THE IMPACT OF SOCIOECONOMIC POSITION ON SEVERE MATERNAL MORBIDITY OUTCOMES AMONGST WOMEN IN THE UNITED KINGDOM AND AUSTRALIA

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ABBREVIATIONS

Abbreviation	Definition
AFE	Amniotic fluid embolism
AFLP	Acute fatty liver of pregnancy
ATSI	Aboriginal and Torres Strait Islander
BMI	Body mass index
BPSU	British Paediatric Surveillance Unit
CCOPMM	Consultative Council on Obstetric and Paediatric Mortality and Morbidity
CEMD	Confidential Enquiry into Maternal Deaths
GRO	General Register Office
HELLP	Haemolysis, elevated liver enzymes, low platelets
ICD	International Classification of Disease
ICU	Intensive Care Unit
IMD	Index of Multiple Deprivation
LEMMoN	Landelijke studie naar Etnische determinanten van Maternale Morbiditeit in Nederland (National Study into Ethnicity Determinants of Maternal Morbidity in the Netherlands)
LLSOA	Lower Layer Super Output Areas
MDG	Millennium Development Goal
MMOI	Maternal Morbidity Outcome Indicator
NHS	National Health Service
NICU	Neonatal Intensive Care Unit
NISRA	Northern Ireland Statistics and Research Agency
NMS	National Maternity Survey
NPEU	National Perinatal Epidemiology Unit
NS-SEC	National Statistics Socio-economic Classification
ONS	Office for National Statistics
OR	Odds ratio
OWLS	Oxford Worries about Labour Scale
SC	Social Class
SCBU	Special Care Baby Unit
SEG	Socio-Economic Groups
UK	United Kingdom (including England, Wales, Scotland and Northern Ireland)
UKOSS	UK Obstetric Surveillance System
US	United States
VBAC	Vaginal birth after caesarean
VPDC	Victorian Perinatal Data Collection
WHO	World Health Organization

GLOSSARY

Term	Definition
Acute fatty liver of pregnancy	A serious but rare condition arising in pregnancy, associated with nausea, vomiting, abdominal pain and jaundice. Diagnosis is confirmed by elevated liver enzymes (AST particularly) and changes of fatty liver on imaging (Edmonds 2008).
Acute renal failure	Abrupt deterioration in kidney function, usually reversible over a period of weeks to days (Kumar and Clark 2005).
Amniotic fluid embolism	An extremely rare but life-threatening condition of pregnancy whereby amniotic fluid enters the maternal bloodstream under a pressure gradient and can result in shock, hypotension, cardiac arrythmias or arrest, acute fetal compromise, seizures or death (Edmonds 2008).
Antenatal	Existing or occurring before birth, with reference to the fetus (Anderson 2000).
Cardiac failure	Heart failure resulting from any structural or functional cardiac disorder that impairs the ability of the heart to function as a pump to support a physiological circulation (Kumar and Clark 2005).
Case-control study	A study that involves a group of people with the disease of interest (cases) and a random sample of people without the disease (controls), allowing assessment of the distribution of exposures in the cases compared with the distribution amongst the controls (Kirkwood and Sterne 2010).
Cohort study	A type of longitudinal study in which a group of individuals is followed over time, and the incidence of one or more outcomes is recorded together with exposure to one or more factors (Kirkwood and Sterne 2010).
Eclampsia	The occurrence of convulsions during pregnancy or in the first ten days postpartum, associated with hypertension, proteinuria, thrombocytopenia and/or deranged liver function tests (Edmonds 2008).
Ethnicity	The fact or state of belonging to a social group that has a common national or cultural tradition (Oxford Dictionaries).
Haemorrhage	Major bleeding event.
HELLP syndrome	A severe variant of pre-eclampsia characterised by Haemolysis, Elevated Liver enzymes and Low Platelets (Edmonds 2008).
Intrapartum	During childbirth or during delivery (Anderson 2000)
Maternal mortality	Maternal death is the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes (WHO 2012b).
Maternal mortality rate	The number of registered maternal deaths due to birth- or pregnancy-related complications per 100,000 registered live births (WHO 2012b).

Term	Definition
Multiparous	Having had two or more pregnancies which resulted in viable fetuses (Anderson 2000).
Multivariable analysis	Analyses that investigate how an outcome variable is related to more than one exposure variable (Kirkwood and Sterne 2010).
Nulliparous	Having never given birth to a viable infant (Anderson 2000).
Peripartum hysterectomy	Any woman giving birth to an infant and having a hysterectomy during the same clinical episode.
Postnatal	Relating to the period after birth (Anderson 2000).
Postpartum	Following childbirth or after delivery (Anderson 2000).
Pre-eclampsia	Hypertension associated with proteinuria during pregnancy which can result in convulsions/ cerebrovascular events (eclampsia) and/or fetal compromise (Edmonds 2008).
Primiparous	Bearing or having borne one child (Anderson 2000).
Septicaemia	Illness arising from blood-borne infection (Kumar and Clark 2005).
Severe maternal morbidity	Life-threatening illness during pregnancy, childbirth or within 42 days of termination of pregnancy (WHO 2012b).
Socioeconomic (position)	Relating to or concerned with the interaction of social and economic factors (Oxford Dictionaries).
Thromboembolic disorders	Conditions that increase the coagulability of the blood and increase the risk of thrombosis and emboli (Kumar and Clark 2005).
Univariable analysis	Analyses that investigate how an outcome variable is related to a single exposure variable (Kirkwood and Sterne 2010).
Uterine rupture	A complete separation of the wall of the pregnant uterus, with or without explusion of the fetus, involving rupture of the membranes at the site of the uterine rupture or extension into the uterine muscle separate from any previous scar, and endangering the life of the mother or fetus.

ABSTRACT

Title: The impact of socioeconomic position on severe maternal morbidity outcomes amongst women in the UK and Australia.

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Aims: The aims of this thesis are to investigate the risk of severe maternal morbidity amongst women from different socioeconomic groups in the UK, explore why these differences exist and compare these findings to the setting in Australia. **Methods**: Three separate analyses were conducted. The first used UK Obstetric Surveillance System (UKOSS) data to assess the incidence and independent odds of severe maternal morbidity by socioeconomic group in the UK. The second analysis used quantitative and qualitative data from the 2010 UK National Maternity Survey (NMS) to explore the possible reasons for the difference in odds of morbidity between socioeconomic groups in the UK. The third analysis used data from the Victorian Perinatal Data Collection (VPDC) unit in Australia to assess the incidence and odds of severe maternal morbidity by socioeconomic group in Victoria. **Results**: The UKOSS analysis showed that compared with women from the highest socioeconomic group, women in the lowest 'unemployed' group had 1.22 (95%CI: 0.92 – 1.61) times greater odds associated with severe maternal morbidity. The NMS analysis demonstrated that independent of ethnicity, age and parity, women from the lowest socioeconomic quintile were 60% less likely to have had any antenatal care (aOR 0.40; 95%CI 0.18 – 0.87), 40% less likely to have been seen by a health professional prior to 12 weeks gestation (aOR 0.62; 95%CI 0.45 – 0.85) and 45% less likely to have had a postnatal check with their doctor (aOR 0.55; 95%CI 0.42 – 0.70) compared to women from the highest quintile. The Victorian analysis showed that women from the lowest socioeconomic group were 21% (aOR 1.21; 95%CI 1.00 – 1.47) more likely and that Aboriginal and Torres Strait Islander women were twice (aOR 2.02; 95%CI 1.32 – 3.09) as likely to experience severe morbidity. **Discussion**: The results suggest that women from the lowest socioeconomic group in the UK and in Victoria have increased odds of severe maternal morbidity. Further research is needed into why these differences exist and efforts must be made to ensure that these women are appropriately prioritised in the future planning of maternity services provision in the UK and Australia.

CHAPTER ONE: Literature Review

1.1 BACKGROUND

Maternal health: A worldwide perspective

Mothers are the cornerstone of families and their health and well-being is "fundamental to the health of newborn babies and children" (Lawn et al 2006). Despite recognition of the integral role mothers play within families and communities, maternal mortality remains one of the greatest public health challenges worldwide.

The human rights implications of maternal deaths are widely appreciated (Rosenfield et al 2006). The Millennium Development Goals (MDG), constructed in 2000, called for a reduction in maternal mortality by 75% by 2015 from baseline levels in 1990 (MDG 5) (Rosenfield et al 2006, Hogan et al 2010). However, of all the Millennium Development Goals, the least progress has been made towards achieving MDG 5 (Rosenfield et al 2006) and still today, over 287,000 women die each year during pregnancy, childbirth or shortly thereafter (WHO 2012c). In sub-Saharan Africa and parts of South Asia, a woman's risk of dying as a result of pregnancy or childbirth during her lifetime is about one in six and in Afghanistan, the risk of maternal mortality is about one in eleven (WHO UNICEF UNFPA World Bank 2010). In comparison, the lifetime risk of maternal mortality in Northern Europe is about one in 30,000 (Ronsmans and Graham 2006, WHO UNICEF UNFPA World Bank 2010).

Despite much lower rates of maternal death in developed countries, there is extensive evidence to suggest that irrespective of the stage of development or condition of the health system, inequalities in the risk of maternal death exist everywhere, both between and within countries; “a link between poverty and maternal health has been clear for more than a century and is lent support by extensive evidence from rich countries” (Ronsmans and Graham 2006).

There are many dimensions to disadvantage in maternal health outcomes, which operate through “subtle and indirect pathways to influence outcomes” (Ronsmans and Graham 2006). These dimensions apply to individuals and groups within societies and, in addition to economic factors, include ethnicity, marital status, social status and psychosocial stress. A national case-control study conducted by Philibert et al in France between 1996 – 2001 showed a maternal mortality rate of 6.8 per 100,000 live births in women of French nationality, compared to 14.9 per 100,000 live births in women of non-European nationality (Bouvier-Colle et al 1997, Philibert et al 2008). The researchers found that the proportion of non-optimal care in women who died was greater among foreign born than French women (Philibert et al 2008, Bouvier-Colle et al 1997). Furthermore, the US in particular provides an interesting example of the complex interaction between dimensions of disadvantage and maternal health where a higher risk of maternal death in black versus Hispanic women in the US cannot be solely explained by economic factors, since they have similar poverty status (Ronsmans and Graham 2006, Hoyert et al 2000).

The shift from monitoring maternal mortality to maternal *morbidity*

Throughout the world, detailed assessment of maternal deaths through formal review processes such as the Confidential Enquiry into Maternal Deaths in the UK, have provided important information on populations of women at risk of maternal death and have been acknowledged as major contributors to the decline in maternal deaths in developed countries over the past 50 years (van Dillen et al 2010).

Maternal deaths are only the “tip of the iceberg” however, as for every woman that dies, many more will suffer the same complications and survive, but may suffer the life-long complications of morbidity (Lewis 2003). Maternal morbidity is a major public health concern throughout the world with some estimates suggesting that as many as ten million women worldwide suffer from pregnancy-related complications each year (Souza et al 2010a). In countries where maternal deaths are infrequent, the information that mortality audits or reviews provide cannot be generalised easily across the population, nor necessarily accurately predict which women are at high risk of adverse outcomes (Souza et al 2010a). Under these circumstances, a focus on maternal *morbidity* is now widely recognised as a much more robust approach to examining the quality of maternal health and healthcare provision within developed countries (van Roosmalen and Zwart 2009, Wen et al 2005, Waterstone et al 2001, Baskett 2008).

Investigating women with severe morbidity also provides useful information about women at risk of adverse outcomes and potentially maternal death, since morbidity frequently occurs “along a health continuum that extends from normal pregnancy and delivery to organ failure and maternal death” (Wen et al 2005). Women who have suffered from severe maternal morbidity continue to experience adverse consequences long after delivery (Waterstone et al 2003) and thus the impact on individuals and health systems extends far beyond the immediate postpartum period.

Definitions of severe maternal morbidity

There is much variation in how severe maternal morbidity is defined by researchers worldwide. Often referred to as ‘near miss’ cases, the WHO defines severe maternal morbidity as the “near death of a woman from a complication during pregnancy, childbirth or within 42 days after the termination of pregnancy” (Souza et al 2010a). In the literature it is generally accepted that a ‘near-miss’ case refers to a pregnant woman who, according to the treating team of health professionals, “almost died, but survived” (Say et al 2004). Identification of individual cases becomes far more complex due to the different definitions employed. For the purpose of research and audit, there are three definitions of severe maternal morbidity commonly used to identify individual cases. These include conditions defined by (a) organ dysfunction, (b) intervention and management or (c) clinical diagnosis. Each definition has advantages and disadvantages.

a) Definition based on organ dysfunction

Morbidity defined by organ-system dysfunction refers to specific criteria for failure related to each organ system (Say et al 2004). For example, renal dysfunction can be defined as oliguria (<400ml / 24hr) unresponsive to fluids or diuretics, serum urea ≥ 15mmol/l, a creatinine ≥ 400 mmol/l or the need for dialysis (Pattison and Hall 2003). Supporters of this approach believe that this definition allows for identification of *all* cases of severe morbidity, for which the primary cause can then be investigated. There are therefore no cases or conditions excluded, and it is a classification reproducible across similar settings worldwide (Say et al 2004). This definition is highly dependent upon the resources available (ie. functioning laboratories) however, and is not therefore appropriate or applicable in all settings, especially in developing countries (Pattison and Hall 2003). Furthermore, in cases of catastrophic haemorrhage for example, women can die before they experience organ failure and would thus be excluded by this definition, despite clearly suffering from severe maternal morbidity.

b) Definition based on management or intervention

The definition based on management or intervention refers to cases resulting in specific interventions such as Intensive Care Unit (ICU) admission, blood transfusion or peripartum hysterectomy. Using this definition, cases are simple to identify, however it is entirely dependent upon other factors such as the availability of ICU facilities and/or beds, different ICU-admission criteria and potentially “differing opinions about the indications for hysterectomy”, for example (Pattison and Hall 2003, Say et al 2004). Furthermore, in the UK only 31% of maternal deaths are reported as having had intensive care (Pattison and Hall 2003, Brace et al 2004, Willatts 2001), possibly because most maternity units have high dependency care available, thus mitigating the need for transfer to an ICU (Pattison and Hall 2003). In some centres, approximately two thirds of cases will therefore be missed if ICU admission is the only criterion used to define severe morbidity (van Roosmalen and Zwart 2009).

c) Definition based on clinical diagnosis

The definition of severe maternal morbidity based on clinical diagnosis is easier to interpret, not reliant on available resources, allows cases to be indentified retrospectively and can enable assessment of quality of care for specific diseases (Willatts 2001, Waterstone et al 2001, Say et al 2004, Pattison and Hall 2003). This class of definition typically encompasses conditions such as major obstetric haemorrhage, pre-eclampsia, eclampsia, HELLP syndrome, thromboembolic disorders, uterine rupture, cardiac failure or arrest, acute renal failure and septicaemia (van Roosmalen and Zwart 2009, Pattison and Hall 2003). Although by focusing on obstetric-specific conditions, other important causes of maternal death and morbidity such as pulmonary embolus and indirect causes such as cardiac disease may be excluded (Say et al 2004). Different hospitals and settings may also define the same condition, such as obstetric haemorrhage, by different parameters, thereby producing different rates and risk factor profiles (Say et al 2004).

Rates of severe maternal morbidity worldwide

Recent studies suggest there has been an increase in severe maternal morbidity in Western countries (Zwart et al 2008b). This has far-reaching implications for women, their families and the health systems in which they are treated, as severe maternal morbidity is often associated with additional infant problems, including low birth weight, admission of the neonate to a neonatal unit, stillbirth and early neonatal death, as well as prolonged maternal postpartum stay (Souza et al 2010a). It is unclear whether the reported increase in morbidity rates is the result of a change in management of obstetric complications, a change in the demographics of pregnant women (increasing age and obesity, for example), increasing caesarean section rates or the absence of a universally accepted definition of 'severe maternal morbidity' (Zwart et al 2008b, Fell et al 2005, Callahan and Berg 2003).

Most likely, as a result of the wide variation in the definition of severe maternal morbidity, the reported rates of morbidity in high-income countries vary substantially, ranging from 5 per 1000 to 12 per 1000 deliveries (Baskett 2008). Over 50% of morbidity is consistently attributed to major obstetric haemorrhage, however even definitions of major haemorrhage vary widely. A large retrospective cohort study conducted in Canada between 1991 and 2001, using a purely clinical definition of morbidity, demonstrated an overall rate of severe maternal morbidity of 4.38 per 1000 deliveries (Wen et al 2005), and suggested recent increases in particular conditions including pulmonary oedema, myocardial infarction, uterine rupture and haemorrhage requiring hysterectomy (Wen et al 2005). A study in the UK in 1998, also using a clinical definition, estimated that 12 per 1000 women (1.2%) suffer from severe maternal morbidity, two-thirds caused by obstetric haemorrhage and one-third by severe pre-eclampsia, sepsis and uterine rupture (Waterstone et al 2003).

In Scotland, a study by Brace et al in 2002, using clinical and intervention-based criteria, reported a severe morbidity rate of 3.83 per 1000 births (Brace et al 2004), with major obstetric haemorrhage accounting for 50% of reported cases. Using a similar combined clinical/intervention definition, the LEMMoN study in the Netherlands recently reported an incidence of morbidity of 7.1 per 1000 births, with major obstetric haemorrhage again being responsible for over 50% of the cases (Zwart et al 2008b).

Studies in low-resource settings have found higher rates of severe morbidity, with 21.1 per 1000 women in Brazil and 34 per 1000 women in Latin America reportedly suffering from severe morbidity, as defined by both clinical and intervention criterion (Souza et al 2010a, Souza et al 2010b). In Latin America, it has also been shown that women suffering from severe maternal morbidity were over 21 times more likely to die than women without severe maternal morbidity (LR 21.1: 95%CI 15.7-28.4) (Souza et al 2010a), highlighting the importance of understanding patterns of maternal morbidity in order to prevent maternal deaths amongst high risk women.

Risk factors for severe maternal morbidity

Identifying high-risk women is imperative for preventing adverse outcomes as it allows more intensive clinical management to be directed towards these women and is the fundamental purpose of antenatal care. Historically, the study of women who die has provided the information needed for risk stratification. Fortunately now, in most developed countries, the maternal mortality rate has fallen to such low rates that it is difficult to gain sufficient information from which to draw generalisable, clinical conclusions and formulate guidelines (Baskett 2008, Drife 1993, Bewley and Creighton 1997). Through larger numbers of cases and therefore greater information available, analysis of women with severe maternal morbidity provides more robust conclusions about risk factors for adverse maternal outcome (Pattison and Hall 2003). Information about demographic variables provides important clues about which women are at greater risk of severe maternal morbidity and can help guide targeted interventions to address existing disparities.

Extensive research has demonstrated convincing links between severe maternal morbidity and advanced maternal age, co-existing medical conditions and obesity (Bouvier-Colle et al 1997, Souza et al 2010b, Zwart et al 2008b). However, these factors are unable to entirely explain the stark differences in maternal morbidity that have been found between different populations of women in the same country or between different countries. The small number of studies available suggest that ethnicity and social disadvantage may have a significant role to play.

In the UK, a study by Knight et al using data collected in 2005/06 investigated ethnic differences in maternal health and revealed that the estimated risk of maternal morbidity (by direct obstetric cause) in white women was 80 per 100,000 maternities compared to 126 per 100,000 maternities in non-white women (Knight et al 2009b). Black African and Caribbean ethnic groups were shown to be at increased risk with five and three times greater risk of death respectively, than white women (Knight et al 2009b). The authors suggested that such differences may be a result of pre-existing maternal medical factors or factors relating to care during pregnancy, labour and birth. They concluded that the differences are unlikely to be due to maternal age, smoking status, BMI, parity or socioeconomic position since the association between non-white ethnicity and severe maternal morbidity remained elevated and statistically significant even after adjustment for these factors (Knight et al 2009b).

A national survey of women's experiences of maternity care in the UK in 2006 reported that women from non-white ethnic groups were more likely to recognise their pregnancy later, access care later and consequently book later for antenatal care than white women

(Redshaw et al 2007). These findings suggest that access to and uptake of care may contribute towards the significant ethnic differences in maternal outcomes in the UK.

An earlier case-control study conducted in the South East Thames region of England in 1997/1998 suggested that non-white ethnicity and social exclusion were strongly associated with an increased risk of severe maternal morbidity (Waterstone et al 2001). The authors considered that single measures of socioeconomic status were inadequate for analysis amongst pregnant women (eg. marital status, male partner's employment) but collected data on indicators of social exclusion (Waterstone et al 2001). Social exclusion was defined as any of the following: concealed pregnancy, age < 16 years, poor housing, low income, previous child in state care, current or past trouble with the law, living alone, un-booked, unwanted pregnancy, involvement of social worker and drug and/or alcohol dependency (Waterstone et al 2001). The investigation found that social exclusion significantly increased the risk of severe maternal morbidity amongst this study population (Waterstone et al 2001).

In the Netherlands, non-Western immigrant women were shown to have a 1.3-fold increased risk of severe maternal morbidity (95%CI 1.2-1.5) (Zwart et al 2008b). Proposed explanations for this disparity include immigrant women's relatively short stay in the Netherlands, their lack of a social support network, their lack of knowledge of the healthcare system, communication problems with healthcare providers and health illiteracy (Zwart et al 2008b). In the study in the UK, access to care was suggested by Knight et al to be a possible contributing factor to the differences between ethnic groups (Knight et al 2009b). Further investigation of this issue in the Netherlands however, revealed that the most important factors contributing to substandard care and eventually adverse outcomes in immigrant women were delay in recognising symptoms by the General Practitioner and delay in referral by the GP to specialist care (van Roosmalen et al 2002).

A recent study in Brazil found that women with little or no formal education had a much greater risk of developing severe maternal morbidity than their more highly educated peers (OR 2.18: 95%CI 1.15 – 4.10) (Souza et al 2010b). In Latin America, poor maternal education was found to be protective against severe morbidity (Souza et al 2010b), however it is likely that this finding is confounded by a lower caesarean rate and therefore lower risk of morbidity amongst women with lower education.

A comparison of the characteristics of women with severe morbidity (identified through UKOSS studies) and women who died from the same conditions (identified through the UK Confidential Enquiries into Maternal Deaths) between 2003 and 2008 was recently published (Kayem et al 2011). The findings demonstrate that the most significant risk factors in the progression from severe morbidity to death were older age (age ≥35 years: aOR 2.36; 95%CI 1.22-4.56), black ethnicity (aOR 2.38; 95%CI 1.15-4.92), obesity (BMI>30 kg/m^2) (aOR 2.73; 95%CI 1.15-6.46) and unemployment or routine/manual occupation (aOR 2.19; 95%CI 1.03-4.68) (Kayem et al 2011).

Knowledge gaps regarding risk factors for severe maternal morbidity

Despite indications that lower socioeconomic status may be associated with adverse maternal outcomes, there are few studies dedicated to investigating this issue. In contrast, research into the association between socioeconomic status and adverse neonatal outcomes has been extensive and convincing. Social deprivation, as measured at the area-level, has been shown to be a risk factor for low birth weight, preterm birth, admission to neonatal ICU and perinatal and neonatal mortality (Smith et al 2007, Manning et al 2005). Recent research in the UK has demonstrated that for babies requiring intensive care following delivery, there is no difference in outcomes or length of admission to NICU (Neonatal Intensive Care Unit) across different socioeconomic groups, indicating that once care is accessed, socioeconomic disparities in outcomes no longer exist (Smith et al 2009). The burden and distribution of morbidity and mortality therefore differs before the period of intensive care, with higher rates of very preterm birth amongst women from the most deprived areas (Smith et al 2009).

The mechanisms underlying the relationship between social deprivation and adverse perinatal health are not yet clear but are thought to be largely the result of poor maternal health and nutrition, access to and use of antenatal care, the effects of smoking, alcohol and other drugs, and psychosocial and environmental factors (Manning et al 2005). Unlike in the neonatal setting, women's experience of maternity care and their health outcomes have the potential to be greatly influenced by their cultural background, communication and interaction with health professionals and the individual treatment they receive. Thus there is greater potential for differences to exist across the socioeconomic spectrum.

