of the NHS organisation(s)	
Date:	21/4/2015
Name:	Natassia Embury

APPENDIX V : TOPIC GUIDE FOR OBESE PREGNANT WOMEN

SECTION	QUESTION
Health during pregnancy	<ol style="list-style-type: none"> How are you feeling during this pregnancy? <ol style="list-style-type: none"> Prompt: If she has been pregnant before – explore if feeling the same or different? How was your health in general before you were pregnant? Did you plan the pregnancy?
Family background and living circumstance	<ol style="list-style-type: none"> Can you tell me about your family situation? <ol style="list-style-type: none"> Prompt: children, husband, household?
Physical activity	<ol style="list-style-type: none"> Can you tell me about your physical activity during this pregnancy? <ol style="list-style-type: none"> Prompt: Is it different from when you are not pregnant? What do you think about exercising in general and during pregnancy? What would help you take exercise in your daily life? What prevents you from taking exercise in your daily life?
Food consumption	<ol style="list-style-type: none"> Can you tell me what you ate yesterday, starting with the morning and going through the day. <ol style="list-style-type: none"> Prompt: eating alone or together with others Prompt: Was this a typical day? What other foods / meals have you been eating during this pregnancy? <ol style="list-style-type: none"> Prompt: Is it different from when you are not pregnant? If so how? Who does the shopping in your family? <ol style="list-style-type: none"> Prompt: How do you (or person doing shopping) decide what food to buy? Does the money you have affect what you buy? Do you eat out or buy ready meals (e.g. McDonalds, takeaways)?
Body weight	<ol style="list-style-type: none"> How do you feel about your body weight during this pregnancy? How different is it to when you were not pregnant? <ol style="list-style-type: none"> Prompt: How different is it to other pregnancies (if applicable)? Have you tried to lose weight before this pregnancy and how did you get on with this? What do you think would help you with your weight?



PARTICIPANT INFORMATION SHEET FOR PREGNANT WOMEN

RESEARCH

“Factors Associated with being Overweight in Pregnancy”

We would like to invite you to take part in our research study. Before you decide we would like you to understand why the research is being done and what it would involve for you. Please take time to read the following information. Talk to others about the study if you wish. One of our team will go through the information sheet with you and answer any questions you have.

Part 1 tells you the purpose of the study and what will happen if you take part.

Part 2 gives you more detailed information about the conduct of the study.

Please ask us if there is anything that is not clear or if you would like more information.

Part 1 of the Information Sheet

1. What is the purpose of the study?

The purpose of this study is to understand the views and activities of first and later generation South Asian and European women concerning their health, diet and physical activity during pregnancy. We also would like to explore the other factors that affect food intake and physical activity among overweight or obese pregnant women who are attending the antenatal clinic at UHCW. Besides interviewing pregnant women, 10 health professionals (Obstetricians, Dietitians and Midwives) will be interviewed to obtain their views on diet, physical activity and environmental factors associated with obesity during pregnancy.

Overweight and obesity is increasing amongst pregnant women, and is higher amongst South Asian women compared to White women. Obesity during pregnancy may have immediate and long term health consequences. This study will increase understanding of the needs and situation of these pregnant women and help in planning appropriate health care provision and lifestyle support.

2. Why have I been invited?

We are aiming to recruit 45-60 pregnant mothers in total to the study (15-20 first generation South Asians (not born in UK), 15-20 later generation South Asians (born in UK) and 15-20 Europeans, from across Coventry and Warwickshire.

You have been invited to participate because you have an appointment at the Antenatal Clinic, UHCW with Professor Siobhan Quenby as a pregnant women who needs additional care. We are interested to know your experiences and views during and before pregnancy. The eligibility criteria of this study are for women to be South Asian (Indian, Pakistani & Bangladeshi) or European, who are aged 18 and older and overweight or obese (at booking).

3. Do I have to take part?

It is up to you to decide to join the study. We will describe the study and go through this information sheet. If you agree to take part, we will then ask you to sign a consent form. You are free to withdraw at any time, without giving a reason. This would not affect the standard of care you receive.

4. What will happen if I take part in the study?

I will meet with you on one occasion after your appointment at the Antenatal Clinics at UHCW or appointment at Biomedical Research Unit (BRU). Overall your participation will take 1 to 1 ½ hours. During this time, I will explain the study and ask for your consent to take part. Then I will ask you a few questions about yourself and then carry out an interview for about 45 minutes

to 1 hour. The interviews will be audio recorded and notes generated. The interview will take place in a private and comfortable environment.