As highlighted by several studies exploring ethnic differences in maternal health, it is unclear whether ethnicity itself is directly related to poor outcomes or whether "it is a surrogate marker for a constellation of factors such as low socioeconomic status and low level of education" (Pollock and King 2009). Because minority ethnic groups are often disproportionately represented in lower socioeconomic groups, ethnicity and socioeconomic status are often confounded and results attributed to ethnic difference, may be due, at least in part, to socioeconomic differences (Adler et al 1993). In a study in Belgium by Haelterman et al, the association between ethnicity and pre-eclampsia disappeared after adjustment for socioeconomic status (Philibert et al 2008, Haelterman et al 2003). An earlier study in South Australia showed that low socioeconomic status was related to a higher risk profile for mothers and babies, independent of maternal age, ethnicity and gravidity (Jonas et al 1992b).

The impact of socioeconomic status on health outcomes

Differences in health and mortality by social class and occupation have been documented since the 19th century (Adler et al 1993). In Providence, America, in 1865, the mortality rate amongst wealthy taxpayers was 10.8 per 1000 people, compared to 24.8 per 1000 people amongst the larger population of poorer non-tax-payers (Adler et al 1993, Chapin 1924). This complex relationship has persisted throughout time, despite advances in medicine and healthcare, with individuals lower in the socioeconomic hierarchy suffering disproportionately more from almost every disease, with higher rates of mortality than those above them (Adler et al 1993).

The social gradient in health

The famous Whitehall Studies conducted in the UK during the 1960's and 1980's demonstrated the existence of health inequalities amongst different occupational groups. Importantly, the studies also highlighted that the relationship between socioeconomic status and health does not just apply between the lowest and highest groups within society, there exists a social *gradient* in health between all socioeconomic groups (Marmot and Davey Smith 1997).

The First Whitehall Study, commenced in 1967, was designed to investigate risk factors for cardio-respiratory disease amongst a rather homogenous population of men aged 40-64 employed by the civil service. The study confirmed the importance of smoking, cholesterol levels and blood glucose in the development of cardiac disease (Marmot and Davey Smith 1997). Incidentally, the study also identified, from social information limited to occupational grade, that there existed a significant association between grade of employment and risk of cardiac disease (Marmot and Davey Smith 1997), independent of other standard risk factors.

In order to investigate this finding in greater depth, the longitudinal Whitehall II Study was established in 1985. This study included women as well as men, focused on morbidity as well as mortality and included much broader demographic information. The results confirmed that one of the most powerful risk factors for mortality was civil-service employment grade. The study also demonstrated a distinct social gradient in mortality, with each grade having worse health and higher mortality than the grade immediately above them.

Research elsewhere has produced similar results, confirming the existence of a social gradient in health by measures other than occupation. In the US, a study conducted in the 1960's by Kitagawa and Hauser found a graded relationship between mortality and years of education (Adler et al 1994, Kitagawa and Hauser 1973). A follow-up to this study was conducted 26 years later by Pappas et al which showed that although death rates had declined during the time between studies, the decreases were greater in more, rather than less well-educated groups (Adler et al 1994). The resulting health gradient between groups was thus, "steeper in 1986 than it had been in 1960" (Adler et al 1994).

Health inequalities also exist by income level; however, research in many developed countries throughout the world has suggested that these health differences "reflect, not differences in wealth, but differences in income distribution" (Judge et al 1998, Smith 1996, Lynch et al 2000). It is the "shape of income distribution and the inequalities that exist within a society that influence the health outcomes within a population, rather than the total income available to a wealthy nation" (Judge et al 1998). In a series of studies conducted during the 1980's and 1990's, Wilkinson et al demonstrated that in industrialised countries where income inequality was less marked (as measured by the percent of income held by the least well-off 70% of the population), such as Sweden, Norway and the Netherlands, life expectancy was higher (Wilkinson 1989, Lynch and Kaplan 1997).

In the US, Kennedy et al conducted a study across all States that showed that "even when personal characteristics and household income were controlled for, individuals living in States with greatest inequalities in income were 30% more likely to report their health as only fair or poor, compared to individuals living in States with the smallest inequalities in income" (Kennedy et al 1998). Higher income inequality in the US is "significantly associated with many aspects of infrastructure – unemployment, health insurance, social welfare, work disability, educational and medical expenditure and even library books per capita" (Lynch et al 2000, Kaplan et al 1996). Thus in the US, poorer health outcomes reflect both the resources available to individuals and the nature of public infrastructure.

In the Indian state of Kerala, where individual income is low, infant mortality, maternal mortality and childhood mortality are better than in other Indian states, and are almost comparable to rates in wealthy, industrialised countries (Lynch et al 2000, World Bank 1996). It has been proposed that this phenomenon may be explained by the dedicated wealth-redistribution actions of the Kerala Government over recent decades. Alternatively, perhaps health in the state of Kerala is a result of the social activities that have promoted greater gender equality, education and public investment in human resources over the past century (Lynch et al 2000).

In the UK, despite escalating income inequality over the past 30 years, mortality amongst the middle and older aged population has generally continued to decline. Earlier social investments, including expansion of the welfare state, improved educational opportunities and the introduction of the NHS, have been thought to explain this trend. These social investments would have had positive influences in early life amongst the cohort experiencing declining mortality and thus reinforces the impact of early social circumstances on health in adulthood (Lynch et al 2000).

Whilst income distribution is a structural characteristic of a social system (Lynch and Kaplan 1997), the examples in Kerala and the UK highlight that the relationship between income inequality and health is not bi-variate (Judge et al 1998), and is likely the result of an interaction of many factors that determine overall population health. Furthermore, the use of income inequality as a measure is problematic in several ways: few countries have robust data on income by area, and secondly, the results produced are strongly influenced by the level at which income inequality is measured. For example, if everyone in a neighbourhood was unemployed, there would be little inequality in income distribution, but the health status of the neighbourhood would be poor (Lynch and Kaplan 1997).

Measuring socioeconomic status

Socioeconomic status is "a composite measure that typically incorporates economic status, measured by income; social status, measured by education; and work status, measured by occupation" (Adler et al 1994, Dutton and Levine 1989). As a consequence, socioeconomic status is difficult to measure and throughout the world, different components of socioeconomic status are used to define and measure social class at both the individual and composite area-level. Nevertheless, using either income, education, occupation or a combination of these factors to measure socioeconomic status at the individual or area-level, the association between health inequalities and socioeconomic status persists (Adler et al 1993).

The UK has a long history of measuring socioeconomic status for the purposes of researching and monitoring health inequalities. Since 1837, the Office of the Registrar General has collected information on a national level about births and deaths, in addition to measuring and monitoring socioeconomic differentials in mortality and other health inequalities. In 1913, the medical statistician THC Stevenson published the first national statistics on infant mortality in England stratified by occupational group (father's occupation if child born within marriage and mother's occupation if parents unmarried) (Gray et al 2009, Registrar General 1913). This approach was later refined by the General Register Office (GRO) with the introduction of the socioeconomic classification 'Social Class based on Occupation (SC)' in the early 20th century. The SC classification was introduced in an effort to explore social differences in health and mortality across the population, however it lacked any true theoretical basis and was largely modelled on a "hierarchy in relation to social standing or occupational skill" (Office for National Statistics 2005).

In response to widespread dissatisfaction with the SC and its oversimplified manual/non-manual division, the Socio-Economic Groups (SEG) classification was developed in 1951 by David Glass, a social scientist interested in social mobility (Office for National Statistics 2005). Unlike SC, the 20-class SEG was a more "social scientific measure" and had an operational requirement to "take into account employment status, size of employing organisation and actual occupation" (Office for National Statistics 2005). However, the SEG also lacked a conceptual basis, with an overall emphasis on skill and the manual/non-manual divide and a poor ability to reflect women's position in the social structure (Office for National Statistics 2005). Additionally, "there were no rules to guide researchers on how best to collapse the SEG classes for analysis" and hence analyses using this method were "very varied and often incoherent" (Office for National Statistics 2005). In 1994, the Office for National Statistics (ONS), which now carries the responsibility for reporting health variations and inequalities, commissioned a review of Government Social Classifications in the UK and the development of an improved system of classification to replace SC and SEG (Office for National Statistics 2005).

Following the review, the occupation-based National Statistics Socio-economic Classification (NS-SEC) was introduced in 2001 by the ONS. Since that time NS-SEC has been widely used throughout the UK for official statistics and surveys. Unlike the past occupation-based classifications that simply stratified social class but provided no further information on causality, NS-SEC was developed with a strong theoretical foundation based on the internationally-accepted ‘Goldthorpe Schema’ (Office for National Statistics 2005). Goldthorpe (1988) proposed the following criteria for socio-economic classification: a) theoretical derivation – the classification should explicitly relate to theoretical ideas, b) technical derivation – the method should be replicable, c) capacity to display variation – the classification should identify and display variation in dependent variables which relate to class, and d) analytic transparency – the classification should help researchers comprehend “just how associations and correlations are brought about” (Office for National Statistics 2005).

In keeping with this theory, NS-SEC was developed through analysing employment relations data and bringing together combinations of occupational groups and employment status that share similar employment relations (Office for National Statistics 2005). In doing so, NS-SEC assumes that the life chances of individuals and families depend mainly on their position in the division of labour and on the “material and symbolic advantages that derive from it (such as housing and income)” (Office for National Statistics 2005). This approach links health with social organisation and by attempting to “capture structural inequalities in people’s socioeconomic position” (Gray et al 2009), helps explain the associations found between NS-SEC classes and a range of health outcomes (Office for National Statistics 2005).

The strong theoretical and conceptual foundation of NS-SEC has also prompted a change in terminology from the use of ‘socioeconomic status’ to ‘socioeconomic position’, since it is a person’s position in the division of labour that is being described, not their status in the social hierarchy that past measures attempted to reflect. ‘Socioeconomic position’ will be the terminology now used throughout this thesis.

Many studies have shown the average health to be poorer in deprived areas and there are clear advantages to measuring socioeconomic position at an aggregate or area-level (Reijneveld et al 2000), instead of using individual measures such as the NS-SEC, especially where individual data may not be available. Deprivation refers to a lack of resources of all kinds, not just financial, leading to "unmet need" (Noble et al 2006) and people are said to be "in poverty" if they lack the resources to escape deprivation (Reijneveld et al 2000). A study in 1987 in the US by Haan et al showed that residing in a neighbourhood that was "federally designated as a poverty area (characterised by a high proportion of low-income families, substandard housing, unskilled labourers etc) was a risk factor for subsequent mortality above and beyond the characteristics of the individual" (Noble et al 2006, Adler et al 1994). Further research has demonstrated the presence of "area effects", where the additional deprivation of residing in an area is above and beyond that attributable to the concentration of deprived people in the area (Noble et al 2006).

Considering that deprivation encompasses a range of factors, evidence suggests that measures of socioeconomic position may function most powerfully in terms of combinations of variables (Adler et al 1994). In keeping with this philosophy, the idea of creating a composite index to measure deprivation at the area-level has been "a consistent feature of government policy in the UK" since the 1960's (Noble et al 2006). In 2000, the British Government commissioned the development of a new area-based measure of socioeconomic position, the Index of Multiple Deprivation (IMD), to "pinpoint small pockets of deprivation throughout the UK" and to use this information to improve the quality of life in disadvantaged communities through targeted policies and funding. The IMD, which has been revised several times since its inception, comprises distinct dimensions of deprivation that are measured separately and then summarised as a weighted area-level aggregate score.

The domains of the IMD, or ranked dimensions of deprivation, include income; employment; health and disability; education, skills and training; barriers to housing and services; crime; and living environment, each of which hold different weightings and are measured by specific component indicators (Noble et al 2006). The weightings of each domain "minimise cancellation effects" that may occur if an area has, for example, high levels of income deprivation and low levels of education deprivation (Noble et al 2006). The indicators used are based on census information available for the whole country at a small-area level and are applied to geographical units called Lower Layer Super Output Area's (LLSOA). These LLSOA geographical units were developed using 2001 Census data and include a minimum of 400 households and an average of 1,500 residents. Measures of proximity and social homogeneity were also considered in the creation of LLSOA (Office for National Statistics 2010).

Unlike earlier deprivation indices, the IMD makes an attempt to capture socioeconomic circumstances characteristic of communities beyond urban centres, such as ex-mining communities, coastal towns and rural areas (Deas et al 2003). The IMD is not a universal measure within the UK, however. England, Wales, Northern Ireland and Scotland each have their own responsibility for tackling deprivation and the combination of factors that influence deprivation in each country may differ. Similar, but separate indices have therefore been constructed in each country to help address issues of deprivation more effectively.

Some authors argue that smaller areas should result in more valid or more stable measures of area-level deprivation (Reijneveld et al 2000). To the contrary, other authors suggest that "health differences by area deprivation differ only slightly if smaller areas are used" (Reijneveld et al 2000, Hyndman et al 1995, Geronimus and Bound 1998, Hobbs and Cole 1996, Dolk et al 1995). The size and homogeneity of the areas included in area-measure studies vary significantly and most of the differences in health by area deprivation, for every geographical categorisation, “can be explained by the differences in individual socioeconomic position of the residents concerned” (Reijneveld et al 2000).

Over time, deprived neighbourhoods generally vary much less than the deprived people within them (Deas et al 2003). If it is accepted that neighbourhood or area effects are as important as individual or household aspects of deprivation, where possible, it has been argued that information should be collected on both individual and area-based measures of socioeconomic position to allow “people-based and place-based policy to exist in tandem” (Deas et al 2003, Ben-Shlomo and Smith 1999).

The relationship between socioeconomic position and maternal health

The justification for researching inequalities in health is ultimately to determine if inequalities can be altered and health outcomes improved (Marmot and Davey Smith 1997). Before efforts can be made to effectively alleviate existing inequalities, it is imperative that robust data are collected and that those at greatest risk of poor health outcomes are identified. In the context of maternal health, the relationship between ethnicity and maternal health has been investigated and is well understood in many settings worldwide. There remains however, a significant gap in research and understanding of the socioeconomic differences in maternal health, particularly outcomes of severe maternal morbidity, and the interaction between socioeconomic position and other demographic factors such as ethnicity, age and co-existing medical conditions.

In the UK in 2005, the Government proposed a series of health reforms to help develop a “patient-led NHS”, and especially highlighted the importance of improving maternity care services and providing “all women and their partners with a wider choice in type and place of maternity care and birth" (Department of Health 2007). The then Government's commitment to maternity care was detailed in the policy document 'Maternity Matters: choice, access and continuity of care in a safe service', which outlines the four national 'choice guarantees' pertaining to access to maternity care, type of antenatal care received, place of birth and place of postnatal care (Department of Health 2007).

Importantly, the Maternity Matters programme draws attention to the plight of vulnerable and disadvantaged women in the community and the need for future maternity services to address currently "unacceptable maternal outcomes" amongst these women (Department of Health 2007). Recognising the vulnerability of these women is a step in the right direction towards improving maternal health outcomes amongst socially disadvantaged women in the UK. However there are still many unanswered questions that remain regarding the risk of morbidity amongst these women and why they suffer disproportionately higher rates of adverse maternal outcomes.

Research has shown that throughout the world, mothers, newborn babies and children all benefit from a functioning health system that provides appropriate interventions throughout "the continuum of care, from pre-pregnancy through pregnancy, childbirth and the postnatal period" (Lawn et al 2006). As such, tackling fundamental health system problems in an effort to combat maternal complications would have implications far beyond maternal health (Rosenfield et al 2006) and would benefit not only childbearing women but also their babies, families and the communities in which they reside.

This thesis aims to elucidate the relationship between socioeconomic position and severe maternal morbidity in the UK, investigate why such social differences may exist and provide a comparison with the Australian context.

CHAPTER TWO: Aims and Objectives

2.1 AIMS & RESEARCH QUESTIONS

The aims of this thesis are to define the risk of severe maternal morbidity amongst women from different socioeconomic groups in the UK, explore why these differences exist and compare these findings to the setting in Australia, where healthcare is also universal.

To achieve the study aims, a series of research questions were formulated:

- In the UK, is there a difference in incidence of severe maternal morbidity amongst women from different socioeconomic groups?
- Is the independent risk of severe morbidity different amongst women from different socioeconomic groups?
- Is there a difference in health-seeking behaviour during pregnancy and childbirth amongst women from different socioeconomic groups?
- Do women from different socioeconomic groups receive different treatment and/or healthcare during pregnancy and childbirth?
    - Are these actual differences in treatment?
    - Are these perceived differences in treatment?
- In Victoria, Australia, is there a difference in risk of severe maternal morbidity between women from different socioeconomic groups?

2.2 OBJECTIVES

The following objectives were defined to meet the thesis aims and to address the research questions:

1. To estimate the incidence of severe maternal morbidity amongst women from different socioeconomic groups in the UK using national data available through the national departments of statistics for England and Wales, Northern Ireland and Scotland in order to explore the question of whether the difference in risk of severe maternal morbidity amongst women from different socioeconomic groups can be explained by a difference in incidence of severe morbidity. This analysis is presented in Chapter Three of the thesis.
2. To conduct a case-control study using UKOSS data to investigate the risk of a series of severe maternal morbidities amongst women from different socioeconomic groups. This analysis is presented in Chapter Three of the thesis.
3. To investigate whether differences in health-seeking behaviour and in the treatment and care received by women during pregnancy and childbirth exist between women from different socioeconomic groups, using data from the 2010 National Maternity Survey (NMS) in England, and whether such differences can explain the difference in risk of severe morbidity in the UK. This analysis is presented in Chapter Four of the thesis.
4. To explore the risk of severe maternal morbidity amongst women from different socioeconomic groups in Victoria using the Victorian Perinatal Data Collection (VPDC) database and to provide a comparison between the UK findings and the Australian context. This analysis is presented in Chapter Five of the thesis.

CHAPTER THREE: Risk of severe maternal morbidity by socioeconomic group in the UK (Analysis of data from a collection of UKOSS studies)

3.1 INTRODUCTION

Clinical enquiry into cases of maternal mortality and morbidity

The process of formalised clinical enquiry into cases of mortality and morbidity has been used in various healthcare settings worldwide to examine critical incidents, provide feedback on the circumstances surrounding these incidents and ultimately effect an improvement in quality of care (Pattison et al 2009).

The most well-known maternal mortality enquiry is the Confidential Enquiry into Maternal Deaths (CEMD) in the UK (Pattison et al 2009, Cantwell et al 2011). Between 1952 and 1986, the CEMD produced triennial reports on all maternal deaths in England and Wales and since 1986, on all maternal deaths in the UK. In doing so, the CEMD has contributed to the dramatic fall in maternal mortality rates throughout the UK during this time (Pattison et al 2009). In 1952, the rate of direct maternal death in the UK was over 530 per million maternities but had fallen to 47 per million by 2008 (Lewis 2011). The impact of the CEMD has been recognised internationally, and similar maternal mortality reviews have, as a consequence, been established in many other countries including South Africa and the Netherlands (Brace and Penney 2007, van Dillen et al 2010).

In developed countries, the maternal mortality rate has now reached levels that are too low to enable accurate detection of changes in health outcomes and monitoring of the quality of maternity care (Pattison et al 2009). With higher numbers of cases, the review of cases of severe maternal morbidity has been recommended as a superior approach in high-resource countries to identify high-risk women, explore appropriate preventive measures and improve care provision and allocation of resources (Brace and Penney 2007, Duffy and Gaffney 2001, Mahutte et al 1999, Mantel et al 1998, Panchal et al 2000, Prual et al 2000). As is the case for maternal death enquiries, it is not adequate to simply count cases of severe morbidity, the course of events leading to adverse outcomes need to be analysed and necessary improvements in the quality of maternity care should be highlighted (Brace and Penney 2007).

The UK Obstetric Surveillance System (UKOSS)

In 2005, the UK Obstetric Surveillance System (UKOSS) was established by the National Perinatal Epidemiology Unit (NPEU) and the Royal College of Obstetricians and Gynaecologists in recognition of the need for more detailed analysis of cases of maternal morbidity in the UK (Knight et al 2005). UKOSS was launched with the aim of investigating a rolling programme of uncommon disorders of pregnancy, including 'near miss' events, to complement the work of the CEMD. Broadly based on the British Paediatric Surveillance Unit (BPSU) methodology, which has developed a reliable method of studying uncommon disorders of childhood over the past 20 years, UKOSS was designed as a "prospective monthly case-collection scheme", looking only at conditions with an estimated incidence of less than one in 2000 maternities to avoid over burdening the notifying clinicians (Knight et al 2005).

UKOSS uses an active, negative surveillance methodology. Each month, cards listing what conditions are currently under investigation are sent out to all consultant-led obstetric units in the UK (currently 223 units in total). The nominated reporting team (obstetrician, midwife, anaesthetist and perinatal risk management co-ordinator) at participating hospitals are then required to report any cases to the UKOSS team by returning the completed card. Nil reports are also collected. If a case is reported, the

UKOSS team then dispatches forms to collect more detailed information, which is obtained from the patient's case notes. The information collected allows confirmation of the appropriate case diagnosis and provides additional information on risk factors, management and outcomes. No personal or identifiable information is collected and consent from each individual woman is therefore not required.

For some studies, anonymised information is also collected on comparison women, to enable case-control and cohort studies to be conducted. For these studies, clinicians are usually asked to identify two women delivering in the same facility immediately before the case and complete a similar data collection form from their case notes. Most UKOSS studies have been conducted over a period of one year, except for conditions that affect an extremely small number of women, such as amniotic fluid embolism, which are conducted over a longer period in order to identify sufficient numbers of cases for valid conclusions to be drawn (Knight et al 2005).

The definition of 'severe maternal morbidity' is not universally agreed and as discussed in Chapter One, has resulted in studies producing differing rates and risk factor profiles. The UKOSS system has been designed to run a rolling programme of studies to focus on specific clinical conditions, directly and indirectly related to pregnancy and childbirth. In doing so, the difficulties encountered when using combined clinical/intervention criteria to define maternal morbidity are avoided. Furthermore, the UKOSS system involves reporting of a manageable number of cases, which minimises the possibility of over-burdening reporting clinicians and thereby ensures a sustainable system over a long period of time.

The conditions studied to date include acute fatty liver of pregnancy, amniotic fluid embolism, antenatal pulmonary embolism, eclampsia, peripartum hysterectomy, uterine rupture, stroke and therapies for peripartum haemorrhage. Some of these conditions were identified by the most recent CEMD report as being associated with leading causes of maternal mortality (antenatal pulmonary embolism, eclampsia, acute fatty liver, amniotic fluid embolism and peripartum hysterectomy resulting from major haemorrhage) (Cantwell et al 2011, Knight et al 2005, Lewis et al 2004). Others however, have been included due to their association with the potential increase in incidence resulting from rising caesarean section rates in the UK (Knight et al 2005).

Importantly, in addition to detailed clinical data, the UKOSS studies have collected extensive demographic information to enable thorough investigation of pre-disposing risk factors for severe maternal morbidity. The demographic information collected includes ethnicity, maternal age, marital status, employment status and occupation.

Defining socioeconomic position in UKOSS

The Office for National Statistics (ONS) reports on health variations and inequalities and has established its own standards of classification of demographic characteristics. As discussed in Chapter One, the socioeconomic classification currently used by the ONS, NS-SEC, is based on an individual's occupation, employment status and the size of their employing organisation (Gray et al 2009), although can be used if employing organisation size is not known, and thus relies on information that is widely collected throughout the UK.

NS-SEC has 17 operational classes, which can be transformed from a nominal coded system into 8, 5 or 3 ordinal categories for simplified analysis (Table 1). For the purposes of research, audit and health policy planning across the UK, the 3 category classification system is widely used (Gray et al 2009). This system defines 'managerial/professional occupations', 'intermediate occupations' and 'routine/ manual occupations', with the option of an additional category for 'never worked/unemployed'. Full-time students are excluded from the collapsed NS-SEC classification systems and there is no category allocated to ‘self-employed’, although this is typically included in the intermediate category with ‘own-account workers’ (Table 1).

Table 1. NS-SEC operational categories and analytical classes (Office for National Statistics 2011c)

Operational categories	**Analytic Classes**		
	Eight (nine) classes	**Five classes**	**Three classes**
L1 Employers in large organisations	**1.1** Large employers and higher managerial occupations	**1** Managerial and professional occupations	**1** Managerial and professional occupations
L2 Higher managerial occupations			
L3 Higher professional occupations	**1.2** Higher professional occupations		
L4 Lower professional and higher technical occupations	**2** Lower managerial and professional occupations		
L5 Lower managerial occupations			
L6 Higher supervisory occupations			
L7 Intermediate occupations	**3** Intermediate occupations	**2** Intermediate occupations	**2** Intermediate occupations
L8 Employers in small organisations	**4** Small employers and own-account workers	**3** Small employers and own-account workers	
L9 Own-account workers			
L10 Lower supervisory occupations	**5** Lower supervisory and technical occupations	**4** Lower supervisory and technical occupations	**3** Routine and manual occupations
L11 Lower technical occupations			
L12 Semi-routine occupations	**6** Semi-routine occupations	**5** Semi-routine and routine occupations	
L13 Routine occupations	**7** Routine occupations		
L14 Never worked and long-term unemployed	**8** Never worked and long-term unemployed	Never worked and unemployed	Never worked and unemployed
L15 Full-time students			
L16 Occupations not stated or inadequately described			
L17 Not classifiable			

Where provided, the occupation of women in each UKOSS study is coded. Where not provided, the woman's partner's/husband's occupation is coded. This method is in contrast to the ONS national birth statistics data where the occupation of the baby's father is always used to code for socioeconomic position and as a result, leaves babies without a registered father as unclassified and referred to as 'sole registrants'.

UKOSS codes the occupation provided with the appropriate NS-SEC 4-number code, which can then be categorised into either of the 8, 5 or 3-class NS-SEC analytic classes. The 3-category system is generally used in UKOSS analyses. However, women who are 'unemployed or never worked' are categorised in a separate class in UKOSS since the CEMD audits have consistently shown that unemployed women have a much higher risk of maternal mortality, compared to women from any category of employment (Cantwell et al 2011). Full-time students are grouped with 'never-worked and unemployed' and self-employed women are categorised with 'own-account workers'.

Known risk factors for severe maternal morbidity

In addition to the widespread recognition of the benefits of using maternal morbidity to monitor maternal health, there is reason to believe that severe maternal morbidity may be increasing in developed countries as a result of the changing demographics of pregnant women (Baskett 2008, Filippi et al 2005, Mhajed et al 2006, Zeeman et al 2003). In response to these changing patterns, a number of studies have been conducted throughout the world in recent years that have further investigated risk factors predisposing women to severe maternal morbidity (Appendix 1). Literature was identified using a free-text search of the Pubmed database using the key terms 'risk factors' and 'severe maternal morbidity', supplemented by hand searching of the reference lists of relevant papers. Both studies of severe morbidity overall and those looking at specific obstetric conditions have produced similar results, with a number of factors consistently shown to be associated with increased risk of severe morbidity in pregnancy and childbirth.

Risk factors for severe maternal morbidity can generally be divided into three categories: first, those not amenable to change (eg. ethnicity, spontaneous twinning); second, those that *may* be amenable to social change (eg. maternal age, social equity); and third, those that are within the control of healthcare professionals (eg. care provided to medically complicated women and rates of intervention) (Pattison and Hall 2003). Factors within the control of healthcare professionals are the main focus of health studies worldwide, which seek to identify the avoidable events that lead to adverse outcomes. Of equal importance however, is the investigation of risk factors that are not amenable to change. It is these factors that if identified early in pregnancy can be used to ensure that women at high risk of severe morbidity are the focus of targeted illness-prevention programs and improved antenatal care provision in order to optimise maternal health across entire populations within the same country.

The UKOSS studies have provided critical evidence of the differences in maternal morbidity amongst women from different ethnic groups within the same country (Knight et al 2009b). In 2009 using data from a combination of UKOSS studies, Knight et al showed that the risk of maternal morbidity for white women in the UK was 80 per 100,000 maternities compared to 126 per 100,000 maternities for non-white women (aRR for black Caribbean women 2.45 (95%CI 1.81-3.31) and Black African women 2.35 (95%CI 1.45-3.81) (Knight et al 2009b). Other studies in Western countries have demonstrated similar findings with non-white ethnicity shown to be associated with increased risk of severe maternal morbidity: France (aOR 5.5 (95%CI 3.3-9.0) for women from Sub-Saharan Africa and 3.3 (95%CI 1.7-6.5) for women from Asia, North and South America) (Philibert et al 2008) and the Netherlands (Non-Western immigrant women 1.3 fold increased risk of morbidity (95%CI 1.2-1.5) (Zwart et al 2008b). Studies of severe obstetric haemorrhage have shown particularly elevated risk for women from some ethnic groups, with a study in Norway demonstrating that women from South-East Asian background were 77% more likely than women of Norwegian background to suffer from severe obstetric haemorrhage (Al-Zirqi et al 2008, Combs et al 1991).

Several studies throughout the world have explored various socioeconomic predictors of maternal outcome, although the definitions and methods used have been inconsistent. A study in Belgium looking at social deprivation and poor access to care as risk factors for severe pre-eclampsia, found a strong link between social disadvantage and obstetric outcome (Haelterman et al 2003). Another study conducted in the South-East Thames region of London in 1997 – 1998, demonstrated that social exclusion was associated with an increased risk of severe maternal morbidity (aOR 2.64: 95%CI 1.69-4.11) (Waterstone et al 2001). Interestingly, a number of studies have shown that the relationship between ethnicity and maternal outcome diminishes, or even disappears, after adequate adjustment for socioeconomic position. Despite strong suggestions that social disadvantage plays a significant role in severe maternal morbidity outcomes, there remains a paucity of robust research.

Morbidity related to older maternal age has become an issue of great interest in recent years due to the trend towards delayed child-bearing generally, as well as amongst better educated women in Western countries (Zhang et al 2005). A mother who is 35 years or older is typically considered to be of ‘advanced maternal age’ with studies in the Netherlands (Zwart et al 2008a), Australia (Roberts et al 2009), Canada (Baskett and O'Connell 2005), France (Philibert et al 2008), England (Waterstone et al 2001) and Brazil (Souza et al 2010b) all demonstrating a significantly increased risk of severe maternal morbidity in these women (Appendix 1). A UKOSS study of caesarean delivery and peripartum hysterectomy showed that women aged 35 years and older were more than twice as likely than younger women to undergo peripartum hysterectomy (OR 2.42: 95%CI 1.66-3.58) (Knight et al 2008a).

Co-existing medical conditions such as diabetes, hypertension, cardiovascular disorders (van Roosmalen and Zwart 2009, Ros et al 1998) and epilepsy have been found to increase women's risk of severe maternal morbidity (Roberts et al 2009, Al-Zirqi et al 2008). In the CEMD report from 2003 to 2005, cardiac diseases were the most common cause of maternal death and since more women with congenital heart disease are reaching reproductive age, such pre-existing medical conditions need careful consideration and management during the prenatal and antenatal period. In Canada, women with co-existing chronic diseases were shown to have a 5.8-fold increased risk of severe maternal morbidity compared to those without pre-existing medical conditions (Wen et al 2005). Co-existing medical conditions (particularly past or current hypertension) were also associated with increased risk of morbidity in a study conducted in England (Waterstone et al 2001).

Few studies looking at severe maternal morbidity have investigated the effect of past pregnancy conditions on subsequent pregnancies. Many condition-specific studies have however, revealed clear differences in risk between women who have experienced complications in previous pregnancies and those with no past pregnancy history (Appendix 1). Studies investigating hypertensive disorders of pregnancy have estimated that women with a past history of pre-eclampsia have seven times the risk of pre-eclampsia in their second pregnancy (Campbell et al 1985, Duckitt and Harrington 2005, Lee et al 2000, Makkonen et al 2000). Past caesarean section has also been shown to increase a woman's risk of complications in subsequent pregnancies by up to 3 times (Zwart et al 2008b), including over three times the risk of peripartum hysterectomy (OR 3.52: 95%CI 2.35-5.26) (Knight et al 2008a).

Evidence regarding the risk of smoking during pregnancy on maternal health is inconsistent, although the evidence of harm in the long-term is unequivocal and the risks to the developing fetus are well-understood. A recent study in France showed no association between current smoking and obstetric outcome (Bouvier-Colle et al 1997) and a study in Norway found no difference in risk of severe obstetric haemorrhage between smokers and non-smokers (aOR 1.01: 95%CI 0.91-1.12)(Al-Zirqi et al 2008). In the context of hypertensive disease, multiple studies conducted in different parts of the world have consistently demonstrated a reduced risk of pregnancy-induced hypertension, pre-eclampsia and eclampsia in women who smoke during pregnancy compared to those that do not (Engel et al 2009, Yang et al 2006, Odegard et al 2000).

Worldwide, the WHO estimates that more than 1.5 billion adults over the age of 20 are overweight (BMI ≥25 – ≤30), and of these, 300 million women are obese (BMI>30) (WHO 2011). In the UK, 50% of women of child-bearing age are either overweight (BMI 25-29.9) or obese (BMI ≥30), with 18% of women starting pregnancy as obese (Thangaratinam and Jolly 2010). The incidence of maternal obesity in the UK has more than doubled since 1989 (Heslehurst et al 2010) and a UKOSS national cohort study recently estimated that the prevalence of extreme obesity (BMI ≥50) in the UK is 8.7 per 10,000 deliveries (Knight et al 2010a).

Maternal overweight and obesity are known to be associated with a range of adverse pregnancy outcomes. A meta-analysis conducted by Heslehurst et al in 2008 concluded that "maternal obesity significantly contributes to a poorer prognosis for mother and baby during delivery and the immediate postpartum period", through increased odds of caesarean section and instrumental deliveries, haemorrhage, infection, longer duration of hospital stay and increased neonatal intensive care requirement (Heslehurst et al 2008). Other studies have demonstrated a significant association between maternal obesity and maternal hypertension, haemorrhage, pre-eclampsia, gestational diabetes, increased rates of caesarean section and post-operative complications (Perlow and Morgan 1994, Siega-Riz and Laraia 2006, Thadhani et al 1999), general anaesthesia and intensive care admission (Knight et al 2010a, Centre for Maternal and Child Enquiries 2010), large-for-gestational-age infants and still birth (Baeten et al 2001, Cedergren 2004, Cnattingus et al 1998, Siebre et al 2001, Stephansson et al 2001, Young and Woodmansee 2002).

A UKOSS study of antenatal pulmonary embolism (PE) showed that BMI ≥30 was a major risk factor for PE (OR 2.65: 95%CI 1.09-6.45) (Knight 2008), a finding confirmed by the recent CMACE enquiry into maternal obesity in the UK (Centre for Maternal and Child Enquiries 2010). The most recent Confidential Enquiry into Maternal Deaths found that 47% of women who died from direct obstetric causes were either overweight or obese, as were 50% of women who died from indirect causes (Lewis 2011). These findings are of great concern due to the rising epidemic of obesity amongst women of reproductive age (Cedergren 2004, Mokdad et al 1999, Heslehurst et al 2010).

In a national case-control study in France, multiparity was identified as a risk factor for severe maternal morbidity (Bouvier-Colle et al 1997) and in Latin America, primiparity and multiparity > 3 have been shown to increase risk of maternal morbidity (Souza et al 2010b). A study in provincial Canada, conducted over a period of 15 years from 1988 – 2002 showed that multiparity was associated with severe morbidity, in particular uterine rupture (Baskett and O'Connell 2005). In the United States, Coonrod et al estimated that the risk of developing pre-eclampsia was four times higher for nulliparous women compared to multiparous women (aRR 4.0 (95%CI 3.3-4.8) (Coonrod et al 1995). Recent UKOSS studies have identified multiparity as one of the main risk factors for antenatal pulmonary embolism (OR 4.03: 95%CI 1.60-9.84) (Knight 2008), and for peripartum hysterectomy with parity ≥3 shown to be associated with an OR of 2.30 (95%CI 1.26-4.18) (Knight et al 2008a). There is strong evidence to suggest that severe obstetric haemorrhage is more common in grand-multiparous women, but recent studies indicate that this risk is far greater for para 10+ than for para 6-9 (Al-Zirqi et al 2008, Maymon et al 1998). Although a rare condition, amniotic fluid embolism has also been shown to be associated with multiparity (mean parity postpartum 2.6) in a study in California (Gilbert and Danielsen 1999).

Rates of multiple pregnancy are currently rising due to "assisted reproductive technologies and an aging population of women giving birth" (Knight et al 2009a). The implications of this trend warrant careful attention with studies in England (Waterstone et al 2001), France (Philibert et al 2008) and the Netherlands (Zwart et al 2008b) demonstrating an increased risk of severe morbidity amongst women with multiple pregnancies. Several UKOSS studies have identified multiple pregnancy as a risk factor in the development of adverse outcomes: the risk of peripartum hysterectomy was shown to be much higher amongst women with twin pregnancies (OR 6.30: 95%CI 1.73-23.0) (Knight et al 2008a), the risk of AFE over 10 times higher in multiple pregnancy (OR 10.9: 95% CI 2.81-42.7) (Knight et al 2010b) and although relatively little is understood about the condition of acute fatty liver of pregnancy (AFLP), another UKOSS study (Knight et al 2008b) suggests that women with twin pregnancies are at higher risk of developing AFLP (OR 14.3; 95%CI 6.4 – 28.6).

3.2 AIMS AND OBJECTIVES

The aim of the work presented in this chapter is to:

(a) estimate the incidence of severe maternal morbidity by specific direct obstetric causes, amongst women from different socioeconomic groups in the UK, and

(b) explore the relationship between socioeconomic position and severe maternal morbidity using data obtained from a series of UKOSS studies, taking into consideration the risk factors reviewed above.

3.3 GENERAL METHODS

Deriving the dataset

The analysis presented here used existing, complete UKOSS datasets. Cases were included only from UKOSS studies of direct causes of maternal morbidity, in order to mitigate inherent problems associated with alternative definitions of 'severe maternal morbidity' and subsequent comparison to published data. The studies from which cases were obtained were amniotic fluid embolism (AFE) (Knight et al 2010b), acute fatty liver of pregnancy (AFLP) (Knight et al 2008b), eclampsia (Knight 2007a), peripartum hysterectomy (Knight 2007b), therapies for peripartum haemorrhage (Knight et al 2009a) and uterine rupture (Fitzpatrick et al 2012) (Figure 1). For the purpose of this analysis, these cases are collectively referred to as having 'severe maternal morbidity'.

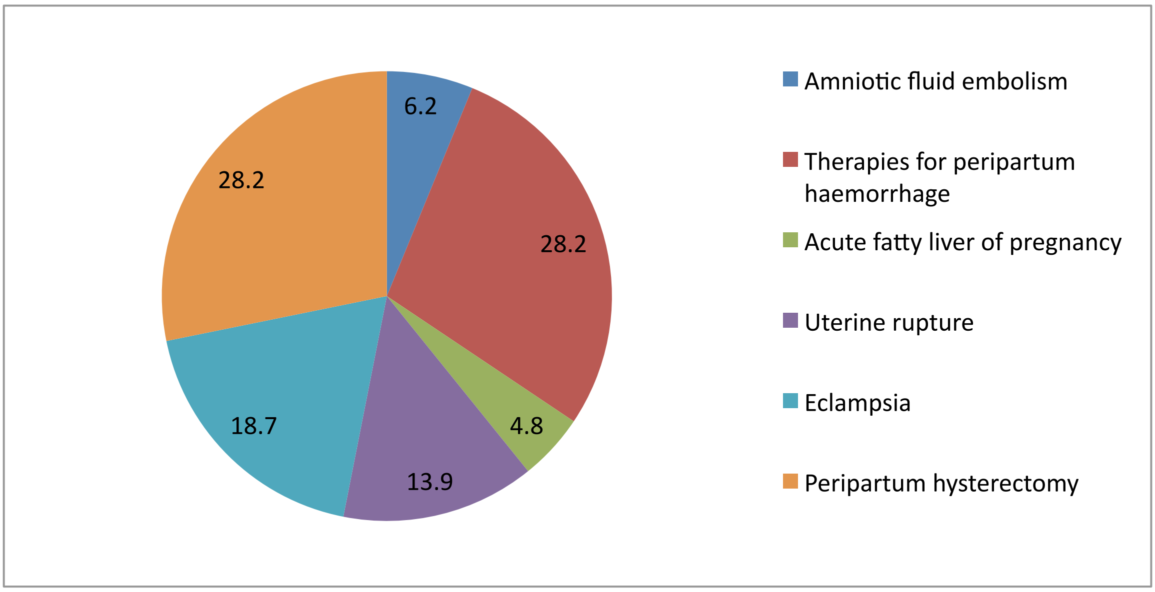

Figure 1. Distribution of accumulated cases from various UKOSS studies (%)

Control data were derived from various UKOSS studies, including eclampsia, peripartum hysterectomy, obesity, antenatal stroke and pulmonary embolism, and were aggregated in this analysis to form a sample source of non-case women for which the same clinical and demographic information was available as for case women. Case women were not able to be recruited as controls in other simultaneous studies.

As illustrated by the project timelines, there was little overlap between the UKOSS study populations (Figure 2) and only one case was included in two separate studies (uterine rupture and AFE). Both these case conditions had occurred during the same pregnancy, and one set of observations for this repeated case was removed from the final dataset. As such, all cases were represented in the analytical dataset as single observations. Theoretically, it is possible for the same woman to be recruited as either a case or control in consecutive pregnancies for different UKOSS studies but the UKOSS conditions studied are rare and thus this scenario is highly unlikely, and it is also unlikely to produce any material difference in risk analyses if there are a small number of women who have been recruited for two separate studies.

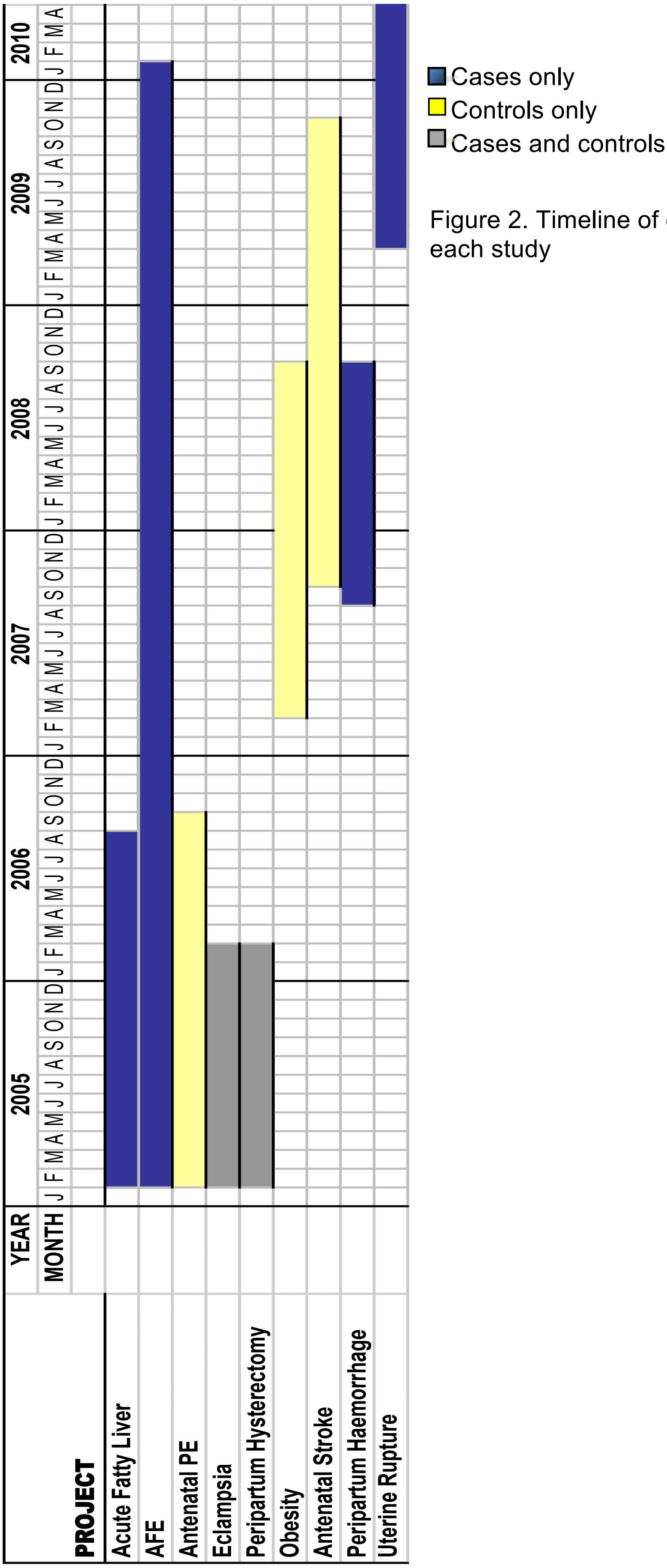

Figure 2. Timeline of data collection periods for each study

Participants

Cases were defined according to the different condition under investigation in each study (Table 2).

Table 2. Case definitions used for each condition of severe maternal morbidity

Conditions	Definition
Amniotic fluid embolism (AFE)	EITHER a clinical diagnosis of AFE (acute hypotension or cardiac arrest, acute hypoxia or coagulopathy in the absence of any other potential explanation for the symptoms and signs observed) OR a pathological diagnosis (presence of fetal squames or hair in the lungs)
Acute fatty liver of pregnancy (AFLP)	EITHER AFLP confirmed by biopsy or post-mortem examination OR a clinician has made a diagnosis of AFLP with signs and symptoms consistent with AFLP
Eclampsia	The occurrence of convulsions during pregnancy or in the first ten days postpartum, together with at least two of the following features within 24 hours after the convulsions: Hypertension (a booking diastolic pressure of <90mmHg, a maximum diastolic of ≥90mmHg, and a diastolic increment of ≥25mmHg) or Proteinuria (at least + protein in a random urine sample or ≥0.3g in a 24hr collection) or Thrombocytopenia (platelet count of <$100X10^9$/l) or An increased plasma alanine aminotransferase (ALT) concentration (≥42 iu/l) or an increased plasma aspartate transaminase aminotransferase (AST) concentration (≥42iu/l)
Peripartum hysterectomy	Any woman giving birth to an infant and having a hysterectomy during the same clinical episode
Therapies for major peripartum haemorrhage	All women in the UK treated therapeutically or prophylactically for major peripartum haemorrhage with: EITHER Activated factor VIIa OR B-lynch suture or other brace suture OR Arterial ligation or embolisation
Uterine rupture	Any woman in the UK identified as having a uterine rupture using the following definition: A complete separation of the wall of the pregnant uterus, with or without explusion of the fetus, involving rupture of the membranes at the site of the uterine rupture or extension into the uterine muscle separate from any previous scar, and endangering the life of the mother or fetus Excluded: any asymptomatic palpable or visualised defect (for example dehiscence noted incidentally at caesarean delivery)

In addition to details of clinical diagnosis, management and outcome, comprehensive demographic and medical information was also collected (National Perinatal Epidemiology Unit 2012). This information included maternal age, ethnic background, marital status, employment status, occupation (maternal and husband/partner's), height and weight, smoking status, parity, past pregnancy conditions and co-existing medical conditions.

Data handling

Data coding and data entry was performed by the UKOSS administrative team at the National Perinatal Epidemiology Unit as each separate study was originally conducted. Cleaning of each dataset was carried out during the primary analysis of each study by the study-specific researcher using STATA 9.0, 10.0 or 11.0, prior to the commencement of this current analysis. The majority of coding errors were identified and corrected during this process. During the course of the analysis presented here, extreme outlier observations were subsequently identified by the current researcher (A. Lindquist) using histograms, and the case ID for these outlier observations was used to cross-check the original paper files. Where the outlying observation clearly resulted from an error of data entry or coding, the appropriate changes were made and the correct code re-entered into the dataset. There were no values recoded as 'missing'.