5. What questions will be asked during the interview?

You will be asked about 5 main topics relating to health during and before pregnancy. These are your family background and living circumstances, physical activity, food consumption and body weight.

6. What are the possible disadvantages and risks of taking part?

A possible disadvantage is the amount of time this interview will take for you.

There is potential for distress for you during the interview. To minimise this, I will stop at any stage of the interview if you do not wish to continue the conversation. There are research midwives available to talk to you if you become distressed during the interview.

7. What are the possible benefits of taking part?

This study is designed to understand and explore your understanding, experience and feelings concerning food and exercise during pregnancy.

We cannot promise the study will help you but the information we get from this study will help pregnant women who are overweight or obese in the future.

8. What if there is a problem?

Any complaint about the way you have been approached or treated during the study or any possible harm you might suffer will be addressed. The detailed information on this is given in Part 2.

9. Will my taking part in the study be kept confidential?

Yes, all information about you will be confidential and will be anonymised.

The only exception to confidentiality is if the content of the interview raises any concerns about the safety of yourself or other individuals. In this event, I would seek advice from the research midwife or PhD Supervisors.

Further details are included in Part 2.

This completes Part 1. If this information has interested you and you are considering participation, please read the additional information in Part 2 before making any decision.

Part 2 of the Information Sheet

1. What will happen if I don't want to carry on with the study?

I will stop at any stage of the interview if you do not wish to continue the conversation.

After the interview, if you wish to withdraw your participation, you can do this within 2 weeks of the interview, and all the notes and the recording will be destroyed.

2. What if there is a problem?

If you have a concern about any aspect of the study you should ask to speak to the researchers or NHS staff who will do their best to answer your questions. Please contact:

University of Warwick	UHCW Staff
Nor Asyikin Abd Ghafar PhD Student Warwick Medical School University of Warwick Coventry CV4 7AL Tel: 07460 402626 Email: n.a.abd-ghafar@warwick.ac.uk	Professor Siobhan Quenby Antenatal Clinic University Hospital Clifford Bridge Road Coventry CV2 2 DX Tel: 024 7696 7350 Email: S.Quenby@warwick.ac.uk

If you remain unhappy and wish to complain formally, complaints should be addressed to the University of Warwick using the following contact details:

University of Warwick – complaints
Jo Horsburgh Deputy Registrar University of Warwick Research Support Services, University House, Kirby Corner Road Coventry CV4 8UW Tel: 024 7652 2785 Fax: 024 7652 4751 Email: n.lynch@warwick.ac.uk

3. What if I would like to complain to UHCW?

If you would like to make a complaint about this study, it could be resolved straight away by talking it through with a member of NHS staff. You can approach NHS staff within the service concerned, or if you would prefer to talk to someone independent of the care, you may value a discussion with PALS (Patient Advice and Liaison Service).

Useful addresses and telephone numbers:

Patient Advice and Liaison Service (PALS) University Hospitals Coventry and Warwickshire NHS Trust Clifford Bridge Road Coventry CV2 2DX Tel: 0800 028 4203	Sharon Wyman, Complaints Manager University Hospitals Coventry and Warwickshire NHS Trust Clifford Bridge Road Coventry CV2 2DX Tel: 024 7696 5198 Email: complaints@uhcw.nhs.uk
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4. Will my taking part in this study be kept confidential?

All information which is collected about you during the course of the research would be kept strictly confidential. There is a specific locked room to keep all the data at the Biomedical Research Unit (BRU) at UHCW which can only be accessed by the research team at the BRU.

The interview transcripts will have any personal identifiable material removed such as any names. All data files (computer files and paper records) will be assigned a study number to ensure anonymity. The link between your name and the unique numerical identifier will be stored in a locked filing cabinet at BRU. Any information which leaves the hospital about you will have your name and address removed so that you cannot be recognised from it.

Electronic data (audio tapes and transcripts) will be stored on University of Warwick computers with restricted access by researcher and supervisors only which will be encrypted and password protected.

Only data essential to the completion of the study will be accessed. All materials will be stored in a locked filing cabinet. No participating individual will be identified personally in any presentation and publication.

The only exception to confidentiality is if the content of the interview raises any concerns about the safety of yourself or other individuals. In this event, I would seek advice from the research midwife or PhD Supervisors.

5. What will happen to the results of the research study?

The results of the study will be written up in a PhD thesis and for publication in academic journals. The identity of those taking part will not be identified in the PhD thesis or in any report or publication. Furthermore, the city and hospital will not be identified either, other than being in the West Midlands.