Ethics approval

Ethics approval for the UKOSS program was granted by the London Multi-Centre Research Ethics Committee, prior to commencement of the first study in 2005 (Knight et al 2005). Each study has subsequently been granted individual ethics approval from the Research Ethics Committee. All data used for the analysis presented here were de-identified and therefore a separate ethics approval was not required.

3.4 INCIDENCE ESTIMATES – METHODS & RESULTS

Using only UKOSS case numbers from the studies outlined above, the incidence of severe maternal morbidity was estimated both for the UK population as a whole, and also amongst each different socioeconomic group, as defined by NS-SEC occupational category. Rates have not been adjusted for age or other variables since this information is not available on an individual basis in the population data.

Incidence UK-wide

In order to estimate the overall incidence of severe maternal morbidity in the UK, the most accurate numerators and denominators were sought from existing data sources. Numerator case numbers were obtained from the UKOSS studies of specific conditions of maternal morbidity, conducted throughout all obstetric units in the UK as outlined above.

Denominator numbers were obtained from the ONS for England and Wales, the Northern Ireland Statistics and Research Agency (NISRA) and the Scottish General Register Office (GRO), which release annual statistics of maternities per year in their respective countries (Table 3). Maternities are defined as the number of women with pregnancies ending in stillbirths or live births with multiple births counting only once (UK National Statistics 2011).

Table 3. Total maternities per year UK-wide (denominator)

Year	Country	Maternities	Total UK maternities per year
2005	UK	715,556	715,556
2006	UK	741,067	741,067
2007	UK	764,387	764,387
2008*	England and Wales Northern Ireland Scotland	701,297 25,378 59,396	786,071
2009*	England and Wales Northern Ireland Scotland	698,324 24,643 58,410	781,377
2010*	England and Wales Northern Ireland Scotland	715,467 25,315 58,139	798,921

*Births and Deaths statistics, including maternities, were provided collectively for the UK up until 2008, after which time individual country estimates had to be sought separately and then combined for 2008 onwards.

Specific denominators were calculated for each individual UKOSS study period based on these maternity statistics and the duration and timing of each study (Table 4). Incidence rates (λ) were calculated first for each study, using the equation $\lambda = d/T$ where d=number of events and T=person-time at risk (Table 4). Rates have been calculated in this analysis as a function of total maternities over a given period of time, as is convention in maternal health research. Rates are also expressed universally as per 100,000 maternities since severe maternal morbidity is a relatively rare condition. Confidence intervals were derived based on the exact binomial distribution, using the numerator and denominator numbers for each study period.

Table 4. Incidence of individual conditions per 100,000 maternities

Study condition	Period of study	Duration of study (months)	Number of cases	Maternities for each study period	Incidence per 100,000 maternities (95%CI)
Amniotic fluid embolism	01/02/05 – 31/01/10	60	69	3,795,405	1.8 (1.4 – 2.30)
Acute fatty liver of pregnancy	01/02/05 – 31/08/06	19	55	1,131,971	4.9 (3.7 – 6.3)
Eclampsia	01/02/05 – 29/02/06	13	214	779,437	27.5 (23.9 – 31.4)
Peripartum hysterectomy	01/02/05 – 29/02/06	13	322	779,437	41.3 (36.9 – 46.1)
Therapies for peripartum haemorrhage	01/09/07 – 31/03/09	19	323	1,236,211	26.1 (23.4 – 29.1)
Uterine rupture	01/04/09 – 30/04/10	13	159	852,340	18.7 (15.9 – 21.8)

In order to calculate the incidence overall, the number of cases in each study were 'scaled-up' (based on number of maternities not period of time) to match the longest study period, which was AFE. The AFE study was conducted over 60 months (5 years) and thus all other studies were adjusted accordingly so that the numerator corresponded to that period and the denominator reflected the total number of maternities in the UK for that period of time, without duplication. The overall incidence rate per 100,000 maternities was then calculated using the total cases and maternities during those 5 years (Table 5).

Table 5. Incidence rate overall during longest study period (5 years)

Study condition	Cases per 5 year period	Total incidence per 100,000 maternities
Amniotic fluid embolism	69	(4563/3,795,405)
Acute fatty liver of pregnancy	184	*100,000
Eclampsia	1042	
Peripartum hysterectomy	1568	=120.2
Therapies for peripartum haemorrhage	992	
Uterine rupture	708	

Confidence intervals were derived based on the exact binomial distribution, using numerator and denominator numbers for the *shortest* study period. Case numbers and maternities were down-scaled to the shortest study period (13 months, eclampsia) in order to obtain conservative confidence intervals (Table 6).

Table 6. Confidence interval calculations

Study condition	**Cases scaled down**	**Confidence Interval**
Amniotic fluid embolism	14	Total cases: 938
Acute fatty liver of pregnancy	38	Exposed: 779,437
Eclampsia	214	95%CI=
Peripartum hysterectomy	322	(113.0 – 128.4)
Therapies for peripartum haemorrhage	204	
Uterine rupture	146	

The overall UK-wide incidence of severe maternal morbidity was 120.2 (95%CI 113.0 – 128.4) cases per 100,000 maternities.

Incidence by NS-SEC category

The ONS records the father's occupation and the corresponding NS-SEC code for 10% of all live births (for married and joint registrants only) in England and Wales. Sole registrants (single mothers) are excluded from these statistics. Based on the 10% recorded, these numbers are scaled up to an approximation of 100% of all live births. The incidence of severe maternal morbidity amongst different socioeconomic groups was therefore able to be estimated using UKOSS cases for the numerators and ONS statistics for England and Wales based on live births by paternal NS-SEC category as denominators.

The number of live births in NS-SEC class 8 across all years of the study (2005-2010) was too small (0 in many cases) for accurate incidence rates to be estimated for this category. This is a result of the ONS coding of unemployed parents whereby only fathers that have never worked or are very long-term unemployed are coded as 'unemployed'. If they have ever been employed they are classified based on their most recent employment. This method is different from UKOSS, where parents are coded as unemployed if the mother and father are unemployed at the time of the pregnancy, regardless of past employment.

It therefore seemed most appropriate to exclude the unemployed category from both the UKOSS case numbers and from the ONS denominator statistics due to a lack of consistency between the definitions used (Table 7).

Table 7. NS-SEC classification used for UKOSS studies, ONS live birth statistics and in the analysis presented here

NS-SEC categories	NS-SEC classification used by UKOSS	ONS classification	Current analysis
1	1 Managerial/ Professional	1 Managerial/ Professional	1 Managerial/ Professional
1.1			
1.2			
2			
3	2 Intermediate occupations	2 Intermediate occupations	2 Intermediate occupations
4			
5	3 Routine/Manual	3 Routine/Manual	3 Routine/Manual
6			
7			
8	4 Unemployed (including students)	Never worked and long-term unemployed	Unclassified (not included in this analysis)
Missing	Unclassified	Unclassified (including students)	

The number of cases in each NS-SEC category was tabulated for each of the UKOSS studies included in the analysis (Table 8).

Table 8. Number of UKOSS cases per NS-SEC category

NS-SEC classification	NS-SEC category	UKOSS cases	Cases per NS-SEC category (%)
1 1.1 1.2 2	1	13 44 65 169	291 (25.5)
3 4	2	171 73	244 (21.4)
5 6 7	3	24 175 73	272 (23.8)
8 Student Missing		128 14 193	335 (29.3) (excluded from analysis)

The ONS provides the number of live births per year, per NS-SEC category and these statistics were then used to calculate the number of live births per NS-SEC category for each specific UKOSS study period. Incidence rates were subsequently calculated for each NS-SEC category within each separate UKOSS study (Table 9).

Table 9. Incidence of each study condition per 100,000 live births by NS-SEC category

Study condition	Period of study	NS-SEC Category	Number of cases per NS-SEC category	Number of live births per NS-SEC	Incidence per 100,000 live births (95% CI)
Amniotic fluid embolism	01/02/05 – 31/01/10	1 2 3	21 10 7	1,190,367 624,625 1,189,283	1.8 (1.1 – 2.7) 1.6 (0.8 – 2.9) 0.6 (0.2 – 1.2)
Acute fatty liver of pregnancy	01/02/05 – 31/08/06	1 2 3	16 13 11	374,942 187,342 357,242	4.3 (2.4 – 6.9) 6.9 (3.7 – 11.9) 3.1 (1.5 – 5.5)
Eclampsia	01/02/05 – 29/02/06	1 2 3	45 46 84	245,842 126,792 242,692	18.3 (13.4 – 24.5) 36.3 (26.6 – 48.4) 34.6 (27.6 – 42.9)
Peripartum hysterectomy	01/02/05 – 29/02/06	1 2 3	87 72 87	245,842 126,792 242,692	35.4 (28.4 – 43.7) 56.8 (44.4 – 71.5) 35.8 (28.7 – 44.2)
Therapies for peripartum haemorrhage	01/09/07 – 31/03/09	1 2 3	85 66 78	384,991 203,150 391,725	22.1 (17.6 – 27.3) 32.5 (25.1 – 41.3) 19.9 (15.7 – 24.9)
Uterine rupture	01/04/09 – 30/04/10	1 2 3	39 36 39	261,842 144,517 264,876	14.9 (10.6 – 20.4) 24.9 (17.5 – 34.5) 14.7 (10.5 – 20.1)

In keeping with the methodology used for the UK-wide estimates, live birth numbers were then scaled-up for each NS-SEC category to match the AFE study denominators (Table 10). An overall incidence estimate was calculated for each NS-SEC category using these total case numbers and the total live births during the period of the AFE study.

Confidence intervals were derived using the same methodology as presented for overall UK-wide estimates, with down-scaled case numbers for each NS-SEC category calculated based on the duration of the shortest study (eclampsia) (Table 10).

Table 10. Overall incidence of severe maternal morbidity per NS-SEC category

NS-SEC Category	Incidence	95% Confidence Intervals
NS-SEC 1	(1,151/1,190,367)*100,000 = 96.7	Cases: 238 Exposed: 245,842 95%CI= (85.2 – 109.8)
NS-SEC 2	(994/624,625)*100,000 = 159.1	Cases: 197 Exposed: 126,792 95%CI= (138.4 – 183.0)
NS-SEC 3	(1294/1,189,283)*100,000 = 108.8	Cases: 264 Exposed: 242,692 95%CI= (88.5 – 133.8)

Rate ratios

Rate ratios were estimated comparing the second and first NS-SEC categories and the third and first NS-SEC categories (Table 11). Confidence intervals were derived using the standard error (se) of the log(rate ratio) and error factors (EF=exp[1.96*se of log(rate ratio)].

Table 11. Rate ratios by NS-SEC categories

Comparison groups	Rate ratio	Se log(rate ratio)	Error factor	95%CI
NS-SEC 2 vs NS-SEC 1	159.1/96.7 = 1.65	0.096	1.448	1.14 – 2.38
NS-SEC 3 vs NS-SEC 1	108.8/96.7 =1.13	0.089	1.191	0.94 – 1.34

The incidence of severe maternal morbidity was 1.65 times higher amongst women from the second NS-SEC group compared with women from the highest group and was statistically significant. Although not statistically significant, the incidence amongst the lowest socioeconomic group was 1.13 times higher than women in the first group.

LIMITATIONS

There were a number of limitations to this analysis. First, the need to use national birth statistics for denominator data without having access to the demographic composition of maternity statistics in terms of maternal age, ethnicity and NS-SEC socioeconomic group, precluded the incidence analysis from being adjusted for these potential confounding factors. Second, NS-SEC codes are only obtained for 10% of live births, thus requiring the 'scaling-up' of denominator numbers. Third, NS-SEC codes are only assigned according to the father's occupation and single mothers are thus excluded from the denominator statistics, which is potentially problematic, particularly when analysing the lower socioeconomic groups. Additionally, denominator numbers by socioeconomic group were only available for England and Wales, not Scotland and Northern Ireland where different socioeconomic classification systems are used for birth registrations. In contrast, the numerator UKOSS case numbers were for the UK as a whole and this discord is likely to have had an impact on the incidence estimates. Finally, the incompatibility between the UKOSS and ONS use of NS-SEC socioeconomic classification for unemployed women ultimately forced the exclusion of unemployed women from this analysis which was one of the primary groups of interest.

As a consequence of these limitations, further analyses were conducted using the same UKOSS case data to examine the risk of severe maternal morbidity amongst women from different socioeconomic groups, taking into account possible confounders such as age and ethnicity.

3.5 RISK FACTOR ANALYSIS – METHODS

Using data from a series of UKOSS studies, the independent risk of severe maternal morbidity associated with NS-SEC socioeconomic group was investigated in a case-control analysis.

Case and control data

Case data were obtained from the UKOSS studies outlined in Section 3.3. Data about a representative group of control women were obtained by collecting information about the two women delivering immediately prior to identified cases in other UKOSS studies covering the same obstetric units. Comparison between UKOSS control women and national data on the characteristics of child-bearing women in the UK suggest that the women recruited as UKOSS controls are closely representative of the general, child-bearing population (Knight et al 2010b). As outlined in Section 3.3, the studies from which control data were obtained for this analysis included eclampsia, peripartum hysterectomy, obesity, antenatal stroke and pulmonary embolism and the same information was obtained for these women as for case women. Controls were not matched to cases in the analysis presented here.

Case and control data from these complete, existing datasets were combined to form an overall case-control dataset.

Variables

The primary outcome of interest, severe maternal morbidity, was designated by case or control status. The primary relationship under investigation in the analysis presented here is between severe maternal morbidity and socioeconomic position, as defined by NS-SEC occupational group. A series of other variables were included in the analysis that were either known risk factors for severe maternal morbidity, were known to be associated with socioeconomic position or had the potential to confound the relationship between socioeconomic position and severe maternal morbidity. These variables were maternal age, ethnicity, BMI, smoking, parity, multiple pregnancy, co-existing medical conditions and past pregnancy conditions.

Definition of variables

There were several variables in the final dataset that consisted of multiple categories which needed to be collapsed into fewer categories for ease of analysis. All the original variables were retained in the dataset.

Occupation had been coded into 12 groups as per the modified NS-SEC classification (Table 12) explained in Section 3.1. Where a woman was unemployed or her occupation was not specified, her husband/partner's occupation was coded, if this information was available.

The original data for ethnicity was coded into 16 ethnic groups based on the 2001 census categories (Table 12). Some of these groups comprised very small numbers and thus were re-classified into four ethnic groups as per the standard method used by the ONS (Table 12). Age was categorised into 5-year age bands, as per recognised categories of age-related risk in maternal health: <20 years, 20-24, 25-29, 30-34, ≥35.

As per the WHO guidelines, BMI was classified into normal, overweight and obese (WHO 2011). Smoking and parity were classified as shown in Table 12. As outlined in Section 3.1, a range of medical conditions have been shown to increase a woman's risk of developing severe (direct) maternal morbidity and the existing literature was used to inform which conditions would constitute potentially important exposures in this analysis (Table 12) (Al-Zirqi et al 2008, Knight et al 2009a, van Roosmalen and Zwart 2009, Zwart et al 2008b). A history of intravenous drug use and alcohol abuse were also included due to the potential for these conditions to confound the association between the primary variable of interest, socioeconomic position, and the outcome of severe maternal morbidity. Past pregnancy conditions were included based on their likelihood of increasing the risk of severe maternal morbidity in subsequent pregnancies.

A baseline comparison level was designated for each categorical variable, generally corresponding to the group with the highest number of observations or the group considered at lowest risk of severe maternal morbidity (Table 12).

Table 12. Categorisation of each variable in the dataset

Variable	Categories	Label	Raw data
Socio-economic group	NS-SEC 1	Managerial/ Professional (baseline)	**NS-SEC occupational codes:** **1** Higher managerial and professional occupations **1.1** Large employers and higher managerial occupations **1.2** Higher professional occupations **2.0** Lower managerial and professional occupations
	NS-SEC 2	Intermediate Occupations	**3.0** Intermediate occupations **4.0** Small employers and own account workers **12.0** Self-employed
	NS-SEC 3	Routine/Manual	**5.0** Lower supervisory and technical occupations **6.0** Semi-routine occupations **7.0** Routine occupations
	NS-SEC 4	Unemployed or unclassifiable	**10.0** Unemployed and never worked **11.0** Student
Ethnic group	1	White (baseline)	British White White other
	2	Asian	Indian Pakistani Bangladeshi Asian other

Table 12 *continued*

Variable	Categories	Label	Raw data
Ethnic group	3	Black	Caribbean African Black other
	4	Other	White and black Caribbean White and Black African Mixed other Chinese Other
Age	1	< 20 years	Age in years based on date of birth
	2	20 – 24 years	
	3	25 – 29 years (baseline)	
	4	30 – 34 years	
	5	≥ 35 years	
BMI	1	Normal BMI (baseline)	BMI < 25
	2	Overweight	BMI 25 – 29
	3	Obese	BMI ≥ 30
Smoking	0	Non-smoker (baseline)	Never smoked Gave up prior to pregnancy
	1	Smoker	Quit during pregnancy Smoked during pregnancy
Co-existing medical condition	0	No medical conditions (baseline)	No conditions of relevance recorded
	1	Positive medical history	Cardiac disease Diabetes Mellitus (insulin and non-insulin dependent) Epilepsy Essential hypertension Haematological disorders (bleeding diatheses) Past thrombotic event Recent/current anticoagulation IV drug use and/or alcohol abuse
Parity	0	Nulliparous (baseline)	No past pregnancies over 24 weeks gestation
	1	Multiparous	≥ 1 past pregnancy over 24 weeks
Past pregnancy condition	0	No past conditions (baseline)	Either nulliparous or no past pregnancy complications
	1	Positive past pregnancy history	Amniotic fluid embolism Gestational diabetes Pregnancy-induced hypertension Pre-eclampsia Eclampsia Thrombotic event Acute fatty liver Manual removal of placenta Placenta accreta Past classical caesarean-section

Study power

The analysis reported here included a fixed number of cases and controls derived from the specified UKOSS studies. Based on 1,144 cases and 2,256 controls, Table 13 gives the range of odds ratios detectable as statistically significant at $p<0.05$ for a range of risk factor prevalence estimates in the controls, for a study power of 80% and 90%, derived using STATA. Thus, for example, for rare exposures with a prevalence of only 1% in the controls, the analysis has 80% power to detect as statistically significant (at $p<0.05$) an odds ratio of 2.36 or greater and 90% power to detect as statistically significant (at $p<0.05$) an odds ratio of 2.66 or greater.

Table 13. Power analysis with fixed sample size of 1,144 cases and 2,256 controls

Risk factor prevalence in control group (%)	Odds Ratio (OR) detectable by the study with 80% power*	Odds Ratio (OR) detectable by the study with 90% power*
1.0	≥ 2.36	≥ 2.66
3.0	≥ 1.71	≥ 1.85
5.0	≥ 1.55	≥ 1.64
10.0	≥ 1.38	≥ 1.45
15.0	≥ 1.32	≥ 1.37
20.0	≥ 1.28	≥ 1.33
30.0	≥ 1.23	≥ 1.29
40.0	≥ 1.23	≥ 1.27
50.0	≥ 1.23	≥ 1.27
60.0	≥ 1.24	≥ 1.28
70.0	≥ 1.26	≥ 1.31
80.0	≥ 1.31	≥ 1.37
90.0	≥ 1.46	≥ 1.56

*OR derived using STATA 11.0

ANALYSIS

All analyses were carried out using STATA version 11.0. The data were initially explored using univariable and bivariable analysis. The analysis was then extended to multivariable analysis.

Unadjusted univariable analysis

Univariable chi-square analysis was performed to examine the association between the outcome (case or control) and each exposure variable. Simple logistic regression was then used to further examine this association, producing odds ratios (OR) for each variable. All variables were analysed as categorical or binary variables, except for age and BMI, which were also examined as continuous variables. Missing data items were included in the analyses as separate categories (proxy indicators) for each variable.

The confounding effect of individual variables on the socioeconomic position-outcome relationship was tested in separate bivariable regression models. The relationship between socioeconomic position and other variables was also explored separately amongst cases and controls using chi-square analysis.

Missing data analysis

Due to the high proportion of data missing for BMI and socioeconomic position, further analyses were necessary to explore the distribution and impact of missing data in this dataset and to plan the most appropriate method of multivariable analysis.

First, the proportion of data missing for each variable amongst cases and controls was assessed. The pattern of missing observations was also explored separately amongst cases and controls. Then, by creating a new variable to distinguish missing vs non-missing socioeconomic observations, chi-square tests were used to investigate the distribution of missing socioeconomic observations in this dataset and to identify whether data were 'missing at random'.

The findings demonstrated that the distribution and impact of missing data was substantial and that the pattern of missingness was unlikely to be 'missing at random'. The results of multivariable analysis were therefore likely to be biased by the high proportion and non-random pattern of missing data if the missing observations were not accounted for. Due to the evidence against a 'missing at random' assumption, Multiple Imputation was not an appropriate solution to deal with the effects of missing data. The decision was therefore made to include the missing data as a separate category for the relevant variables, treating them as 'proxy indicators' in the subsequent model-building processes.

Adjusted multivariable analysis and model-building

Variables that were likely to confound the relationship between socioeconomic position and severe maternal morbidity were selected *a priori* based on (a) the results of the univariable analysis (significant p-values defined at the 5% level) and (b) evidence from published literature demonstrating which variables are known to be strong predisposing risk factors for severe maternal morbidity. The *a priori* confounders included were ethnicity, maternal age, smoking, co-existing medical conditions and BMI. Age was included as a categorical variable after testing for departure from linearity. Due to the substantial amount of data missing for BMI, it was decided that BMI should also be included in the model from the beginning as a categorical variable to ensure the results were not biased by the exclusion of the missing observations.

Other variables included in the model as possible confounders were parity, multiple pregnancy and past pregnancy condition. These variables each had a significant effect on outcome in the univariable analysis despite a relative lack of published evidence to suggest they were likely to confound the relationship between socioeconomic position and severe maternal morbidity.

Multivariable analysis was performed using unconditional logistic regression with *a priori* variables included one-by-one in a step-wise method, with the results reviewed after each addition. The effect of each variable on the relationship between socioeconomic position and outcome was assessed using likelihood ratio tests. Even though the *a priori* variables were all pre-selected, the inclusion of each variable in turn enabled assessment of the independent effect of each variable on the fit of the model and therefore a more complete understanding of the relationship between the variables. The additional three variables (parity, multiple pregnancy and past pregnancy condition) were also included in the model using the same approach, with only those variables demonstrating a statistically significant effect on the fit of the data ($p<0.05$) retained in the model.

The inclusion of age had the most significant effect on the fit of the model and was subsequently tested in a model including only age and socioeconomic position to explore whether the effect of age alone could explain the final results.

Testing for departure from linearity

The results of the model suggested that the relationship between age and outcome was non-linear. Using likelihood ratio tests, the fit of the model was tested by comparing the model with age as a categorical variable to the model with age as a continuous variable. Statistical significance was defined as $p<0.01$.

Testing for interactions

Likelihood ratio tests were then used to explore possible interactions between socioeconomic position and all other variables included in the model, as there was the potential for the effect of socioeconomic position to differ at different levels of each exposure variable. Possible interactions were explored between socioeconomic position and ethnicity, BMI, smoking, age, co-existing medical condition, multiple pregnancy and past pregnancy condition. Statistical significance for interactions was defined as $p<0.01$. No interactions were found.

Comparison with complete data analysis

Once the final model was complete, the model was re-run excluding the proxy indicators (ie. including only cases and controls with complete data), allowing comparison to be made between the model in which missing data is accounted for and the model excluding missing data.

Sensitivity analysis

Sensitivity analyses were used to explore the impact of including only the variables with the highest proportion of missing data – socioeconomic position and BMI. The multivariable regression model was re-run after redistributing the missing values into the lowest socioeconomic category, and then again after re-distributing them into the highest category. This process was repeated for the missing BMI values.

3.6 RISK FACTOR ANALYSIS – RESULTS

This analysis included a total of 1,144 cases and 2,256 controls. The study participants ranged in age from 14 to 55 years.

DESCRIPTIVE ANALYSIS

The proportion of women in each socioeconomic group and those women with missing socioeconomic data was similar between cases and controls (Table 14). At the univariable level, socioeconomic position was not associated with a statistically significant increase in odds of severe maternal morbidity (p=0.06). Compared with the baseline 'managerial/professional' group, the odds ratio (OR) for the 'intermediate occupations' group was 0.98 (95%CI 0.80 – 1.21), 0.89 (95%CI 0.73 – 1.09) for 'routine/manual' and 0.89 (95%CI 0.70 – 1.14) for 'unemployed' women. Women with missing socioeconomic data had an unadjusted OR of 1.24 (95%CI 0.98 – 1.56).

The univariable analysis across the four ethnic groups, demonstrated a clear difference in the odds of severe maternal morbidity amongst women from different ethnic groups. Compared to the baseline 'White' category, 'Asian' women were found to have 1.50 times the odds of severe maternal morbidity (OR 1.53; 95%CI 1.22 – 1.93), 'Black' women twice the odds (OR 2.02; 95%CI 1.54 – 2.66) and women from 'Other' ethnic background 1.6 times the odds (OR 1.64; 95%CI 1.13 – 2.37). Overall, women from non-white ethnic groups were 1.7 times more likely to experience severe morbidity than white women (OR 1.70; 95%CI 1.43 – 2.02).

Compared to the controls, there was a higher proportion of cases aged 35 years and over (34.3% vs 21.2%) and a smaller proportion aged under 20 years (4.9% vs 6.2%) (Table 14). Younger age (≤24 years) was shown to be protective against severe maternal morbidity (Age 20-24 OR 0.69; 95%CI 0.54 – 0.89) with older women (≥35 years) twice as likely to suffer from severe maternal morbidity (OR 2.00; 95%CI 1.63 – 2.45).

Smoking showed a protective effect against severe morbidity, with smokers almost 30% less likely to have experienced an adverse outcome (OR 0.72; 95%CI 0.60 – 0.86). Since smoking has been shown to reduce the risk of pre-eclampsia, the analysis was repeated after removing the eclampsia cases from the dataset to verify whether the overall reduction in odds associated with smoking was in fact related to the number of eclampsia cases in the dataset. However, when the eclampsia cases were excluded from the analysis, the results remained unchanged (OR 0.72; 95%CI 0.59 – 0.88).

Unadjusted analysis of BMI as a categorical variable showed that overweight (OR 1.19; 95%CI 1.00 – 1.42; p=0.06) and obese (OR 1.21; 95%CI 0.99 – 1.48; p=0.06) women have increased odds of severe maternal morbidity however these findings were not statistically significant (Table 14). Overall, the odds of severe maternal morbidity increased by 1% with each 1-point increase in BMI (OR 1.01; 95%CI 1.00 – 1.03; p=0.04).

Women with co-existing medical conditions and women with a history of past pregnancy conditions were both 1.8 times more likely to experience severe maternal morbidity (medical condition: OR 1.84; 95%CI 1.38 – 2.46 and past pregnancy condition: OR 1.84; 95%CI 1.38 – 2.46). Multiparous women had a greater odds of severe morbidity (OR 1.44; 95%CI 1.24 – 1.67) and despite small numbers, women with a multiple pregnancy had more than four times the odds of severe maternal morbidity (OR 4.46; 95%CI 2.81 – 7.08) than women with a singleton pregnancy (Table 14).

Table 14. Unadjusted analysis comparing cases of morbidity with controls

Variable	Cases n= (%) N= 1,144	Controls n= (%) N=2,256	Unadjusted OR (95% CI)	χ^2 p-value*
Socioeconomic group				
Managerial/ Professional	292 (25.5)	567 (25.1)	1.0	
Intermediate	244 (21.3)	482 (21.4)	0.98 (0.80 – 1.21)	P=0.06
Routine/Manual	273 (28.7)	595 (26.4)	0.89 (0.73 – 1.09)	
Unemployed	142 (14.9)	309 (13.7)	0.89 (0.70 – 1.14)	
Missing	193 (16.9)	303 (13.4)	1.24 (0.98 – 1.56)	
Ethnicity				
White	827 (72.3)	1796 (79.6)	1.0	
Asian	139 (12.2)	197 (8.7)	1.53 (1.22 – 1.93)	P<0.001
Black	108 (9.4)	116 (5.1)	2.02 (1.54 – 2.66)	
Other	52 (4.6)	69 (3.1)	1.64 (1.13 – 2.37)	
Missing	18 (1.6)	78 (3.5)	0.50 (0.30 – 0.84)	
Age				
Age continuous (per year increase in age)			1.06 (1.05 – 1.08)	P<0.001
Age <20	56 (4.9)	139 (6.2)	0.98 (0.70 – 1.39)	
Age 20 – 24	127 (11.1)	449 (19.9)	0.69 (0.54 – 0.89)	P<0.001
Age 25 – 29	225 (19.7)	549 (24.3)	1.0 (ref)	
Age 30 – 34	341 (29.8)	622 (27.6)	1.34 (1.09 – 1.64)	
Age ≥35	392 (34.3)	479 (21.2)	2.00 (1.63 – 2.45)	
Missing	3 (0.3)	18 (0.8)	0.41 (0.12 – 1.39)	
Smoking status				
Non-Smokers	899 (78.6)	1,642 (72.8)	1.0	
Smokers	217 (19.0)	553 (24.5)	0.72 (0.60 – 0.86)	P<0.001
Missing	28 (2.5)	61 (2.7)	0.84 (0.53 – 1.32)	
BMI				
BMI continuous (per point increase in BMI)			1.01 (1.00 – 1.03)	P=0.04
BMI (Normal)	513 (44.8)	1,121 (49.7)	1.0	
BMI (Overweight)	297 (26.0)	545 (24.2)	1.19 (1.00 – 1.42)	P=0.06
BMI (Obese)	206 (18.0)	371 (16.5)	1.21 (0.99 – 1.48)	
Missing	128 (11.2)	219 (9.7)	1.28 (1.00 – 1.63)	
Co-existing medical condition				
Medical condition (no)	1,045 (91.4)	2,126 (94.2)	1.0	
Medical condition (yes)	93 (8.1)	103 (4.6)	1.84 (1.38 – 2.46)	P<0.001
Missing	6 (0.5)	27 (1.2)	0.45 (1.18 – 1.10)	
Parity				
Nulliparous	403 (35.2)	984 (43.6)	1.0	
Multiparous	738 (64.5)	1,250 (55.4)	1.44 (1.24 – 1.67)	P<0.001
Missing	3 (0.3)	22 (1.0)	0.33 (0.10 – 1.12)	
Multiple pregnancy				
Multiple pregnancy (no)	1,083 (94.7)	2,211 (98.0)	1.0	
Multiple pregnancy (yes)	59 (5.2)	27 (1.2)	4.46 (2.81 – 7.08)	P<0.001
Missing	2 (0.2)	18 (0.8)	0.23 (0.53 – 0.98)	
Past pregnancy condition				
Past condition (no)	1,041 (91.0)	2,121 (94.0)	1.0	
Past condition (yes)	94 (8.2)	104 (4.6)	1.81 (1.38 – 2.46)	P<0.001
Missing	9 (0.8)	31 (1.4)	0.59 (0.28 – 1.25)	

*χ^2 p-value reported for overall difference in proportions between groups (cases and controls)

The effect of individual variables on the relationship between socioeconomic position and outcome was explored using logistic regression (Table 15). The inclusion of age (categorical) in the bivariable regression model resulted in the most substantial changes in OR across all levels of socioeconomic position, suggesting that age is the strongest confounder of the observed relationship between socioeconomic position and severe morbidity.

Table 15. Individual variable effects (reference category Managerial/Professional omitted)

Model	Intermediate OR (95%CI)	Routine/Manual OR (95%CI)	Unemployed OR (95%CI)	Missing OR (95%CI)
SEP*	0.98 (0.80 – 1.21)	0.89 (0.73 – 1.09)	0.89 (0.70 – 1.14)	1.24 (0.98 – 1.56)
SEP & Ethnicity	0.98 (0.79 – 1.21)	0.87 (0.71 – 1.06)	0.84 (0.65 – 1.07)	1.25 (0.99 – 1.58)
SEP & Age	1.14 (0.92 – 1.41)	1.17 (0.95 – 1.45)	1.28 (0.99 – 1.67)	1.55 (1.21 – 1.96)
SEP & Smoking	1.01 (0.82 – 1.24)	0.95 (0.77 – 1.16)	1.00 (0.78 – 1.29)	1.35 (1.06 – 1.71)
SEP & BMI	0.98 (0.79 – 1.21)	0.87 (0.71 – 1.07)	0.89 (0.70 – 1.14)	1.21 (0.96 – 1.52)
SEP & Medical condition	0.99 (0.80 – 1.22)	0.88 (0.72 – 1.08)	0.88 (0.69 – 1.13)	1.29 (1.02 – 1.63)
SEP & Parity	0.97 (0.79 – 1.19)	0.87 (0.71 – 1.06)	0.87 (0.68 – 1.11)	1.26 (0.99 – 1.59)
SEP & Multiple pregnancy	1.00 (0.81 – 1.24)	0.93 (0.76 – 1.15)	0.91 (0.71 – 1.17)	1.31 (1.04 – 1.66)
SEP & Past pregnancy condition	1.00 (0.81 – 1.23)	0.89 (0.73 – 1.09)	0.91 (0.71 – 1.16)	1.31 (1.04 – 1.66)

*SEP denotes socioeconomic position

Characteristics of the cases and controls

Amongst the cases, unemployed women were more likely than women from other socioeconomic groups to be younger (<20 years), current smokers and of black or other ethnicity (significance defined at 5% level). 'Managerial/professional' women were most likely to be older (≥35 years), non-smokers or nulliparous (Table 16). Cases with missing socioeconomic data were also more likely to have missing data for some other variables, in particular BMI, smoking and past pregnancy condition compared to cases with complete data (Table 16, column 6).

Table 16. Characteristics of the cases by socioeconomic group

Variable	Managerial/ Professional (%)	Intermediate occupations (%)	Routine/ Manual (%)	Unemployed (%)	Missing (%)	χ^2 p-value*
Ethnicity						
White	221 (75.7)	191 (78.3)	197 (72.2)	91 (64.1)	127 (65.8)	
Asian	32 (11.0)	28 (11.5)	39 (14.3)	12 (8.5)	28 (14.5)	P<0.001
Black	20 (6.9)	14 (5.7)	26 (9.5)	27 (19.0)	21 (10.9)	
Other	13 (4.5)	7 (2.9)	11 (4.0)	11 (7.8)	10 (5.2)	
Missing	6 (2.1)	4 (1.6)	0	1 (0.7)	7 (3.6)	
Age						
<20	1 (0.3)	7 (2.9)	11 (4.0)	32 (22.5)	5 (2.6)	
20-24	9 (3.1)	23 (9.4)	48 (17.6)	21 (14.8)	26 (13.5)	P<0.001
25-29	35 (12.0)	49 (20.1)	69 (25.3)	31 (21.8)	41 (21.2)	
30-34	97 (33.2)	84 (34.4)	70 (25.6)	34 (23.9)	56 (29.0)	
≥35	149 (51.0)	81 (33.2)	75 (27.5)	24 (16.9)	63 (32.6)	
Missing	1 (0.3)	0	0	0	2 (1.0)	
BMI						
<25	151 (51.7)	119 (48.8)	104 (38.1)	72 (50.7)	67 (34.7)	
25-29	69 (23.6)	71 (29.1)	80 (29.3)	34 (23.9)	43 (22.3)	P<0.001
≥30	48 (16.4)	38 (15.6)	59 (21.6)	25 (17.6)	36 (18.7)	
Missing	24 (8.2)	16 (6.6)	30 (11.0)	11 (7.8)	47 (24.4)	
Smoking						
No	266 (91.1)	207 (84.8)	206 (75.5)	89 (62.7)	131 (67.9)	
Yes	23 (7.9)	37 (15.2)	64 (23.4)	52 (36.6)	41 (21.2)	P<0.001
Missing	3 (1.0)	0	3 (1.0)	1 (0.7)	21 (10.9)	
Medical condition						
No	275 (94.2)	229 (93.9)	241 (88.3)	130 (91.6)	170 (88.1)	
Yes	17 (5.8)	15 (6.2)	30 (11.0)	12 (8.5)	19 (9.8)	P=0.01
Missing	0	0	2 (0.7)	0	4 (2.1)	
Parity						
Nulliparous	115 (39.4)	103 (42.2)	82 (30.0)	51 (35.9)	52 (26.9)	
Multiparous	177 (60.6)	141 (57.8)	190 (69.6)	91 (64.1)	139 (72.0)	P=0.01
Missing	0	0	1 (0.4)	0	2 (1.0)	
Past pregnancy condition						
No	257 (88.0)	229 (93.9)	242 (88.6)	133 (93.7)	180 (93.3)	
Yes	34 (11.6)	15 (6.2)	29 (10.6)	9 (6.3)	7 (3.6)	P<0.001
Missing	1 (0.3)	0 (0.0)	2 (0.7)	0 (0.0)	6 (3.1)	

*χ^2 p-value reported for overall difference in proportions between groups

Amongst the controls, unemployed women were more likely to be younger (≤24 years), multiparous and of black or other ethnic background compared to the women from 'managerial/professional' occupations, who were more likely to be older (≥30 years), non-smokers and nulliparous. Controls with missing socioeconomic data were more likely to have data missing for all other variables (Table 17, column 6).

Table 17. Characteristics of the controls by socioeconomic group

Variable	Managerial/ Professional (%)	Intermediate occupations (%)	Routine/ Manual (%)	Unemployed (%)	Missing (%)	χ^2 p-value*
Ethnicity						
White	469 (82.7)	395 (82.0)	490 (82.4)	234 (75.7)	208 (68.7)	P<0.001
Asian	50 (8.8)	45 (9.3)	48 (8.1)	27 (8.7)	27 (8.9)	
Black	19 (3.4)	21 (4.4)	32 (5.4)	25 (8.1)	19 (6.3)	
Other	15 (2.7)	11 (2.3)	16 (2.7)	15 (4.9)	12 (4.0)	
Missing	14 (2.5)	10 (2.1)	9 (1.5)	8 (2.6)	37 (12.2)	
Age						
<20	6 (1.1)	13 (2.7)	38 (6.4)	63 (20.4)	19 (6.3)	P<0.001
20-24	31 (5.5)	81 (16.8)	169 (28.4)	111 (35.9)	57 (18.8)	
25-29	110 (19.4)	133 (27.6)	174 (29.2)	60 (19.4)	72 (23.8)	
30-34	236 (41.6)	145 (30.1)	130 (21.6)	38 (12.3)	73 (24.1)	
≥35	184 (32.5)	110 (22.8)	84 (14.1)	37 (12.0)	64 (21.1)	
Missing	0	0	0	0	18 (5.9)	
BMI						
<25	304 (53.6)	244 (50.6)	270 (45.4)	167 (54.1)	136 (44.9)	P<0.001
25-29	136 (24.0)	130 (27.0)	159 (26.7)	58 (18.8)	62 (20.5)	
≥30	78 (13.8)	78 (16.2)	126 (21.2)	51 (16.5)	38 (12.5)	
Missing	49 (8.6)	30 (6.2)	40 (6.7)	33 (10.7)	67 (22.1)	
Smoking						
No	503 (88.7)	388 (80.5)	409 (68.7)	153 (49.5)	189 (62.4)	P<0.001
Yes	58 (10.2)	92 (19.1)	180 (30.3)	153 (49.5)	70 (23.1)	
Missing	6 (1.1)	2 (0.4)	6 (1.0)	3 (1.0)	44 (14.5)	
Medical condition						
No	541 (95.4)	464 (96.3)	566 (95.1)	290 (93.9)	265 (87.5)	P<0.001
Yes	26 (4.6)	18 (3.7)	28 (4.7)	18 (5.8)	13 (4.3)	
Missing	0	0	1 (0.2)	1 (0.3)	25 (8.3)	
Parity						
Nulliparous	285 (50.3)	202 (41.9)	254 (42.7)	129 (41.8)	114 (37.6)	P<0.001
Multiparous	282 (49.7)	279 (57.9)	341 (57.3)	180 (58.3)	168 (55.5)	
Missing	0	1 (0.2)	0	0	21 (6.9)	
Past pregnancy condition						
No	540 (95.2)	457 (94.8)	563 (94.6)	300 (97.1)	261 (86.1)	P<0.001
Yes	26 (4.6)	23 (4.8)	31 (5.2)	9 (2.9)	15 (5.0)	
Missing	1 (0.2)	2 (0.4)	1 (0.2)	0 (0.0)	27 (8.9)	

*χ^2 p-value reported for overall difference in proportions between groups

The results of univariable analysis and the differences demonstrated between the cases and controls, suggested that there was likely to be confounding of the relationship between socioeconomic position and maternal morbidity.

MISSING DATA ANALYSIS

In view of the extent of data missing for a number of variables, a detailed analysis of the distribution and impact of missing data was undertaken. There was a higher proportion of observations missing for cases than for controls amongst the variables with the most missing data: socioeconomic group and BMI (Table 18). Missing data for all other variables was minimal and similarly distributed between cases and controls.

Table 18. Distribution of missing data across cases and controls

Variable	Number of cases with missing data (% of total cases)	Number of controls with missing data (% of total controls)
Socioeconomic group	193 (16.9)	303 (13.4)
Ethnicity	18 (1.6)	78 (3.5)
Age	3 (0.3)	18 (0.8)
Smoking	28 (2.5)	61 (2.7)
Medical condition	6 (0.5)	27 (1.2)
BMI	128 (11.2)	219 (9.7)
Parity	3 (0.3)	22 (1.0)
Multiple pregnancy	2 (0.2)	18 (0.8)
Past pregnancy condition	9 (0.8)	31 (1.4)

The distribution of missing socioeconomic data was explored separately amongst cases and controls. Amongst the case population, the results showed that women with missing socioeconomic data were more likely to be multiparous, current smokers, have higher BMI (≥30) and have a co-existing medical condition ($p<0.001$) (Table 19). Cases with missing socioeconomic data were also more likely to have missing data in other variables such as ethnicity, smoking status, BMI and past pregnancy condition.

Table 19. Characteristics of the cases with complete data on socioeconomic position (SEP) compared to cases with missing socioeconomic data

Variable	Complete SEP data n= (%)	Missing SEP data n= (%)	χ^2 p-value*
Ethnicity			
White	700 (73.6)	127 (64.8)	
Asian	111 (11.7)	28 (14.5)	P=0.05
Black	87 (9.2)	21 (10.9)	
Other	42 (4.4)	10 (5.2)	
Missing	11 (1.2)	7 (3.6)	
Age			
<20	51 (5.4)	5 (2.6)	
20 –24	101 (10.6)	26 (13.5)	P=0.09
25-29	184 (19.4)	41 (21.2)	
30-34	285 (30.0)	56 (29.0)	
≥35	329 (34.6)	63 (33.0)	
Missing	1 (0.1)	2 (1.0)	
Smoking			
No	768 (80.8)	131 (67.9)	
Yes	176 (18.5)	41 (21.2)	P<0.001
Missing	7 (0.7)	21 (10.9)	
BMI			
<25	446 (46.9)	67 (34.7)	
25-29	254 (26.7)	43 (22.3)	P<0.001
≥ 30	170 (17.9)	36 (18.7)	
Missing	81 (8.5)	24 (24.4)	
Medical condition			
No	875 (92.0)	170 (88.1)	
Yes	74 (7.8)	19 (9.8)	P<0.001
Missing	2 (0.2)	4 (2.1)	
Parity			
Nulliparous	351 (36.9)	52 (26.9)	
Multiparous	599 (63.0)	139 (72.0)	P<0.001
Missing	1 (0.1)	2 (1.0)	
Multiple pregnancy			
No	903 (95.0)	180 (93.3)	
Yes	48 (5.1)	11 (5.7)	P=0.01
Missing	0	2 (1.0)	
Past pregnancy condition			
No	861 (90.5)	180 (93.3)	
Yes	87 (9.2)	7 (3.6)	P<0.001
Missing	3 (0.3)	6 (3.1)	

*χ^2 p-value reported for overall difference in proportions between groups

The control women with missing socioeconomic data were more likely to be of black or other ethnic background (p<0.001) and have missing data in other variables such as ethnicity, age, smoking status, BMI, medical condition, parity and past pregnancy condition (Table 20).

Table 20. Characteristics of the controls with complete data on socioeconomic position (SEP) compared to controls with missing socioeconomic data

Variable	Complete SEP data n= (%)	Missing SEP data n= (%)	χ^2 p-value*
Ethnicity			
White	1,588 (81.3)	208 (68.7)	P<0.001
Asian	170 (8.7)	27 (8.9)	
Black	97 (5.0)	19 (6.3)	
Other	57 (2.9)	12 (4.0)	
Missing	41 (2.1)	37 (12.2)	
Age			
<20	120 (6.1)	19 (6.3)	P<0.001
20 – 24	392 (20.1)	57 (18.8)	
25-29	477 (24.4)	72 (23.8)	
30-34	549 (28.1)	73 (24.1)	
≥35	415 (21.3)	64 (21.2)	
Missing	0	18 (5.9)	
Smoking			
No	1,453 (74.4)	189 (62.4)	P<0.001
Yes	483 (24.7)	70 (23.1)	
Missing	17 (0.9)	44 (14.5)	
BMI			
<25	985 (50.4)	136 (44.9)	P<0.001
25-29	483 (24.7)	62 (20.5)	
≥ 30	333 (17.1)	38 (12.5)	
Missing	152 (7.8)	67 (22.1)	
Medical condition			
No	1,861 (95.3)	265 (87.5)	P<0.001
Yes	90 (4.6)	13 (4.3)	
Missing	2 (0.1)	25 (8.3)	
Parity			
Nulliparous	870 (44.6)	114 (37.6)	P=0.19
Multiparous	1,082 (55.4)	168 (55.5)	
Missing	1 (0.1)	21 (6.9)	
Multiple pregnancy			
No	1,932 (98.9)	279 (92.1)	P<0.001
Yes	21 (1.1)	6 (2.0)	
Missing	0	18 (5.9)	
Past pregnancy condition			
No	1,860 (95.2)	261 (86.1)	P<0.001
Yes	89 (4.6)	15 (5.0)	
Missing	4 (0.2)	27 (8.9)	

*χ^2 p-value reported for overall difference in proportions between groups

MULTIVARIABLE ANALYSIS AND MODEL-BUILDING

Following exploration of the missing data, missing data were re-categorised separately using a proxy indicator ‘missing’ for each variable. All observations in the dataset (3400) were therefore able to be included in the multivariable model analysis.

Ethnicity was the first additional variable included in the multivariable model. This analysis resulted in equivocal OR across the different socioeconomic groups, largely unchanged from the model including only socioeconomic position (Table 21). Age was then added to the model as a categorical variable, which significantly altered the fit of the data and produced substantial changes in the OR for each socioeconomic group. The addition of smoking to the model produced only minor changes in the OR for each socioeconomic group and its overall effect was not statistically significant (p=0.52); because it was selected as an *a priori* variable it was retained in the model. The OR remained largely unchanged following the inclusion of co-existing medical condition (MC) (p<0.001) and BMI to the model (p=0.28). Despite not significantly altering the fit of the model, BMI was an *a priori* variable and was therefore retained in the model.

The variable parity had no significant effect on the fit of the model (p=0.09) and was therefore excluded. Multiple pregnancy produced little change in the OR but was found to significantly improve the fit of the model (p<0.001) and was therefore retained. The addition of past pregnancy condition to the model only resulted in the OR for the ‘unemployed’ socioeconomic group changing from 1.20 (95%CI 0.91 – 1.59) to 1.22 (95%CI 0.92 – 1.61) but had a significant effect on the fit of the data (p=0.01) and was retained in the model.