We will send you a summary of the results in the post.

6. How long will personal data be stored or accessed after the study has ended?

After the study ends, the data will be saved on the university server and will be kept by Warwick Medical School under the supervision of Dr Wendy Robertson and Professor Siobhan Quenby. The researcher will also have a set of the anonymised research data. All your contact details will be shredded.

In accordance with the University of Warwick's Research Code of Conduct, data will be retained intact in paper or electronic format as appropriate, normally for a period of at least 10 years from the date of any publication which is based upon it.

7. Who is organising the research?

The research is being organised by Nor Asyikin Abd Ghafar, PhD student from the Medical School at the University of Warwick, supervised by three academic members of staff as named below:

- i. Professor Siobhan Quenby, Professor of Obstetrics, Division of Reproductive Health, Warwick Medical School
- ii. Dr Wendy Robertson, Associate Professor in Public Health, Division of Health Sciences, Warwick Medical School, University of Warwick
- iii. Professor Gillian Hundt, Professor of Social Sciences in Health, Division of Health Sciences, Warwick Medical School, University of Warwick

The researchers do not receive any payment for including you in the study.

8. Who has reviewed the study?

All research in the NHS is looked at by an independent group of people, called a Research Ethics Committee, to protect your interests. The study has been reviewed and given a favourable opinion by West Midlands - Edgbaston Research Ethics Committee.

9. Further information and contact details

(a) General Information about Research

'Consumers for Ethics in Research' have produced a leaflet 'Medical Research and You'. This leaflet gives more information about medical research, and looks at questions you may want to ask. A copy is attached.

(b) Specific Information about this Research Project

If you have any questions about this study, please contact a member of the research team. These are:-

Nor Asyikin Abd Ghafar on Tel: 07460402626

Supervisors:

Dr Wendy Robertson Associate Professor of Public Health Room B149 Medical School Building Gibbet Hill campus Warwick Medical School University of Warwick CV4 7AL Tel : 024 7657 4660 Email : W.Robertson@warwick.ac.uk	or	Professor Siobhan Quenby Professor at Obstetrics Honorary Consultant Reproductive Health Warwick Medical School University of Warwick CV4 7AL Tel : 024 7696 8657 Email : S.Quenby@warwick.ac.uk
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Thank you for taking time to read this & for thinking about taking part.



RESEARCH STUDY REPLY SLIP

Title of Project:

“Factors Associated with being Overweight in Pregnancy”

I am interested in discussing the research project in more detail before agreeing to be interviewed: Yes ☐ No ☐

Name :

Tel :

Address :

.....

Please send this reply slip back in the pre-paid envelope to

Professor Siobhan Quenby

Antenatal Clinic, University Hospital

Clifford Bridge Road, Coventry CV2 2DX

or bring it to your clinic visit at UHCW.

Many thanks for considering taking part in this research.

APPENDIX VIII



Identification Number for this study:

CONSENT FORM FOR PREGNANT WOMEN

Title of Project: “Factors Associated with being Overweight in Pregnancy”

Name of Researcher: Nor Asyikin Abd Ghafar, Warwick Medical School, University of Warwick
Tel: 07460402626

		Please initial
box		
1.	I confirm that I have read and understand the information sheet dated 20.01.15 (version 2) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	<input type="checkbox"/>
2.	I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected.	<input type="checkbox"/>
3.	I understand that the anonymised data collected during the study, may be looked at by individuals from regulatory authorities or from NHS Trust, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my anonymised data.	<input type="checkbox"/>
4.	I understand that I will be interviewed and I consent to this interview being tape recorded.	<input type="checkbox"/>
5.	I understand that the information I give will remain confidential and that I will be given anonymity in any publications or reports which arise from the research.	<input type="checkbox"/>
6.	I agree to take part in the above study.	<input type="checkbox"/>

Name of Participant

Date

Signature

Name of Person taking consent

Date

Signature

Copies:- 1 for participant; 1 for researcher site file; 1 (original) to be kept with hospital notes.