Table 21. Multivariable model-building (reference category Managerial/Professional omitted)

Multivariable model	Intermediate OR (95%CI)	Routine/ Manual OR (95%CI)	Unemployed OR (95%CI)	Missing SEP OR (95%CI)	LRT p-value
SEP*	0.98 (0.80 – 1.21)	0.89 (0.73 – 1.09)	0.89 (0.70 – 1.14)	1.24 (0.98 – 1.56)	N/A
SEP /Ethnicity	0.98 (0.79 – 1.21)	0.87 (0.71 – 1.06)	0.84 (0.65 – 1.07)	1.25 (0.99 – 1.58)	P<0.001
SEP /Ethnicity/Age	1.13 (0.91 – 1.40)	1.13 (0.92 – 1.40)	1.18 (0.91 – 1.55)	1.51 (1.18 – 1.92)	P<0.001
SEP /Ethnicity/Age/ Smoking	1.14 (0.92 – 1.41)	1.15 (0.93 – 1.43)	1.22 (0.93 – 1.61)	1.53 (1.20 – 1.96)	P=0.52
SEP /Ethnicity/Age/ Smoking/ Medical Condition	1.13 (0.92 – 1.41)	1.12 (0.91 – 1.39)	1.17 (0.89 – 1.54)	1.52 (1.19 – 1.95)	P<0.001
SEP /Ethnicity/Age/ Smoking/ Medical Condition / BMI	1.14 (0.92 – 1.41)	1.12 (0.91 – 1.40)	1.20 (0.91 – 1.58)	1.49 (1.17 – 1.91)	P=0.28
SEP /Ethnicity/Age/ Smoking/ Medical Condition / BMI/ Parity	1.12 (0.90 – 1.39)	1.10 (0.88 – 1.36)	1.58 (0.88 – 1.53)	1.46 (1.13 – 1.87)	P=0.09
SEP /Ethnicity/Age/ Smoking/ Medical Condition / BMI/Multiple Pregnancy	1.15 (0.93 – 1.43)	1.15 (0.93 – 1.43)	1.20 (1.91 – 1.59)	1.49 (1.16 – 1.91)	P<0.001
SEP /Ethnicity/Age/ Smoking/ Medical Condition /BMI/ Multiple Pregnancy / Past Pregnancy Condition	1.17 (0.94 – 1.45)	1.16 (0.93 – 1.45)	1.22 (0.92 – 1.61)	1.51 (1.18 – 1.94)	P=0.01

*SEP denotes socioeconomic position

The model was repeated, adjusted only for age which had the most substantial impact on the odds ratios. The age-adjusted OR were 1.14 (95%CI 0.92 – 1.41) amongst the 'intermediate' socioeconomic group, 1.17 (95%CI 0.95 – 1.45) amongst the 'routine/manual' group, 1.28 (95%CI 0.99 – 1.67) amongst the 'unemployed' women and 1.55 (95%CI 1.22 – 1.96) amongst the women with missing socioeconomic data. These results are similar to those of the final model and suggest that age had the most significant impact on the odds of severe morbidity in the model.

Final multivariable model

Compared with the ‘managerial/professional’ group, those in the ‘intermediate’ group were 1.17 (95%CI: 0.94 – 1.45) times more likely to experience severe maternal morbidity, those in the ‘routine/manual’ group were 1.16 (95%CI: 0.93 – 1.45) times more likely, those in the ‘unemployed’ group were 1.22 (95%CI: 0.92 – 1.61) times more likely and those women with missing socioeconomic observations were 1.51 (95%CI: 1.18 – 1.94) times more likely to experience severe maternal morbidity (Table 22).

Multivariable analysis, excluding the proxy indicators for missing observations, that is including only those cases and controls with complete data, was also performed for comparison and produced an OR of 1.19 (95%CI 0.94 – 1.49) for the intermediate occupational group, 1.13 (95%CI 0.90 – 1.43) for the routine/manual group and 1.31 (95%CI 0.97 – 1.77) for unemployed women (Table 22).

Compared to the results of the analysis where only case and controls with complete data were included, accounting for missing data in the proxy indicator model produced changes in OR for the unemployed socioeconomic group and the women with multiple pregnancy (Table 22). The highest odds of severe morbidity was shown to be associated with black (OR 1.77; 95%CI 1.32 – 2.36) or Asian (OR 1.57; 95%CI 1.23 – 2.00) ethnic background, co-existing medical condition (OR 1.60; 95%CI 1.18 – 2.17), multiple pregnancy (OR 3.88; 95%CI 2.42 – 6.22) and past pregnancy condition (OR 1.58; 95%CI 1.16 – 2.13).

Table 22. Adjusted analysis of the entire dataset with proxy indicators for missing data and without

Variable	Proxy indicator model adjusted OR (95%CI)	Complete data analysis adjusted OR (95%CI)
Socioeconomic group		
Managerial/Professional	1.0	1.0
Intermediate	1.17 (0.94 – 1.45)	1.19 (0.94 – 1.49)
Routine/Manual	1.16 (0.93 – 1.45)	1.13 (0.90 – 1.43)
Unemployed	1.22 (0.92 – 1.61)	1.31 (0.97 – 1.77)
Missing	1.51 (1.18 – 1.94)	
Ethnicity		
White	1.0	1.0
Asian	1.57 (1.23 – 2.00)	1.49 (1.13 – 1.97)
Black	1.77 (1.32 – 2.36)	1.79 (1.27 – 2.52)
Other	1.50 (1.02 – 2.19)	1.48 (0.94 – 2.32)
Missing	0.51 (0.28 – 0.91)	
Age		
<20 years	1.08 (0.75 – 1.56)	1.20 (0.80 – 1.80)
20-24	0.71 (0.55 – 0.92)	0.69 (0.51 – 0.92)
25-29	1.0	1.0
30-34	1.33 (1.08 – 1.64)	1.30 (1.02 – 1.66)
≥35	1.98 (1.60 – 2.45)	1.90 (1.49 – 2.44)
Missing	2.66 (0.22 – 26.00)	
Smoking		
Non-smokers	1.0	1.0
Smokers	0.89 (0.73 – 1.08)	0.84 (0.67 – 1.06)
Missing	0.95 (0.54 – 1.67)	
Co-existing medical condition		
No	1.0	1.0
Yes	1.60 (1.18 – 2.17)	1.55 (1.09 – 2.20)
Missing	0.76 (0.17 – 3.41)	
BMI		
< 25	1.0	1.0
25-29	1.10 (0.92 – 1.32)	1.10 (0.90 – 1.34)
≥ 30	1.09 (0.88 – 1.34)	1.02 (0.81 – 1.29)
Missing	1.24 (0.95 – 1.61)	
Multiple pregnancy		
No	1.0	1.0
Yes	3.88 (2.42 – 6.22)	4.64 (2.60 – 8.29)
Missing	0.20 (0.02 – 2.54)	
Past pregnancy condition		
No	1.0	1.0
Yes	1.58 (1.16 – 2.14)	1.77 (1.26 – 2.49)
Missing	1.12 (0.36 – 3.54)	

SENSITIVITY ANALYSIS

Recoding missing observations to the extreme values

Using the multivariable regression model outlined in Table 22, the effect of recoding missing observations into extreme categories for socioeconomic group and BMI was explored. Redistributing missing socioeconomic observations into the 'managerial/ professional' group (best case scenario) reduced the 'unemployed' OR from 1.22 (95% CI 0.92 – 1.61) to 1.02 (95%CI 0.79 – 1.32), although neither result was statistically significant. Redistributing the missing socioeconomic observations into the 'unemployed' group (worst case scenario) increased the OR for 'unemployed' women from 1.22 (95% CI 0.92 – 1.61) to 1.38 (95%CI 1.11 – 1.72) (Table 23).

There were minimal changes in the ORs for BMI when missing values were recoded into normal or obese categories.

Table 23. Sensitivity analysis for missing observations

Missing values	Sub-category	Cases (%)	Controls (%)	Adjusted OR (95% CI)
Socioeconomic group				
Missing SEP values recoded to 'Managerial/ Professional' (best case)	Managerial	485 (42.4)	870 (38.6)	1.0
	Intermediate	244 (21.3)	482 (21.4)	1.01 (0.83 – 1.23)
	Routine/Manual	273 (23.9)	595 (26.4)	0.99 (0.82 – 1.21)
	Unemployed	142 (12.4)	309 (13.7)	1.02 (0.79 – 1.32)
Missing SEP values recoded to 'unemployed' (worst case)	Managerial	292 (25.5)	567 (25.1)	1.0
	Intermediate	244 (21.3)	482 (21.37)	1.17 (0.94 – 1.46)
	Routine/Manual	273 (23.9)	595 (26.4)	1.17 (0.94 – 1.46)
	Unemployed	335 (29.3)	612 (27.1)	1.38 (1.11 – 1.72)
BMI				
Recoded to 'Normal' BMI	Normal	641 (56.0)	1,340 (59.4)	1.0
	Overweight	297 (26.0)	545 (24.2)	1.06 (0.89 – 1.27)
	Obese	206 (18.0)	371 (16.5)	1.05 (0.85 – 1.29)
Recoded to 'Obese' BMI	Normal	513 (44.8)	1,121 (49.7)	1.0
	Overweight	297 (26.0)	545 (24.2)	1.10 (0.92 – 1.32)
	Obese	334 (29.20)	590 (26.2)	1.14 (0.95 – 1.36)

FINAL RESULTS

The adjusted results of the final analyses using the different analytical approaches are summarised below (Table 24).

Table 24. Odds ratios* of severe morbidity across socioeconomic groups by the different analytical approaches used to generate the results

Method of analysis	N= (cases & controls)	Intermediate OR (95%CI)	Routine/ Manual OR (95%CI)	Unemployed OR (95% CI)	Missing SEP OR (95%CI)
Crude unadjusted analysis	3400	0.98 (0.80 – 1.21)	0.89 (0.73 – 1.09)	0.89 (0.70 – 1.14)	1.24 (0.98 – 1.56)
Proxy indicator model	3400	1.17 (0.94 – 1.45)	1.16 (0.93 – 1.45)	1.22 (0.92 – 1.61)	1.51 (1.18 – 1.94)
Complete data analysis	2601	1.19 (0.94 – 1.49)	1.13 (0.90 – 1.43)	1.31 (0.97 – 1.77)	N/A
Socioeconomic sensitivity analysis (best case)	3400	1.01 (0.83 – 1.23)	0.99 (0.82 – 1.21)	1.02 (0.79 – 1.32)	N/A
Socioeconomic sensitivity analysis (worst case)	3400	1.17 (0.94 – 1.46)	1.17 (0.94 – 1.46)	1.38 (1.11 – 1.72)	N/A

*Reference group Managerial/Professional omitted

3.7 DISCUSSION

Results

Historically, research has consistently shown that the most marginalised members of the community in developed countries tend to have similar characteristics. People from ethnic minority groups and those with a lower level of education are typically over-represented amongst the lowest socioeconomic group. There is also often a clustering of other behavioural and physical characteristics such as smoking, overweight and obesity, multiparity and poor diet and these factors are considered probable contributors to poorer health amongst citizens from lower socioeconomic groups (Adler et al 1994, Lakksonen et al 2004, McLaren 2007, Sobal and Stunkard 1989). It is not surprising then that the results of this study demonstrated that the women from the lowest socioeconomic position, as defined by occupation, were more often from black or other minority ethnic groups, smokers, multiparous and of younger age.

Univariable analysis did not reveal a strong relationship between socioeconomic position and severe maternal morbidity, however in keeping with existing literature, there was a strong relationship with both ethnicity and advanced maternal age. The apparently protective effect of smoking was unexpected and it was initially thought that this finding might have resulted from the proportion of cases of eclampsia in the study population, since the protective effect of smoking against the development of pre-eclampsia and eclampsia is well-established (Yang et al 2006, Engel et al 2009). When the eclampsia cases were removed from the dataset however, the OR remained unchanged. As expected, co-existing medical condition and multiple pregnancy were significant univariable predictors of severe maternal morbidity.

The amount of missing data for specific variables in the dataset became apparent during univariable analysis, where a substantial proportion of observations were missing for socioeconomic position and BMI and the unadjusted odds of maternal morbidity for women with missing data was shown to be significantly different from other women. The distribution and pattern of missing data was further explored to determine which analytical approaches would be appropriate to use for the multivariable analysis.

Amongst the variables with the most missing data – socioeconomic position and BMI – each was missing for over 9.0% of total observations, with a slightly higher proportion of data missing for cases than for controls. This finding is potentially a side-effect of the notifying clinicians directing greater attention towards completing the clinical variables (diagnosis, management and outcome) amongst case women than controls, to the neglect of demographic variables. Alternatively, information on occupation, BMI etc may have been missing from the clinical notes and clinicians were therefore unable to provide the data. This finding relating to missing BMI data is in stark contrast with the results of the recently published UK Birthplace study, which looked at perinatal and maternal outcomes by planned place of birth and reported that only 0.4% of data were missing for 'BMI in pregnancy' (National Institute of Health Research 2011).

Although the nature of UKOSS data collection, involving health professionals completing the questionnaire retrospectively makes reporting bias in this context less likely, the exploration of missing data in the current study suggested that there were in fact systematic differences between the women with missing data and those with complete data. This theory was supported by the following findings:

a) The difference in demographic characteristics between women with missing vs complete socioeconomic data

Using a new variable to denote missing vs complete socioeconomic observations, the case and control women were compared separately. The results showed that there were statistically significant differences between the case and control women with missing vs complete socioeconomic observations. Case women with missing socioeconomic data were more likely to be multiparous, smokers, have higher BMI and a co-existing medical condition. Control women with missing socioeconomic data were more likely to be from black or minority ethnic backgrounds. Cases and controls with missing socioeconomic information were more likely to also have missing data in other variables.

b) Results of the proxy indicator model compared to complete data analysis

Although the differences were minimal overall, the OR of severe morbidity amongst women with missing socioeconomic data was higher than for women in any other socioeconomic group in both the proxy indicator or complete data analysis, suggesting that women with missing socioeconomic data were different.

c) Sensitivity analysis

Sensitivity analysis for BMI produced only marginal changes in adjusted OR, however, the sensitivity analysis for socioeconomic position produced notably different results. With missing socioeconomic observations recoded to unemployed, the OR (OR 1.38; 95%CI: 1.11 – 1.72) for unemployed women was similar to the results of complete case analysis (OR 1.31), supporting the assumption that the pattern of missing data was more systematic than random. When the missing socioeconomic data were recoded to managerial/professional, the OR was reduced to 1.02 (95%CI: 0.79 – 1.32).

Although the statistical method multiple imputation (MI) has become popular in recent years for dealing with datasets with missing data (Sterne et al 2009, White et al 2010), MI can only produce valid results under the assumption that missing data are 'missing at random' (White et al 2010). The findings from this study outlined above supported the assumption that the missing data were in fact not missing at random and thus multiple imputation would have been an inappropriate method of analysis to use in this situation.

The use of proxy indicators to account for missing data was chosen as the most appropriate method for multivariable analysis since this approach included all observations in the dataset and was thus able to maximise study power and avoid the potential for biased results if the women with missing observations were excluded from multivariable analysis. The results of the multivariable model suggest that there is a 22% higher risk of severe morbidity amongst unemployed women compared to women from the highest socioeconomic group, although this finding was not statistically significant. Of note, the results also showed that the women with missing socioeconomic data had a significantly higher risk of morbidity than any other socioeconomic group (OR 1.51; 95%CI 1.18 – 1.94).

UKOSS: strengths and limitations

UKOSS, the first system of its kind in obstetrics worldwide, has provided an invaluable wealth of information on uncommon but serious disorders of pregnancy and in doing so, has helped shape the clinical management of these conditions in many high-resource settings. One of the main strengths of UKOSS is the active, negative surveillance approach which has ensured robust case ascertainment. As a result, many of the UKOSS studies are the largest-scale studies on rare disorders of pregnancy worldwide.

By studying disorders of pregnancy and childbirth in separate studies, UKOSS provided the ideal setting in which to explore 'severe maternal morbidity' as an aggregate of multiple obstetric conditions. As discussed in Chapter 1, the differing definitions of severe maternal morbidity used by different researchers around the world and the inconsistent inclusion of obstetric and non-obstetric causes of maternal morbidity have made the comparison of rates and risk factor profiles challenging. By using a collection of studies of obstetric conditions, with clearly defined and measurable clinical outcomes, the challenges encountered by previous studies which have used combined clinical and intervention criteria and have included obstetric and non-obstetric conditions, were able to be avoided. The disadvantage of this approach was that indirect or non-obstetric causes of maternal morbidity were excluded from this study, including several major contributors to maternal mortality in the UK such as cardiac disease, thromboembolic disease and puerperal psychosis/suicide (Cantwell et al 2011), since UKOSS studies have not yet been performed for these conditions.

The design of UKOSS studies ensures that case sampling bias is minimised by recruiting cases from all obstetric-led units across the UK, including women from all different ethnic, age and socioeconomic groups. Selection of controls is also aimed at attaining a representative sample of the general population of women giving birth by recruiting women from across the same obstetric units as cases during the same admission period, throughout the UK. By maximising the representativeness of the controls, UKOSS data are able to be combined into case-control datasets. Cases are only matched to controls in a practical sense by time and hospital, not by individual characteristics. This is sometimes referred to as "cosmetic matching" and in this scenario, the matching can be ignored in subsequent analysis (Bland and Altman 1994). In large studies with many variables, it can be "easier to take an unmatched control group and adjust in the analysis for the variables which would have been matched using regression methods" (Bland and Altman 1994), as was performed in the analysis presented here. In this analysis, the control data were not matched in any way to the cases, since different studies and datasets were used as a source of cases and controls (Figure 2).

Through the recruitment of controls from tertiary centres where an over-representation of cases may occur, there is the possibility that the control women have higher pre-existing risk of severe maternal morbidity and thus differ from the vast majority of the child-bearing population in the UK. As identified in the Methods section of this chapter, national data on the characteristics of child-bearing women in the UK suggest however, that the women recruited as UKOSS controls are in fact, closely representative of the general, child-bearing population (Knight et al 2010b). Comparison between the control women recruited for the UKOSS amniotic fluid embolism study and UK national data showed for example, that the rate of multiple pregnancy was 1% amongst the UKOSS controls and 2% nationally, the rate of induction of labour was 22% amongst the controls and 20% nationally, and that the rate of delivery by caesarean section was 24% amongst the controls and 24% nationally (Knight et al 2010b).

Despite the strengths of UKOSS, there were a number of research limitations. First, although the retrospective collection of information from women's case notes ensured that recall or reporting bias was unlikely to be an issue, the absence of any follow-up contact with the women meant that the information collected was entirely dependent on what was recorded in each woman's hospital record. This method ensured that anonymous data could be obtained without patient consent however it limited the information which could be obtained. The collection of patient demographics was particularly restricted since this information is not always recorded in patients' notes. It was fortunate that information on the occupation of participants and their partner was able to be obtained in the majority of cases, however the proportion of data missing for this variable was evidently an issue for subsequent analysis. Additionally, there was no information collected on other socioeconomic indicators such as level of education, years of schooling or income, since this information is not routinely recorded in medical records. Residential location is routinely recorded in clinical notes, however this information is not able to be accessed for the purpose of UKOSS data collection due to patient confidentiality and was therefore not able to be used in subsequent analysis.

As a consequence of this method of data collection, socioeconomic classification was limited to that based on occupation. Using the ONS classification of socioeconomic position (NS-SEC) ensured that the study population was classified using a system that is recognised throughout the UK. As has been emphasised in past studies on social determinants of health however, aggregate measures of socioeconomic position such as the UK's Index of Multiple Deprivation (IMD) can provide a more comprehensive and accurate assessment of people's overall social standing and relative deprivation (Noble et al 2006). Furthermore, maternal education has been shown to be a significant predictor of health-seeking behaviours, level of healthcare received and ultimately, pregnancy outcome in different settings around the world (Lynch et al 2000). Thus, in order to conduct a thorough analysis of socioeconomic determinants of maternal health, it would have been ideal to have access to additional information on socioeconomic position such as level of education or residential location which can be linked to IMD.

The inclusion of a separate category for women who are unemployed or have never worked and full-time students in the UKOSS socioeconomic classification somewhat limits the generalisability of the results across other settings and this limitation has been recognised throughout the UKOSS studies. However the findings of the recent CEMD reports, consistently showing that unemployed women have significantly elevated risk of adverse outcomes of pregnancy and childbirth (Cantwell et al 2011) demand that these women receive individual consideration in the context of maternal health and should therefore be examined as a separate group.

Although there were many advantages to using a pre-existing dataset, there were also disadvantages relating to the analysis and use of different variables. There are likely to have been benefits for this study if additional variables had been able to be explored in the analysis, however variables that were not collected universally across all UKOSS studies or were not collected at all were not able to be included. Studies exploring risk factors for adverse maternal outcome have demonstrated that past caesarean-section for example, has been shown to increase the risk of various complications in subsequent pregnancies (Zwart et al 2008b, Souza et al 2010b, Waterstone et al 2001). It would have been interesting to examine the risk of severe maternal morbidity related to past caesarean section across socioeconomic groups however this information was not collected universally across all UKOSS studies and therefore could not be included in this analysis.

Conclusion

The final results suggest that socioeconomic position may be independently associated with severe maternal morbidity, and clearly needs further investigation. In addition to the expected findings of a higher risk of morbidity amongst women with known clinical risk factors such co-existing medical conditions, multiple pregnancy and past pregnancy conditions, this study also echoed the findings of past studies in the UK, France and the Netherlands which have demonstrated a significantly increased risk of severe morbidity amongst women from minority ethnic groups. Despite universal healthcare free at the point of access, in addition to tremendous government and human resources investment in researching social inequalities in health in the UK, socially-marginalised groups within society continue to fare poorly across a range of health outcomes including maternal health, as demonstrated in this analysis. With the suggestion that a difference in risk of morbidity exists, the underlying reasons for the elevated risk amongst women from lower socioeconomic groups need to be explored.

The following questions remain:

- Do women from lower socioeconomic groups receive a different quality and type of healthcare and treatment throughout the continuum of care from pregnancy through childbirth to the postnatal period?
- Is this due to differences in health-seeking behaviour or differences in the quality of treatment provided once healthcare is sought?

CHAPTER FOUR: Experiences of maternity care amongst women from different socioeconomic groups in the UK (Analysis of National Maternity Survey data)

4.1 INTRODUCTION

Explaining the social gradient in health

Social inequalities in health have been recognised by academics, researchers and policy makers since the 19th century. Despite extensive evidence of a social gradient in health outcomes such as cardiovascular disease (Marmot and Davey Smith 1997), the association between social disadvantage and severe maternal morbidity is not yet thoroughly understood. Many possible explanations for social inequalities in health have been proposed over time, yet the true causes underlying the known social gradient in specific health outcomes remain largely elusive.

Studies in developed countries throughout the world have demonstrated measurable differences between socioeconomic groups regarding behavioural factors such as smoking, diet and lack of exercise that may contribute to differences in health by social class (Adler et al 1993). Both a lack of exercise and obesity have been shown to be positively associated with poor health outcomes and are inversely related to socioeconomic position (Marmot and Davey Smith 1997, Adler et al 1994). A study in the US by Matthews et al amongst women aged 42 – 50 years found that rates of smoking were far greater amongst those with less than a high school education, compared to those with advanced degrees (Matthews et al 1989, Adler et al 1993). The same study also found that educational level was significantly associated with cholesterol levels, blood pressure, glucose tolerance and BMI with all risk factors more adverse, the less educated women were (Adler et al 1993, Matthews et al 1989). However, as demonstrated by the Whitehall studies in Britain, the elevated risk of mortality by lower social class remains significant even after controlling for behavioural factors, such as smoking (Adler et al 1993, Goldberg 2009, Marmot and Davey Smith 1997).

The 'general susceptibility hypothesis' proposed by Marmot et al as another possible explanation for the social gradient in health states "that there are factors operating, which cluster socially, cut across our current system of classifying diseases and increase risk of mortality, in addition to the effect of known risk factors" (Marmot and Davey Smith 1997). Social position may lead to differential exposures to a range of influences on health outcomes that accumulate over a person's lifetime and determine their eventual susceptibility to disease (Marmot and Davey Smith 1997). This theory is supported by research demonstrating that health in adulthood is partly determined by social class at birth (Lynch et al 1997).