**PARTICIPANT'S DEMOGRAPHIC FORM:
SEMI- STRUCTURED INTERVIEW WITH PREGNANT WOMEN**

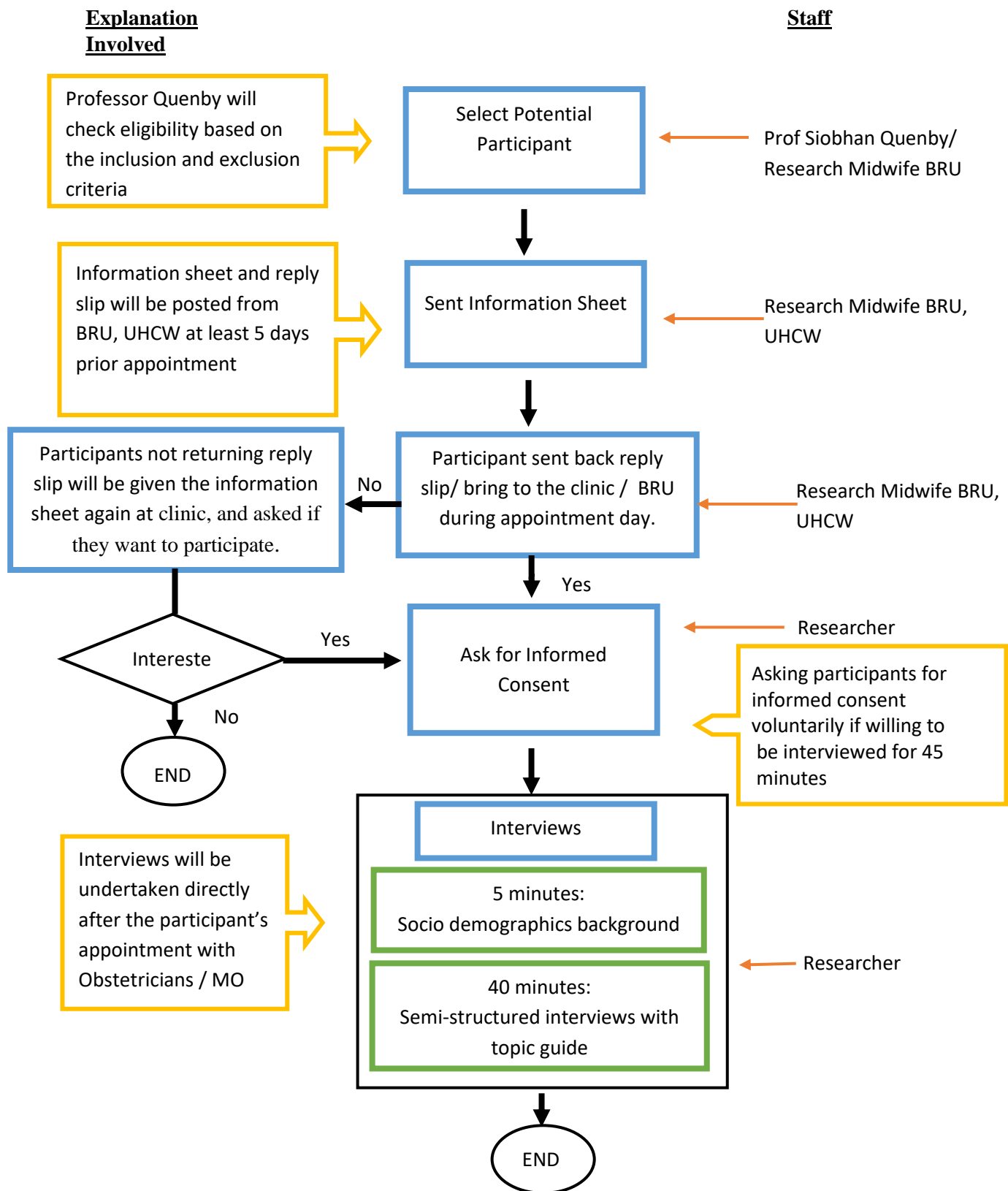
Instruction: To be completed by researcher.

1. Age : _____
2. Height : _____ cm
(at booking)
3. Weight : _____ kg
(at booking)
4. Stage of Pregnancy : ☐ 1st Trimester
☐ 2nd Trimester
☐ 3rd Trimester
5. Postcode : _____
6. Ethnic Origin: ☐ White British
☐ Asian / Asian British
☐ Indian
☐ Pakistani
☐ Bangladeshi
☐ Other
7. Country of Birth: ☐ UK
☐ India
☐ Pakistan
☐ Bangladesh
☐ Other
8. Employment Status: ☐ Employed Full Time
☐ Employed Part Time
☐ Full Time Housewife
☐ Student
☐ Other, please specify
: _____
9. Education Level: ☐ Degree or higher education
☐ Diploma/ GCSE/ A Level
or equivalent
☐ No qualification
10. Number of Children : ☐ 0
☐ 1
☐ 2
☐ 3 or more
11. Marital Status : ☐ Married
☐ Single
☐ Separated/ Divorced/ Widowed