Some evidence suggests that some inequalities in health outcomes may arise in part from differences in access to and use of health services, with individuals with fewer social and economic resources "making less use of preventive health services, including screening" (Adler et al 1993). In the US, research found that women with less than a high school education were less likely than those with more education to have been screened for cervical cancer or to have heard of a 'Pap Test' (for cervical cancer screening) (Adler et al 1993). In addition to the accessibility of health services, this finding also highlights the important role that education plays in health-seeking behaviour and in particular "knowledge of what providers offer, education about how best to utilise self- and practitioner-provided services and cultural norms of treatment" (Ensor and Cooper 2004).

In a qualitative study conducted in Britain in 1993 by Bowler, it was shown that midwives in the hospital studied made assumptions about women on the "basis of their physical appearance which led to differences in the care provided" (Bowler 1993). For example, the study reported that midwives 'typified' women on their racial appearance so that they felt "if an Asian woman makes a noise in labour this is not because she is pain but because Asian women in general have low pain thresholds and make a fuss about nothing" (Bowler 1993). Similar research has yet to be conducted exploring the treatment of women based on their socioeconomic position but it is possible that a similar phenomenon exists.

Furthermore, research suggests that in developed countries the poor often benefit less from public spending (Demery 2000, Ensor and Cooper 2004) with the "availability of good medical care tending to vary inversely with the need for it in the population served" (Hart 1971). At a systemic level in the US, states with the greatest inequality in income distribution have been shown to invest less in public education, have larger uninsured populations and spend less on safety nets (Daniels et al 2000, Goldberg 2009). Even the poor in the US, "who enjoy a substantially higher GDP than the poor in many developing countries", have worse health outcomes across a variety of measures (Goldberg 2009).

A study conducted by Marmot et al in 2003 showed that life expectancy in Costa Rica which has a GNP of $6000 per person was 74 years, compared to the US where the GNP is $26,000 and life expectancy for African-Americans was 66 years (Marmot and Davey Smith 2003, Goldberg 2009). Subsequent research demonstrated that African-American men living in Harlem had a shorter life span than men in Bangladesh, where material living standards are much lower (Brunner et al 2006, Goldberg 2009). The social gradient of health is therefore not one of absolute deprivation versus wealth, it is more an issue of relative deprivation and inequality (Goldberg 2009, Marmot and Davey Smith 2003).

International comparison suggests however that the gradient is not inevitable, and can be modified (Department of Health Statistics Division 2001). In Scandinavian countries, the socioeconomic gradient in health emerges but is weaker than in countries such as the US and UK (Vagero and Lundberg 1989, Vagero 1991, Lundberg 1991, Adler et al 1993). It has been proposed that this may reflect the "more homogenous populations in these countries", in addition to national social policies that have reduced discrepancies in social class, income and resources, and that provide universal access to healthcare (Adler et al 1993). It seems likely that the presence of smaller socioeconomic *disparities* explains why countries with significantly lower GDP per capita than the US and UK have higher life expectancy rates (Daniels et al 2000, Goldberg 2009, Kaufman and Cooper 2006).

The National Maternity Survey

The UK Department of Health 'Changing Childbirth' initiative, launched in 1993, recommended a wholesale review of maternity services, to achieve a "woman-centred service" (Department of Health NHS Executive 1993). Subsequently in 1995, the first National Maternity Survey (NMS), titled "First Class Delivery", was carried out in an attempt to better understand the experiences of mothers giving birth in the UK, and in particular to explore differences in experience of care amongst women from different socio-demographic groups (Garcia et al 1998). Later, in 2004, the Department of Health released the 'National Service Framework for Children, Young People and Maternity Services (NSF)' in order to govern and uphold improvements in maternity and children's health services throughout the UK. The NMS was then repeated in 2006 to "inform policy changes in maternity care, support the implementation of the NSF and provide a basis for comparison of maternity care experiences in individual trusts" (Redshaw et al 2007).

Since the first survey in 1995, the National Perinatal Epidemiology Unit (NPEU) has been responsible for the analysis, reporting and publication of NMS data. The most recent NMS was carried out in July 2010 and data obtained from the 2010 questionnaire form the basis of this chapter. As in the 1995 and 2006 NMS, participant women were randomly sampled by the Office for National Statistics (ONS) from birth registration records (Redshaw and Heikkila 2010). All women had given birth during a specified 2-week period (October-November 2009), three months prior to the mailing of the questionnaire. Women were not excluded from the survey due to their location of birth (homebirth, obstetric unit, midwifery units all included) however, women whose babies had died and new mothers less than 16 years of age were excluded from the survey cohort.

The questionnaire was mailed out by the ONS in January 2010 to 10,000 women living in England. Women were asked to complete and return the questionnaire, either by post or online, by late April 2010. A 14 week time period was allowed for return. A reminder letter was sent out two weeks after the initial mailing, a further questionnaire after 4 weeks and a further reminder letter 4 weeks later to non-respondents only. The questionnaires returned by post to NPEU were identifiable only by a unique reference number. The NPEU used a tailored return system, whereby checks were made at the NPEU between postal and online responses and anonymous details of respondents were sent to ONS to prevent inappropriate reminder notices being mailed. Further questionnaires received after April 2012 were not included in the dataset. The 2010 survey response was 55.1%, with a usable response of 54.1%. There were 4,526 women who did not respond to the questionnaire.

The questionnaire asked a wide range of questions about women's health-seeking behaviour, the care they received during pregnancy, labour/birth and the postnatal period, their experiences of communication and interaction with health professionals during that time and their general health and well-being throughout the antenatal and postnatal period. Importantly, the collection of comprehensive demographic information has allowed the experiences of specific groups of women to be analysed separately. In particular, these women include single parents, those from black and minority ethnic groups and those living in the most deprived areas (as a measure of socioeconomic position).

The IMD-based (Index of Multiple Deprivation) socioeconomic position of both respondents and non-respondents to the NMS were classified using the postcode information available to the ONS. By using weighted, ranked dimensions of deprivation (including income; employment; health and disability; education, skills and training; barriers to housing and services; crime; and living environment) the IMD provides a composite measure of socioeconomic position at the area-level (Noble et al 2006). For the purposes of research and to protect survey-respondents anonymity, individual IMD scores were not released but individual women were assigned to IMD quintiles. This classification of survey respondents by IMD allowed the NMS to be used to explore the health-seeking behaviour and experiences of maternity care amongst women from different socioeconomic groups.

Methods of the National Maternity Survey

The Survey

The twenty-eight page National Maternity Survey consisted of 11 sections, with questions exploring different aspects of maternity care and giving women the opportunity to express their views and describe the care they received. Demographic information was also requested from each respondent. Table 25 outlines the content of the survey and provides examples of topics from each section. Both quantitative and qualitative data were collected through specific multi-choice questions and open-ended free-text response questions. The complete questionnaire is included in Appendix 2.

Table 25. Content and sample topics from the 2010 National Maternity Survey

Theme	Sample Topics
Dates and your baby	Multiple pregnancy Gestation at birth Birth weight
Antenatal Care	Gestation at first consultation and booking appointment
	Frequency and location of antenatal check-ups Health professional seen for antenatal care
	Down's syndrome screening Dating and anomaly ultrasound scans
	Number of antenatal admissions
	Contact details for a midwife in case of any concerns Antenatal classes offered and attended
Your labour and the birth of your baby	Options given for location of birth Location where baby was born
	Duration of labour Transfer during labour
	Past caesarean sections Mode of delivery – most recent
	Episiotomy and perineal injury
	Communication of staff during labour and delivery
Babies born at home	Homebirth – planned or unplanned Information received about pain relief, monitoring and availability of emergency back-up
Care of you and your baby in a Maternity Unit after the birth	Length of stay in maternity unit Care received in maternity unit
Care at home after the birth	Contact details for a midwife in case of concern Frequency of home-visit by a midwife Check-up 6-8weeks postpartum
Overall experience of maternity care	Overall satisfaction with care during labour and delivery
Father and partner involvement	Involvement in antenatal care and labour/delivery
Previous pregnancies and childbirth	Past pregnancies Past pregnancy complications (free-text) Problems with fertility
You and your household	Age Ethnic group Country of birth Employment status

Data handling

Responses from each questionnaire returned within the specified time period were individually entered into a database by a private company commissioned for the data entry. The data were then sent to the NPEU for analysis.

4.2 AIMS AND OBJECTIVES

Using quantitative and qualitative data from the 2010 National Maternity Survey, the work presented in this chapter aims to improve understanding of why socially disadvantaged women in the UK may have a greater risk of adverse maternal outcomes. The following research questions will be explored:

- Is there a difference in reported health-seeking behaviour between women from different socioeconomic groups in the UK?
- Do women's report of their care indicate that women from different socioeconomic groups receive a different quality of care and treatment during pregnancy, labour and the postnatal period?
- Do women's perceptions of their care indicate that women from different socioeconomic groups are treated differently, in terms of care and communication from health professionals, during pregnancy, labour and the postnatal period?

4.3 QUANTITATIVE ANALYSIS – METHODS

A secondary analysis of observational cross-sectional data from the 2010 National Maternity Survey was performed. All variables that related to women's demographic characteristics, their health-seeking behaviour and the quality and type of treatment they received throughout pregnancy, labour and the postpartum period were included in the dataset used for the analysis.

Data checking and cleaning

Preliminary data cleaning was performed by the study-specific researcher at the time the NMS data were initially collected in 2010. Subsequently during the analysis presented here, extreme outlier observations were identified and where possible, the unique identifier numbers of the corresponding respondent were used to check the original paper files. If the outlying observation had resulted from an error of data-entry, the correct response was re-entered into the database. There were four extreme outliers for age (age<12 years) and the original files were consulted for these women. The answer recorded in the file was clearly incorrect for three women (recorded as age=1, age=3, age=4) and these observations had to be recoded as 'missing'. The fourth outlying age, 12 years, was recoded to the correct 17 years after the original file had been checked. All other variables were correctly coded and so no other observations in the dataset were recoded as 'missing' during this analysis.

Variables

The majority of questions were multiple-choice, with answers listed as either binary or multi-option tick-box categories (Appendix 2). Demographic variables were grouped into the categories outlined in Table 26. Ethnicity was classified into four categories, as per the 2001 UK Census categories.

The mother's employment status was provided by each respondent and was limited to the categories listed in Table 26. Unlike in the UKOSS studies, the occupation of women's partner's/husbands was not collected and overall household employment status could not therefore be assumed from the employment information provided. Additionally, the overlap between occupational categories in the NMS dataset (women 'on maternity leave' could also be encompassed by the category 'in paid employment') further limited the use of the employment variable as a measure of socioeconomic position. IMD quintile was therefore felt to be the most representative measure of women's socioeconomic position.

In addition to providing IMD quintile, the ONS also provided information on the marital status of each respondent based on birth registration statistics (Table 26).

Table 26. Demographic variables and the corresponding categories used for analysis

Variable and source of information	Categories used for analysis
Ethnicity (questionnaire)	White Asian Black Other
Country of birth (questionnaire)	UK Non-UK
Socioeconomic position (provided by the ONS)	IMD quintile 1 (highest socioeconomic group) IMD quintile 2 IMD quintile 3 IMD quintile 4 IMD quintile 5 (lowest socioeconomic group)
Employment status (questionnaire)	In paid employment On maternity leave Housewife Education/training Unemployed
Age (questionnaire)	Age < 20 years Age 20-24 Age 25-29 Age 30-34 years Age ≥ 35 years
	Age in years
Marital status (birth registration data from the ONS)	Married Sole registrant Joint registration (same address) Joint registration (different address)
Age at leaving full-time education (questionnaire)	Did not leave full-time education before age 16 Left full-time education at or before age 16

Unadjusted analysis

Using chi-square analysis to test for the association between socioeconomic group and a range of different characteristics, univariable analysis was performed within four 'themes' in order to examine the differences between women from different IMD quintiles. Statistically significant associations were defined by $p<0.05$ in all analyses and p-values were reported for differences in proportion between IMD quintile 5 (most deprived) and 1 (least deprived).

First, the demographic and pregnancy characteristics of women in each IMD quintile were explored. The variables analysed were employment status, ethnicity, country of birth (UK vs non-UK), English language competency, age when full-time education ceased, marital status, age, parity and planning of pregnancy.

Second, questions pertaining to women's reported health-seeking behaviour were analysed across IMD quintiles. These questions included gestation of pregnancy at first consultation with a health professional, gestation at booking appointment, attendance at antenatal check-ups and antenatal classes, use of antenatal and postnatal websites and postnatal contact with health professionals (midwife and/or GP).

Questions relating to the type, appropriateness, timing and breadth of healthcare women received were then used to look at the quality of care provided to women from different IMD quintiles during their pregnancy, labour, delivery and the postnatal period. The questions analysed in this section included: ability to see a health professional as early as desired, location and number of antenatal check-ups, frequency and type of ultrasounds, antenatal hospital admissions, transfer during labour (and if so, where from and to), mode of delivery, duration of inpatient postpartum stay, routine postnatal check-up at 6-8 weeks and frequency of postnatal home-visits by a midwife.

Finally, questions relating to women's personal experiences and interactions with healthcare professionals were analysed to ascertain perceptions amongst women from different socioeconomic groups of the quality of communication and care they received during their pregnancy, labour, delivery and the postnatal period. These questions explored women's own assessment about the quality of communication they received and the interactions they experienced with the health professionals caring for them, including whether they felt treated with respect and kindness, whether they felt confident and trusting in the health professionals caring for them and the appropriateness of the length of their postnatal stay.

The questionnaire contained free-text sections for women to explain any co-existing medical conditions, past and recent pregnancy complications or reasons for any antenatal hospital admission. However, the nature of self-reporting and thus inconsistent case ascertainment meant that this information could not reliably be used to classify women by those variables/risk factors.

Adjusted analysis

Unadjusted univariable analysis showed that the age, ethnicity and parity of women in each IMD quintile varied significantly. Multivariable analysis adjusting for these variables was therefore undertaken to account for any potential confounding. Regression based standardisation was used as a "practical alternative to the direct method of standardisation" (Roalfe et al 2008).

Maternal age, as a continuous variable, was tested for departure from linearity using higher order terms. The results of likelihood ratio testing confirmed that there was no evidence of departure from linearity. The final regression model therefore included IMD quintile, ethnic group, parity and maternal age as a continuous variable. All outcomes analysed were binary.

The regression analysis was then repeated using IMD as a continuous variable to test for evidence of a linear trend across the quintiles.

The adjusted analysis explored only data relating to the specific research questions outlined in the aims – (a) do women from different socioeconomic groups (IMD quintiles) have different health-seeking behaviours, (b) do they receive different quality of treatment, or (c) are they treated differently by health professionals during pregnancy, labour and the postnatal period? Reponses to the following questions were analysed:

- Did you receive antenatal care during your pregnancy?
- How many weeks pregnant were you when you were first seen by a health-professional (before 12 weeks gestation vs 12 weeks and over)?
- Were you able to see a health professional as early as you desired in your pregnancy?
- Were you (a) spoken to in a way you could understand and (b) treated with respect by midwives and doctors, during your antenatal care?
- Were you admitted to hospital during your pregnancy?
- Were you transferred from one facility to another during your labour?
- Was your baby born by caesarean (planned or unplanned) or another mode of delivery?
- Were you (a) spoken to in a way you could understand and (b) treated with respect by doctors and midwives during labour and birth?
- Did you have a check-up with a doctor at 6-8 weeks postpartum?
- Did you feel you were given enough information to help you decide about your pregnancy care?

Analysis of women's worries about labour and birth

A separate section of the NMS survey explored women's 'worries about labour and birth' using the Oxford Worries about Labour Scale (OWLS). The OWLS was developed for use in large-scale studies such as the NMS (Redshaw et al 2009). The results of the 2006 NMS were used to validate the OWLS for use in subsequent studies, including in the 2010 NMS questionnaire.

Using the OWLS, women were asked 'Before you went into labour or had your baby did you have any particular worries about the labour and birth?'. Women then had to respond to a list of 10 items of common worries about labour and giving birth (Garcia et al 1998), for example 'not knowing when I would go into labour', and give a score from 1 to 4, ranging from 'very worried' to 'not worried at all'. Higher scores indicated less worry (Redshaw et al 2009).

The responses to these common worries from the 2006 NMS questionnaire were analysed in the paper "Ethnic differences in women's worries about labour and birth" (Redshaw and Heikkila 2011). Similar methods were employed in the analysis presented here to allow for comparison of findings.

For the analysis, the OWL scale for each worry item was condensed into a binary variable to allow analysis by logistic regression. Women who responded as 'very worried' or 'quite worried' were categorised as 'worried' and those that were 'not very worried' or 'not at all worried' were categorised as 'not worried' (Table 27).

Table 27. An example of the OWLS scale and it's translation into a binary variable

<table>
<tr><th>Worry item</th><th>4-point scale responses</th><th>Binary variable</th></tr>
<tr><td rowspan="4">Not knowing when labour would start</td><td>Very worried</td><td rowspan="2">Worried</td></tr>
<tr><td>Quite worried</td></tr>
<tr><td>Not very worried</td><td rowspan="2">Not worried</td></tr>
<tr><td>Not at all worried</td></tr>
</table>

Unadjusted chi-square tests were performed to compare OWLS outcomes between IMD quintiles 1 and 5. Based on existing knowledge of what factors are likely to confound the relationship between socioeconomic position (as per IMD quintile) and women's worries in labour and birth, potential confounders were then selected for inclusion in the adjusted analysis. The *a priori* variables were ethnicity, maternal age and parity.

There is published evidence to suggest that false positive screening test results in pregnancy lead to ongoing and elevated anxiety and concern amongst pregnant women (Susanne et al 2006, Weinans et al 2000). Screening test results were not explored in the questionnaire however, and were therefore unable to be included in analysis. Antenatal hospital admission was initially included in the model as a possible confounding factor, assuming that it could have a similar effect to false positive screening on women's worries about labour and birth. However there was no difference in the fit of the data whether hospital admission was included or excluded and in the absence of any evidence of confounding, it was removed from the model.

Logistic regression analysis, adjusting for ethnicity, age and parity was performed for each worry item.

Analysis of the perceptions of care adjective checklist

The perceptions of care adjective checklist was developed in 2009 as a reliable and effective method of assessing women's experiences of care during labour and childbirth (Redshaw and Martin 2009). The checklist was subsequently included in the 2010 NMS.

The checklist comprises 16 adjectives, 8 positive and 8 negative, and women were asked to circle all adjectives that they felt applied to their experience of care or described the staff caring for them during labour and birth (Figure 3). The positive adjectives used were humorous, kind, considerate, supportive, warm, polite, sensitive and informative. The negative adjectives used were rushed, insensitive, unhelpful, offhand, rude, inconsiderate, bossy and condescending.

We would like to know how you feel you were looked after during your labour and birth.

Please circle any of the words below which describe the staff you saw during labour.

Circle as many as you wish.

rushed	humorous	insensitive	kind
considerate	unhelpful	supportive	offhand
rude	warm	inconsiderate	polite
sensitive	bossy	informative	condescending

Figure 3. Perceptions of care adjective checklist

For the analysis presented here, every woman was given a score for each separate adjective of 1 if they had circled that adjective and 0 if they hadn't. These binary data were then analysed by calculating the number and proportion of women in each IMD quintile that circled each particular adjective. Non-parametric tests for trend were then used to assess the trend in positive and negative adjectives across IMD quintiles.

4.4 QUANTITATIVE ANALYSIS RESULTS

DESCRIPTIVE ANALYSIS

Respondents

The total respondent survey population comprised 5,332 women ranging in age from 16 to 51 years. The mean age was 30.6 years (SD 5.71 years). All percentages in this section are calculated for the total study population.

The predominant ethnic group was White comprising 4,487 women (84.2%), followed by 386 women (7.2%) of Asian ethnicity, 202 (3.8%) women of Black ethnicity and 162 (3.0%) women of other ethnic origin (Table 28). Of the total survey population, 4,002 (75.1%) women were themselves born within the UK and 1,081 (20.3%) were born in countries outside the UK, with 4.7% of data missing for this question. Women were also asked about whether they needed help speaking English. The vast majority of women (4,932: 92.5%) responded that they did not need help with English, with only 157 (2.9%) responding that they did.

The socioeconomic distribution of respondents across IMD quintiles was reasonably even with 1,055 (19.8%) women classified in the highest quintile, 1,041 (19.5%) in the 2nd quintile, 1,131 (21.2%) in the 3rd quintile, 1,013 (19.0%) in the 4th quintile and 1,091 (20.5%) in the lowest quintile. Women were asked about the age at which they left formal education and the majority of women (4,015: 75.3%) reported that they did not leave education before or at the age of 16 years, with 1,223 (22.9%) reporting that they did.

Marital status and birth registration information was combined by the ONS to define groups as married, sole registrant, joint registration (same address) or joint registration (different address). Amongst the respondents, there were 3,276 (61.5%) married women, 193 (3.6%) sole registrants (assumed to be single parents), 1,550 (29.1%) women co-habiting with their partner and 311 (5.8%) women with partners living at a different address.

Amongst respondents, there was an even division of parity with 2,610 (49.0%) primiparous women and 2,603 (48.0%) multiparous women; and 3,816 (71.6%) women reported that their pregnancy was planned and 1,311 (24.6%) reported that it was unplanned.

Table 28. Characteristics of respondents to the NMS

Variable	n= (%) N=5,332
Ethnicity	
White	4,487 (84.2)
Asian	386 (7.2)
Black	202 (3.8)
Other	162 (3.0)
Missing	95 (1.8)
Country of birth	
Born in UK	4,002 (75.1)
Born outside UK	1,081 (20.3)
Missing	294 (4.7)
English language skills	
Good English	4,932 (92.5)
Need help with English	157 (2.9)
Missing	243 (4.6)
IMD quintile	
1	1,055 (19.8)
2	1,041 (19.5)
3	1,131 (21.2)
4	1,013 (19.0)
5	1,091 (20.5)
Missing	1 (0.02)
Education	
Did not leave school <16 yrs	4,015 (75.3)
Left school at ≤16 yrs	1,223 (22.9)
Missing	94 (1.8)

Table 28 *continued*

Variable	n= (%) N=5,332
Marital status	
Married	3,276 (61.5)
Sole registrant	193 (3.6)
Joint registration (same address)	1,550 (29.1)
Joint registration (different address)	311 (5.8)
Missing	2 (0.04)
Parity	
Primiparous	2,610 (49.0)
Multiparous	2,603 (48.0)
Missing	119 (2.2)
Pregnancy planning	
Planned	3,816 (71.6)
Unplanned	1,311 (24.6)
Missing	205 (3.8)

Non-respondents

The ONS also provided the individual IMD quintile for each non-respondent to the questionnaire, in addition to summary statistics of the number of non-respondents in each age, marital status and country of birth category (Table 29).

Table 29. Demographic characteristics of non-respondents

Characteristic	Category	Non-respondents n (overall % not responding) N=4,526
IMD quintile	1	471 (30.9)
	2	563 (35.1)
	3	774 (40.6)
	4	1,095 (52.0)
	5	1623 (59.8)
Age	< 20 years	365 (70.9)
	20 – 24 years	1,148 (62.2)
	25 – 29 years	1,320 (50.2)
	30 – 34 years	1,008 (36.6)
	≥ 35 years	685 (33.5)

Table 29 *continued*

Characteristic	Category	Non-respondents n (overall % not responding) N=4,526
Marital status	Married Sole registrant Joint registration (same address) Joint registration (different address)	2,141 (39.5) 373 (65.9) 1,409 (47.6) 603 (66.0)
Country of birth	UK Non-UK	3,184 (44.3) 1,342 (55.4)

Overall, 30.9% of women from the 1st IMD quintile did not respond, 35.1% from the 2nd quintile, 40.6% from the 3rd quintile, 52.0% from the 4th quintile and 59.8 % of women from the 5th IMD quintile did not respond to the questionnaire.

UNADJUSTED ANALYSIS

Demographic characteristics of respondents

Compared to those from the highest quintile, women from the lowest IMD quintile were significantly more likely to be younger, of non-white ethnicity, born outside the UK, need help speaking English, have no formal education beyond age 16, single parents or co-habiting with their partner, and to report that the pregnancy was unplanned (Table 30).