12. Do you have any medical conditions (such as gestational diabetes, hypertension), if yes please specify: _____

APPENDIX X

DIAGRAM OF RECRUITMENT PROCEDURE
OBESE PREGNANT WOMEN AT BIOMEDICAL RESEARCH UNIT (BRU), UHCW



APPENDIX XI

TOPIC Guide For Health Professionals

SECTION	QUESTION
Health during pregnancy	<ol style="list-style-type: none">1. What are your views on the health of obese pregnant women?<ol style="list-style-type: none">a. Prompt: Are there any differences between South Asian first generation versus South Asian later generation and European?
Family background and living circumstance	<ol style="list-style-type: none">2. What is your views on family support of obese pregnant women?<ol style="list-style-type: none">a. Prompt: children, husband, householdb. Prompt: Are there any differences between South Asian first generation versus South Asian later generation and European?
Physical activity	<ol style="list-style-type: none">3. What are your views on current practice of physical activity among obese pregnant women?<ol style="list-style-type: none">a. Prompt: Are there any differences between South Asian first generation versus South Asian later generation and European?b. Prompt : What is the barriers to exercise during pregnancy among obese pregnant women?4. What advice usually do you give them?<ol style="list-style-type: none">a. Prompt: Is there any different advice given to South Asian first generation versus South Asian later generation and European?5. Are you confident with the physical activity advice you give them?<ol style="list-style-type: none">a. Prompt: Any tools?6. What is their reaction to advice that you gave to them?<ol style="list-style-type: none">a. Prompt: Do you know whether they follow the advice that you give to them?b. Prompt: What do you think would help the obese pregnant to increase physical activity during pregnancy?
Food consumption	<ol style="list-style-type: none">7. What is your opinion on current food intake among obese pregnant women?<ol style="list-style-type: none">a. Prompt : Are there any differences between South Asian first generation versus South Asian later generation and European?8. What advice do you give them?<ol style="list-style-type: none">a. Prompt: Is there any different advice given to South Asian first generation versus South Asian later generation and European?

SECTION	QUESTION
	<p>9. Are you confident regarding the nutrition information you give them?</p> <p>a. Prompt: Do you use any tools?</p> <p>10. What is their reaction on advice that you gave to them?</p> <p>a. Prompt: Do they follow the advice given to them?</p> <p>11. What do you think would help the obese pregnant women to eat healthily?</p>
Body weight	<p>12. How do you advice obese pregnant women to control their body weight during pregnancy?</p> <p>a. Prompt: Any tools?</p> <p>13. Are you confident with the information you give them?</p> <p>a. Prompt: Any tools?</p> <p>b. Prompt: Are there any differences between South Asian first generation versus South Asian later generation and European?</p> <p>14. Are there any differences of attitude and behaviour among obese women who can control their body weight and those who don't?</p> <p>15. What do you think would help the obese pregnant to control their body weight?</p>
Preconception Health	<p>16. Have you ever been involved in providing information about weight management before pregnancy to obese women (or preconception health more generally)?</p> <p>17. Do they follow the advice given to them?</p>

APPENDIX XII



PARTICIPANT INFORMATION SHEET FOR HEALTH PROFESSIONALS

RESEARCH

“Factors Associated with being Overweight in Pregnancy”

I would like to invite you to take part in our research study. Before you decide, I would like you to understand why the research is being done and what it would involve for you. Please take time to read the following information. Talk to others about the study if you wish. I will go through the information sheet with you and answer any questions you have.

Part 1 tells you the purpose of the study and what will happen if you take part.

Part 2 gives you more detailed information about the conduct of the study.

Please ask us if there is anything that is not clear or if you would like more information.

Part 1 of the Information Sheet

1. What is the purpose of the study?

The purpose of this study is to explore the views and experience of health professionals related to dietary intake and physical activity of overweight or obese pregnant women. We would like to explore the advice you give to pregnant women who are overweight or obese using a semi-structured interview. The interviews will be carried out at UHCW or an NHS base that is convenient for you.

Besides interviewing health professionals, 45-60 pregnant women (15-20 first generation South Asians (not born in UK), 15-20 later generation South Asians (born in UK) and 15-20 Europeans) will be interviewed to obtain their views and activities on diet, physical activity and environmental factors associated with obesity during pregnancy who are attending the antenatal clinic at UHCW .

Overweight and obesity is increasing amongst pregnant women, and is higher amongst South Asian women compared to White women. Obesity during pregnancy may have immediate and long term health consequences. This study will increase understanding of the needs and situation of these pregnant women and help in planning appropriate health care provision and lifestyle support.

2. Why have I been invited?

We are aiming to recruit 10 health professionals in total to the study, 2 obstetricians (from UHCW), 2 dieticians (from UHCW) and 6 community midwives (Foleshill, and Hillfields area).

You have been invited to participate because you are working at UHCW or in the Coventry area. We are interested to hear your experiences and views during your time working with the overweight or obese pregnant women.

3. Do I have to take part?

It is up to you to decide whether you want to join the study. If you agree to take part, we will then ask you to sign a consent form. You are free to withdraw at any time, without giving a reason.

4. What will happen if we take part in the study?

We only meet one time during this study with an appointment to suit you. Overall your participation will take 1 to 1 ½ hour. I will ask your consent first to take part in this study, followed by a questionnaire about you and your working experience. Then, you will be interviewed for approximately 1 hour. The face to face interviews will be digitally audio recorded and field notes generated. During the interview process, open ended questions will be used. The interview will take place in a private and comfortable environment.

5. What questions will be asked during the interview?

You will be asked about 6 main topics relating to health during and before pregnancy. These are about the family background and living circumstances, physical activity, food consumption, body weight and preconception health of obese pregnant women. This will include the advice you give.

6. What are the possible disadvantages and risks of taking part?

A possible disadvantage is the amount of time this interview will take for you, but we will restrict the length to around 1 ½ hour.

7. What are the possible benefits of taking part?

This study is designed to understand and explore your views, feelings, understanding and experience concerning the dietary intake and physical activity of overweight or obese pregnant women.

This study will help by giving a better understanding of the issues, and may help with the advice given to overweight or obese pregnant women in the future.

8. What if there is a problem?

Any complaint about the way you have been approached or treated during the study or any possible harm you might suffer will be addressed. The detailed information on this is given in Part 2.

9. Will my taking part in the study be kept confidential?

Yes, all information about you will be confidential and will be anonymised.

The only exception to confidentiality is if the content of the interview raises any concerns about the safety of yourself or other individuals. In this event, I would seek advice from the research midwife or PhD Supervisors.

This completes Part 1. If this information has interested you and you are considering participation, please read the additional information in Part 2 before making any decision.

Part 2 of the Information Sheet

1. What will happen if I don't want to carry on with the study?

I will stop at any stage of the interview if you do not wish to continue the conversation.

After the interview, if you wish to withdraw your participation, you can do this within 2 weeks of the interview, and all the notes and the recording will be destroyed.

2. What if there is a problem?

If you have a concern about any aspect of the study you should ask to speak to the researchers or NHS staff who will do their best to answer your questions. Please contact:

University of Warwick	UHCW Staff
Nor Asyikin Abd Ghafar PhD Student Warwick Medical School University of Warwick Coventry CV4 7AL Tel: 07460 402626 Email: n.a.abd-ghafar@warwick.ac.uk	Professor Siobhan Quenby Antenatal Clinic University Hospital Clifford Bridge Road Coventry CV2 2 DX Tel: 024 7696 7350 Email: s.quenby@warwick.ac.uk

If you remain unhappy and wish to complain formally, complaints should be addressed to the University of Warwick using the following contact details:

University of Warwick – complaints
Jo Horsburgh Deputy Registrar University of Warwick Research Support Services, University House, Kirby Corner Road Coventry CV4 8UW Tel: 024 7652 2785 Fax: 024 7652 4751 Email: n.lynch@warwick.ac.uk

3. What if I would like to complain to UHCW?

If you would like to complain to UHCW or prefer to talk to someone independent of the care, you may value a discussion with PALS (Patient Advice and Liaison Service).

Useful addresses and telephone numbers:

Patient Advice and Liaison Service (PALS) University Hospitals Coventry and Warwickshire NHS Trust Clifford Bridge Road Coventry CV2 2DX Tel: 0800 028 4203	Sharon Wyman, Complaints Manager University Hospitals Coventry and Warwickshire NHS Trust Clifford Bridge Road Coventry CV2 2DX Tel: 024 7696 5198 Email: complaints@uhcw.nhs.uk
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4. Will my taking part in this study be kept confidential?

All information which is collected about you during the course of the research would be kept strictly confidential. There is a specific locked room to keep all the data at the Biomedical Research Unit (BRU) at UHCW which can only be accessed by the research team at the BRU.

The interview transcripts will have any personal identifiable material removed such as any names. All data files (computer files and paper records) will be assigned a study number to ensure anonymity. The link between your name and the unique numerical identifier will be stored in a locked filing cabinet at BRU. Any information which leaves the hospital about you will have your name and address removed so that you cannot be recognised from it.

Electronic data (audio tapes and transcripts) will be stored on University of Warwick computers with restricted access by researcher and supervisors only which will be encrypted and password protected.

Only data essential to the completion of the study will be accessed. All materials will be stored in a locked filing cabinet. No participating individual will be identified personally in any presentation and publication.

5. What will happen to the results of the research study?

The results of the study will be written up in a PhD thesis and for publication in academics journals. The identity of those taking part will not be identified in my PhD thesis or in any report or publication. Furthermore, the city and hospital will not be identified either, other than being in the West Midlands.

We will send you a summary of the results in the post.

6. How long will personal data be stored or accessed after the study has ended?

After the study ends, the data will be saved on the university server and will be kept by Warwick Medical School under the supervision of Dr Wendy Robertson and Professor Siobhan Quenby. The researcher will also have a set of the anonymised research data. All your contact details will be shredded.

In accordance with the University of Warwick's Research Code of Conduct, data will be retained intact in paper or electronic format as appropriate, normally for a period of at least 10 years from the date of any publication which is based upon it.

7. Who is organising and funding the research?

The research is being organised by Nor Asyikin Abd Ghafar, PhD student from the Medical School at the University of Warwick, supervised by three academic members of staff as named below:

- i. Professor Siobhan Quenby, Professor of Obstetrics, Division of Reproductive Health, Warwick Medical School
- ii. Dr Wendy Robertson, Associate Professor in Public Health, Division of Health Sciences, Warwick Medical School, University of Warwick
- iii. Professor Gillian Hundt, Professor of Social Sciences in Health, Division of Health Sciences, Warwick Medical School, University of Warwick

The researchers do not receive any payment for including you in the study.

8. Who has reviewed the study?

All research in the NHS is looked at by an independent group of people, called a Research Ethics Committee, to protect your interests. The study has been reviewed and given a favourable opinion by West Midlands - Edgbaston Research Ethics Committee.

9. Further information and contact details

(a) General Information about Research

‘Consumers for Ethics in Research’ have produced a leaflet ‘Medical Research and You’. This leaflet gives more information about medical research, and looks at questions you may want to ask. A copy is attached.

(b) Specific Information about this Research Project

If you have any questions about this study, please contact a member of the research team. These are:-

Nor Asyikin Abd Ghafar on Tel: 07460402626

Supervisor

Dr Wendy Robertson Associate Professor of Public Health Medical School Building Gibbet Hill campus Warwick Medical School University of Warwick CV4 7AL Tel : 024 7657 4660 Email : W.Robertson@warwick.ac.uk	or	Professor Siobhan Quenby Professor of Obstetrics Honorary Consultant Reproductive Health Warwick Medical School University of Warwick CV4 7AL Tel : 024 7696 8657 Email : S.Quenby@warwick.ac.uk
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Thank you for taking time to read this & for thinking about taking part.



Identification Number for this study:

CONSENT FORM FOR HEALTH PROFESSIONALS

Title of Project: “Factors Associated with being Overweight in Pregnancy”

Name of Researcher: Nor Asyikin Abd Ghafar, Warwick Medical School, University of Warwick
Tel: 07460402626

		Please
initial Box		
1.	I confirm that I have read and understand the information sheet dated 20.01.15 (version 2) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	<input type="checkbox"/>
2.	I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected.	<input type="checkbox"/>
3.	I understand that the anonymised data collected during the study, may be looked at by individuals from regulatory authorities or from NHS Trust, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my anonymised data.	<input type="checkbox"/>
4.	I understand that I will be interviewed and I consent to this interview being tape recorded.	<input type="checkbox"/>
5.	I understand that the information I give will remain confidential and that I will be given anonymity in any publications or reports which arise from the research.	<input type="checkbox"/>
6.	I agree to take part in the above study.	<input type="checkbox"/>

Name of Participant

Date

Signature

Name of Person taking consent

Date

Signature

Copies:- 1 for participant; 1 for researcher site file; 1 (original) to be kept with hospital

APPENDIX XIV:

PARTICIPANT'S DEMOGRAPHIC FORM:

SEMI-STRUCTURED INTERVIEWS WITH HEALTH PROFESSIONALS

Instruction: Please provide information in the blank section or make a tick in the box (✓).

1. Age : _____

2. Gender : ☐ Male

☐ Female

3. Ethnic Origin:

☐ White British

☐ Asian British/ Asian, please specify : _____

☐ Black British/ African/ Caribbean, please specify : _____

☐ Mixed Group, please specify : _____

☐ Other Ethnic Group, please specify : _____

4. Occupation: ☐ Obstetrician

☐ Dietician

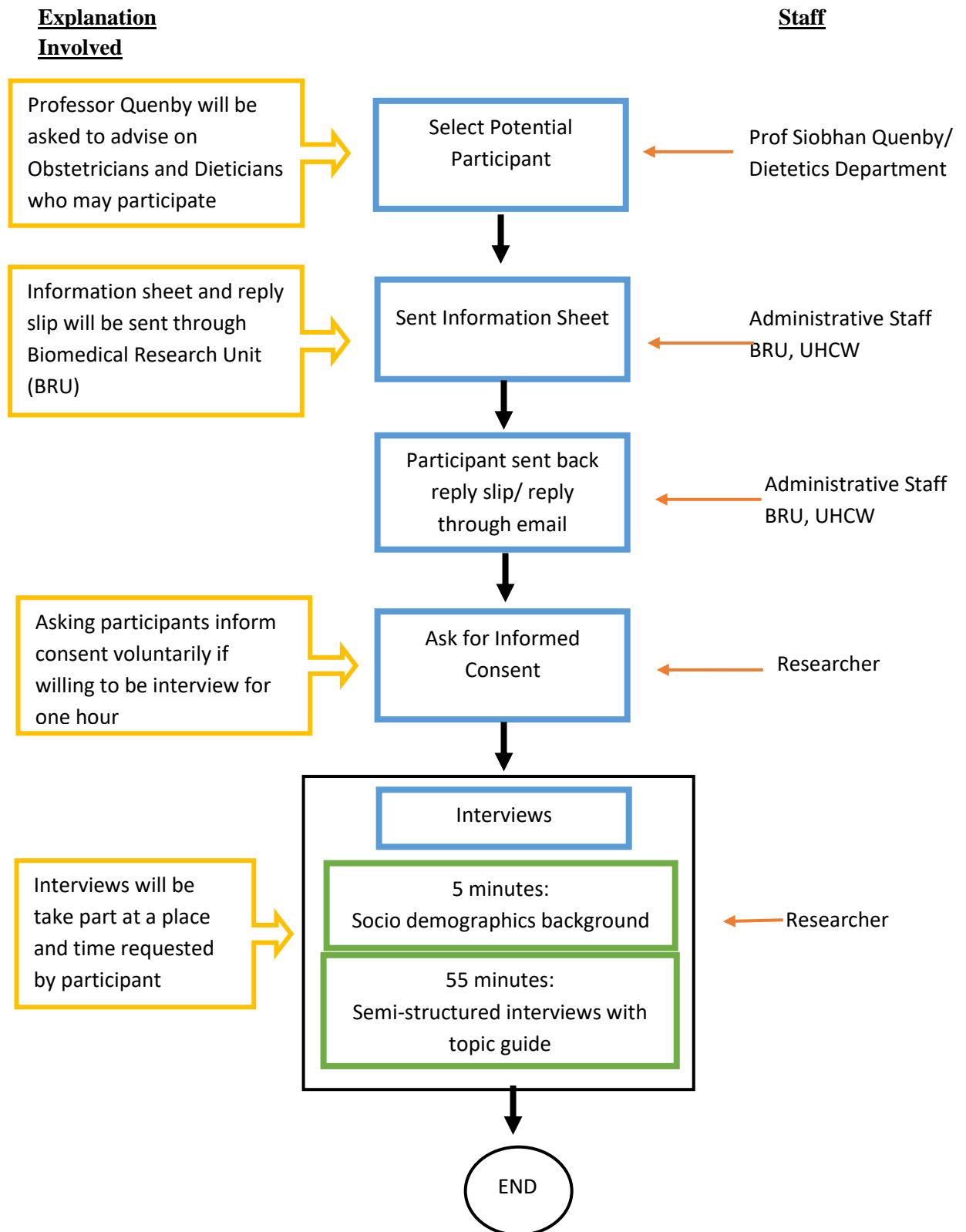
☐ Community Midwife

5. Working experience with obese pregnant women: _____ years

6. Job description:

APPENDIX XV

DIAGRAM OF RECRUITMENT PROCEDURE HEALTH PROFESSIONALS (OBSTETRICIANS AND DIETICIANS)



APPENDIX XVI:

DIAGRAM OF RECRUITMENT PROCEDURE HEALTH PROFESSIONALS (COMMUNITY MIDWIVES)