Table 30. Demographic characteristics of respondents in each IMD quintile

Variable	1ST IMD quintile n (%)	2ND IMD quintile n (%)	3RD IMD quintile n (%)	4TH IMD quintile n (%)	5TH IMD quintile n (%)	χ^2 p-value*
Ethnicity						
White/British Asian Black Other	968 (93.3) 40 (3.9) 14 (1.4) 16 (1.5)	958 (93.1) 36 (3.5) 12 (1.2) 23 (2.2)	992 (88.8) 67 (6.0) 21 (1.9) 37 (3.3)	811 (81.8) 96 (9.7) 50 (5.0) 35 (3.5)	758 (71.5) 146 (13.8) 105 (9.9) 51 (4.8)	P<0.001
Country of birth						
UK Non-UK	869 (86.0) 141 (14.0)	869 (86.1) 140 (13.9)	869 (79.9) 218 (20.1)	714 (75.0) 238 (25.0)	680 (66.4) 344 (33.6)	P<0.001

Table 30 *continued*

Variable	1ST IMD quintile n (%)	2ND IMD quintile n (%)	3RD IMD quintile n (%)	4TH IMD quintile n (%)	5TH IMD quintile n (%)	χ^2 p-value*
English language skills						
Good English	1,009 (99.0)	983 (98.5)	1,068 (98.1)	918 (96.2)	953 (92.7)	
Need help with English	10 (1.0)	15 (1.5)	21 (1.9)	36 (3.8)	75 (7.3)	P<0.001
Level of education						
Did not leave school at <16	863 (82.8)	830 (80.7)	873 (78.2)	720 (72.7)	728 (68.7)	P<0.001
Left school at age ≤16 years	179 (17.2)	199 (19.3)	244 (21.8)	270 (27.3)	331 (31.3)	
Marital status						
Married	796 (75.5)	711 (68.3)	702 (62.1)	544 (53.7)	523 (47.9)	
Single parent	10 (1.0)	23 (2.2)	38 (3.4)	50 (4.9)	72 (6.6)	P<0.001
Joint reg. (same address)	224 (21.3)	271 (26.0)	343 (30.3)	347 (34.3)	365 (33.5)	
Joint reg. (different address)	24 (2.3)	36 (3.5)	48 (4.2)	72 (7.1)	131 (12.0)	
Age						
≤ 20 years	16 (1.5)	13 (1.3)	27 (2.4)	40 (4.0)	54 (5.1)	
20-24 years	69 (6.6)	83 (8.0)	138 (12.3)	165 (16.5)	242 (22.6)	
25-29 years	194 (18.6)	229 (22.2)	283 (25.3)	282 (28.2)	324 (30.3)	P<0.001
30-34 years	406 (38.9)	392 (38.0)	391 (35.0)	301 (30.1)	257 (24.0)	
≥ 35 years	360 (34.5)	315 (30.5)	279 (25.0)	211 (21.1)	193(18.0)	
Parity						
Primiparous	479 (46.2)	497 (48.7)	581 (52.6)	528 (53.3)	525 (49.5)	P=0.13
Multiparous	558 (53.8)	523 (51.3)	523 (47.4)	462 (46.7)	536 (50.5)	
Pregnancy planning						
Unplanned	164 (16.2)	219 (21.6)	254 (23.2)	292 (30.3)	382 (36.8)	P<0.001
Planned	850 (83.8)	794 (78.4)	843 (76.9)	673 (69.7)	655 (63.2)	

*χ^2 p-value reported for difference in proportions between IMD quintile 1 and IMD quintile 5

Reaction to pregnancy

Across the different IMD quintiles, the respondents' reaction to their pregnancy is shown in Figure 4. There was a significant relationship between IMD quintile and reaction to pregnancy (p<0.001), with fewer women from the 5th quintile reportedly feeling 'overjoyed' about the pregnancy and more feeling 'unhappy or indifferent' or having 'mixed feelings'.

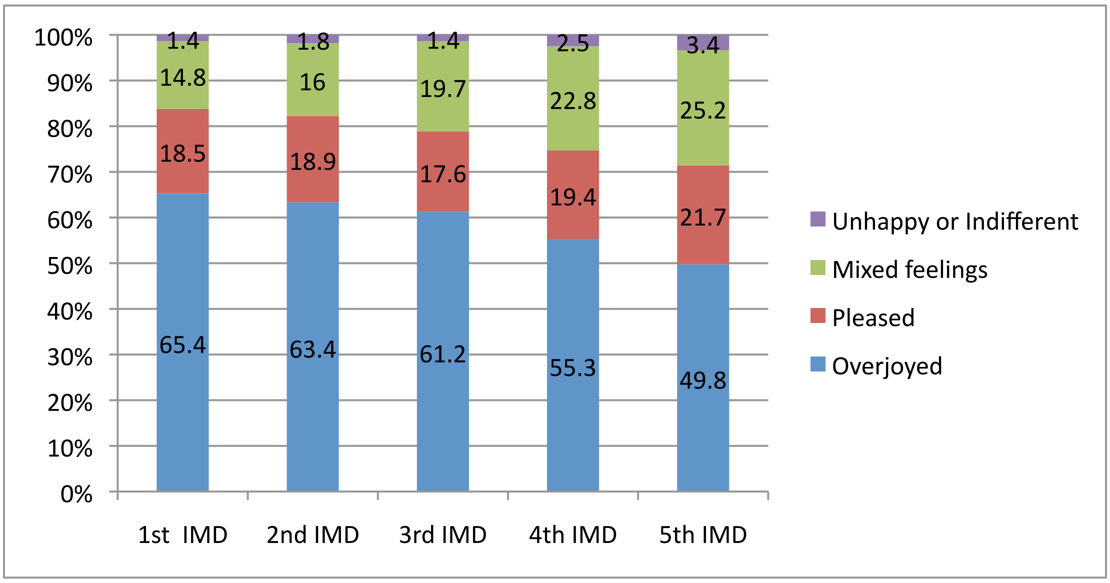

Figure 4. Women's reaction to their pregnancy

Involvement of husbands/partners

Of the women with husbands or partners, those from the 5th IMD quintile consistently and significantly reported less involvement of their husband/partner throughout pregnancy and labour, with fewer partners present for antenatal check-ups, antenatal classes and during labour and birth (Table 31).

Table 31. Husband/partner involvement in pregnancy care during antenatal check-ups, antenatal classes and labour and birth

Partner present	1ST IMD quintile	2ND IMD quintile	3RD IMD quintile	4TH IMD quintile	5TH IMD quintile	χ^2 p-value*
Antenatal check-ups						
No	344 (41.8)	314 (41.1)	283 (36.2)	288 (43.7)	327 (45.7)	P<0.001
Yes	480 (58.3)	451 (59.0)	499 (63.8)	371 (56.3)	388 (54.3)	
Antenatal classes						
No	526 (63.8)	490 (64.1)	487 (62.3)	463 (70.3)	556 (77.8)	P<0.001
Yes	298 (36.2)	275 (36.0)	295 (37.7)	196 (29.7)	159 (22.2)	
Labour and birth						
No	53 (6.4)	60 (7.8)	93 (11.9)	112 (17.0)	159 (22.2)	P<0.001
Yes	771 (93.6)	705 (92.2)	689 (88.11)	547 (83.0)	556 (77.8)	

*χ^2 p-value reported for difference in proportions between IMD quintile 1 and IMD quintile 5

HEALTH-SEEKING BEHAVIOUR

When asked whether they had had any antenatal care/check-ups, and although only a small proportion, more women from the 5th IMD quintile reported that they had not had antenatal care or that they were 'unsure' (3.6%), compared to women from higher quintiles ($p<0.001$) (Table 32). Additionally, women from the 5th IMD quintile were significantly less likely to have consulted a health professional prior to or at 12 weeks gestation, compared to women from higher quintiles (8.4% of women in quintile 5 vs 2.9% of women in quintile 1).

Women from the 5th IMD quintile also reported less use of pregnancy information websites during the antenatal period, compared to women from the higher IMD quintiles. There were no significant differences between IMD quintiles regarding those offered and those not offered antenatal classes, with between 65% and 71% of women across all quintiles reporting that they were offered classes. Despite this, the attendance at classes differed significantly, with women from the 5th IMD quintile least likely to have attended (Table 32). When attendance at antenatal classes was analysed separately amongst multiparous and primiparous women, the difference across IMD quintiles remained significant only amongst primiparous women ($p=0.32$ amongst multiparous women; data not shown).

Compared to women from the highest quintile, women from the 5th IMD quintile were significantly less likely to have been in contact with a midwife postnatally, or alternatively to have been in contact on more than 5 occasions (Table 32). Women from the 5th IMD quintile were least likely to report having used information/parenting websites postnatally compared to women from the highest IMD quintile.

Table 32. Health-seeking behaviours across IMD quintiles

Question	1ST IMD quintile	2ND IMD quintile	3RD IMD quintile	4TH IMD quintile	5TH IMD quintile	χ^2 p-value*
Attended antenatal care/check-ups						
No/unsure	9 (0.9)	9 (0.9)	12 (1.1)	21 (2.1)	39 (3.6)	p<0.001
Yes	1,044 (99.2)	1,028 (99.1)	1,113 (98.9)	987 (97.9)	1,041 (96.4)	
Health professional seen before 12 weeks						
No	30 (2.9)	38 (3.7)	44 (4.0)	49 (4.9)	89 (8.4)	p<0.001
Yes	1,010 (97.1)	989 (96.3)	1,068 (96.0)	948 (95.1)	977 (91.7)	
Antenatal website use						
No	542 (51.4)	582 (55.9)	642 (56.8)	613 (60.5)	704 (64.5)	p<0.001
Yes	513 (48.6)	459 (44.1)	489 (43.2)	400 (39.5)	387 (35.5)	
Attendance at antenatal classes						
No	514 (58.5)	504 (56.8)	565 (56.6)	514 (58.8)	656 (68.1)	p<0.001
Yes	365 (41.5)	384 (43.2)	433 (43.4)	360 (41.2)	307 (31.9)	
Attendance at antenatal classes amongst primiparous women						
No	144 (31.9)	153 (32.5)	198 (35.4)	187 (37.3)	246 (49.6)	p<0.001
Yes	307 (68.1)	318 (67.5)	361 (64.6)	315 (62.8)	250 (50.4)	
Postnatal contact with midwife						
Nil	677 (65.4)	676 (66.2)	716 (64.3)	687 (69.2)	752 (71.2)	
1-4 times	347 (33.5)	326 (31.9)	380 (34.1)	287 (28.9)	281 (26.6)	p<0.001
>5 times	12 (1.2)	19 (1.9)	18 (1.6)	19 (1.9)	23 (2.2)	
Postnatal website use						
No	576 (54.6)	586 (56.6)	651 (57.6)	629 (62.1)	728 (66.7)	p<0.001
Yes	479 (45.4)	455 (43.7)	480 (42.4)	384 (37.9)	363 (33.3)	

*χ^2 p-value reported for difference in proportions between IMD quintile 1 and IMD quintile 5

QUALITY AND TYPE OF TREATMENT RECEIVED

Antenatal care

Women from the 5th IMD quintile were more likely to report that they were not able to see a health professional about their pregnancy as early as they wished however, there was no reported difference in which health professional was first consulted by women from different quintiles (p=0.74) (Table 33).

Table 33. Antenatal care amongst women from different IMD quintiles

Question	1ST IMD quintile	2ND IMD quintile	3RD IMD quintile	4TH IMD quintile	5TH IMD quintile	χ^2 p-value*
Able to see health professional as early as wished						
No	86 (8.2)	81 (7.8)	96 (8.7)	111 (11.1)	168 (15.7)	p<0.001
Yes	958 (91.8)	954 (92.2)	1,014 (91.4)	890 (88.9)	903 (84.3)	
Health professional first consulted about the pregnancy						
GP	804 (76.6)	795 (76.5)	868 (77.2)	783 (77.5)	822 (75.5)	
Midwife	215 (20.5)	210 (20.2)	224 (19.9)	187 (18.5)	232 (21.3)	P=0.74
Other	31 (3.0)	34 (3.3)	33 (2.9)	41 (4.1)	35 (3.2)	

*χ^2 p-value reported for difference in proportions between IMD quintile 1 and IMD quintile 5

During the course of their pregnancy, women from the lowest IMD quintile were most likely to have had three or more antenatal check-up appointments at a Children's Centre or a Hospital Clinic but significantly less likely to have had three or more GP clinic appointments, compared to women from the first quintile (Table 34).

Table 34. Location of 3 or more antenatal check-ups

Location of >3 check-ups	1ST IMD quintile	2ND IMD quintile	3RD IMD quintile	4TH IMD quintile	5TH IMD quintile	χ^2 p-value*
Local clinic						
<3 check-ups	851 (83.4)	828 (83.13)	910 (83.1)	799 (83.1)	844 (82.8)	P=0.68
≥3 check-ups	169 (16.6)	168 (16.9)	185 (16.9)	162 (16.9)	176 (17.3)	
Children's centre						
<3 check-ups	993 (97.4)	920 (92.4)	1,017 (92.9)	869 (90.4)	905 (88.7)	P<0.001
≥3 check-ups	27 (2.7)	76 (7.6)	78 (7.1)	92 (9.6)	115 (11.3)	
GP clinic						
<3 check-ups	293 (28.7)	362 (36.4)	389 (35.5)	356 (37.0)	435 (42.7)	P<0.001
≥3 check-ups	727 (71.3)	634 (63.7)	706 (64.5)	605 (63.0)	585 (57.4)	
Hospital clinic						
<3 check-ups	631 (61.9)	621 (62.4)	653 (59.6)	580 (60.4)	553 (54.2)	P<0.001
≥3 check-ups	389 (38.1)	375 (37.7)	442 (40.4)	381 (39.7)	467 (45.8)	
Home						
<3 check-ups	957 (93.8)	919 (92.3)	1,020 (93.2)	898 (93.44)	930 (91.2)	P=0.02
≥3 check-ups	63 (6.2)	77 (7.7)	75 (6.9)	63 (6.6)	90 (8.82)	

*χ^2 p-value reported for difference in proportions between IMD quintile 1 and IMD quintile 5

Women from IMD quintiles 3, 4 and 5 were more likely to report not having contact details for a midwife during the antenatal period compared to women from higher IMD quintiles (p<0.001), with 8.6% of women in IMD 5 reporting not having had contact details for a midwife.

Women from the 5th IMD quintile were less likely to report having had a dating scan ($p<0.001$) or a 20-week anomaly scan ($p<0.001$) although the overall difference between quintiles regarding any ultrasound was not significant (Table 35).

Table 35. Frequency and type of ultrasound scans during pregnancy

Question	1ST IMD quintile	2ND IMD quintile	3RD IMD quintile	4TH IMD quintile	5TH IMD quintile	χ^2 p-value*
Any ultrasounds						
No Yes	2 (0.2) 1,052 (99.8)	1 (0.1) 1,037 (99.9)	1 (0.1) 1,129 (99.9)	6 (0.6) 1,004 (99.4)	7 (0.6) 1,079 (99.4)	P=0.10
Dating scan						
No Yes	93 (8.9) 949 (91.1)	84 (8.2) 943 (91.8)	100 (8.9) 1,020 (91.1)	102 (10.3) 884 (89.7)	154 (14.4) 915 (85.6)	P<0.001
Anomaly scan						
No Yes	8 (0.8) 1,040 (99.2)	6 (0.6) 1,030 (99.4)	9 (0.8) 1,109 (99.2)	14 (1.4) 989 (98.6)	44 (4.1) 1,034 (95.9)	P<0.001

*χ^2 p-value reported for difference in proportions between IMD quintile 1 and IMD quintile 5

Women from the 5th IMD quintile reported more frequently that they were admitted to hospital overnight during the antenatal period ($p<0.001$) (Table 36). In the absence of any further information regarding the reason for admission, the management received or the outcome of admission it is not possible to indentify whether these admissions were due to minor or major maternal morbidity.

Table 36. Overnight admission to hospital during the antenatal period

Hospital admission	1ST IMD quintile	2ND IMD quintile	3RD IMD quintile	4TH IMD quintile	5TH IMD quintile	χ^2 p-value*
No Yes	877 (83.4) 175 (16.6)	860 (82.9) 177 (17.1)	942 (83.6) 185 (16.4)	810 (80.9) 199 (19.7)	837 (77.4) 245 (22.6)	P<0.001

*χ^2 p-value reported for difference in proportions between IMD quintile 1 and IMD quintile 5

Labour and delivery care

Women from the 5th IMD quintile were more likely to have been transferred during labour (p=0.01) and compared to women from the highest quintile, were most likely to have been transferred from a midwifery-led unit within a hospital (Alongside Midwifery Unit (AMU)) to the obstetric consultant-led unit within the same hospital (p<0.001) (Table 37). Although based on small numbers, women from the highest IMD quintile were more likely to have been transferred from a freestanding midwifery-led unit (FMU) outside the hospital to a consultant-led unit at hospital, or from home to hospital.

Table 37. Transfer during labour

Question	1ST IMD quintile	2ND IMD quintile	3RD IMD quintile	4TH IMD quintile	5TH IMD quintile	χ^2 p-value*
Transferred during labour						
No Yes	849 (93.0) 64 (7.0)	834 (93.1) 62 (6.9)	878 (91.3) 84 (8.7)	821 (90.2) 89 (9.8)	861 (89.6) 100 (10.4)	P=0.01
Transfer sites						
AMU to Obstetric Unit	22 (37.3)	29 (49.2)	33 (42.9)	48 (57.8)	57 (62.6)	P<0.001
FMU to Hospital	12 (20.3)	8 (13.6)	8 (10.4)	5 (6.0)	2 (2.2)	
Home to Hospital	16 (27.1)	10 (17.0)	18 (23.4)	13 (15.7)	22 (24.2)	
Inter-Hospital	6 (10.2)	3 (5.1)	8 (10.4)	5 (6.0)	6 (6.6)	
Other transfer	3 (5.1)	9 (15.3)	10 (13.0)	12 (14.5)	4 (4.4)	

*χ^2 p-value reported for difference in proportions between IMD quintile 1 and IMD quintile 5

The univariable association between IMD quintile and mode of delivery (caesarean section vs other) was not statistically significant (Table 38) nor was the association between IMD quintile and planned or unplanned caesarean (p=0.07).

Table 38. Mode of delivery across IMD quintiles

Mode of delivery	1ST IMD quintile	2ND IMD quintile	3RD IMD quintile	4TH IMD quintile	5TH IMD quintile	χ^2 p-value*
Caesarean vs vaginal delivery (normal/ instrumental)						
Vaginal delivery	783 (74.9)	786 (76.1)	814 (72.9)	759 (76.2)	793 (75.7)	P=0.67
Caesarean section	263 (25.1)	247 (23.9)	303 (27.1)	237 (23.8)	255 (24.3)	
Caesarean-section only						
Planned	141 (53.6)	137 (55.5)	151 (49.8)	85 (35.9)	116 (45.5)	P=0.07
Unplanned	122 (46.4)	110 (44.5)	152 (50.2)	152 (64.1)	139 (54.5)	

*χ^2 p-value reported for difference in proportions between IMD quintile 1 and IMD quintile 5

Postnatal care

Women across all quintiles reported postnatal inpatient stays of comparable duration. The median stay for all women and for women from the 5th IMD quintile alone was 2 days (inter-quartile range 1-3 days). A greater proportion of women from the 5th IMD quintile reported not having had a routine postnatal check-up with a health professional at 6-8 weeks postpartum (p<0.001) (Table 39).

Table 39. Postnatal care

Question	1ST IMD quintile	2ND IMD quintile	3RD IMD quintile	4TH IMD quintile	5TH IMD quintile	χ^2 p-value*
Postnatal check-up at 6-8 weeks						
No	127 (12.2)	117 (11.3)	145 (12.9)	159 (16.0)	238 (22.2)	P<0.001
Yes	917 (87.8)	916 (88.7)	976 (87.1)	836 (84.0)	835 (77.8)	
Midwife contact details						
No/unsure	49 (4.7)	22 (2.1)	75 (6.7)	65 (6.5)	64 (6.0)	P=0.20
Yes	994 (95.3)	1,009 (97.9)	1,041 (93.3)	929 (93.5)	1,010 (94.4)	
Postnatal home-visit						
No	18 (1.7)	24 (2.3)	16 (1.4)	21 (2.1)	13 (1.2)	P=0.32
Yes	1,025 (98.3)	1,013 (97.7)	1,108 (98.6)	981 (97.9)	1,067 (98.8)	

*χ^2 p-value reported for difference in proportions between IMD quintile 1 and IMD quintile 5

QUALITY OF COMMUNICATION AND CARE RECEIVED

Antenatal care

The vast majority of women reported being treated with respect and kindness during the antenatal period. Although the proportions and the differences between groups were quite small, women from the 5th IMD quintile were more likely to report feeling that they were not spoken to in a way they could understand by midwives or doctors, nor treated with respect by midwives and doctors most of the time during their antenatal care (Table 40).

Table 40. Quality of communication and treatment during the antenatal period

Response	1ST IMD quintile	2ND IMD quintile	3RD IMD quintile	4TH IMD quintile	5TH IMD quintile	χ^2 P-value*
COMMUNICATION						
Midwives talked in a way I could understand						
Agree Disagree/ Unsure	1,028 (98.0) 21 (2.0)	1,011 (97.7) 24 (2.3)	1,090 (97.0) 34 (3.0)	973 (96.3) 37 (3.7)	1,032 (95.6) 47 (4.4)	P<0.001
Doctors talked in a way I could understand						
Agree Disagree/ Unsure	988 (98.2) 18 (1.8)	970 (96.2) 38 (3.8)	1,042 (95.5) 49 (4.5)	923 (94.1) 58 (5.9)	1,013 (95.0) 53 (5.0)	P<0.001
RESPECT						
Midwives were respectful most of the time						
Agree Disagree/ Unsure	1,014 (96.7) 35 (3.3)	1,002 (97.2) 29 (2.8)	1,069 (95.6) 49 (4.4)	949 (94.7) 53 (2.3)	1,014 (95.0) 53 (5.0)	P=0.06
Doctors were respectful most of the time						
Agree Disagree/ Unsure	974 (97.1) 29 (2.9)	966 (96.1) 39 (3.9)	1,039 (95.4) 50 (4.6)	930 (95.7) 42 (4.3)	999 (94.9) 54 (5.1)	P=0.01
KINDNESS						
Midwives treated me with kindness most of the time						
Agree Disagree/ Unsure	994 (94.9) 53 (5.1)	992 (96.3) 38 (3.7)	1,057 (94.5) 62 (5.5)	934 (93.8) 62 (6.2)	1,000 (93.8) 66 (6.2)	P=0.26
Doctors treated me with kindness most of the time						
Agree Disagree/ Unsure	955 (95.3) 47 (4.7)	953 (95.0) 50 (5.0)	1,027 (94.3) 62 (5.7)	914 (93.7) 61 (6.3)	979 (93.0) 74 (7.0)	P=0.02

*χ^2 p-value reported for difference in proportions between IMD quintile 1 and IMD quintile 5

Labour and delivery care

Similarly, differences between IMD quintiles regarding women's perceptions of the treatment they received from health professionals during labour and delivery were small, with good quality of communication reported overall. Never-the-less, women from the 5th IMD quintile were less likely to agree that they were spoken to by midwives and doctors in a way they could understand nor treated with respect and kindness by doctors and midwives during labour and delivery, compared to women from the highest quintile (Table 41).

Table 41. Quality of communication and treatment during labour and delivery

Response	1ST IMD quintile	2ND IMD quintile	3RD IMD quintile	4TH IMD quintile	5TH IMD quintile	χ^2 P-value*
COMMUNICATION						
Midwives talked in a way I could understand						
Agree Disagree/Unsure	1,005 (97.1) 30 (2.9)	995 (96.9) 32 (3.1)	1,084 (97.1) 33 (2.9)	952 (95.3) 47 (4.7)	1,009 (94.0) 64 (6.0)	P<0.001
Doctors talked in a way I could understand						
Agree Disagree/Unsure	832 (95.3) 41 (4.7)	823 (95.8) 36 (4.2)	923 (95.3) 46 (4.8)	803 (91.2) 78 (8.9)	902 (91.5) 84 (8.5)	P<0.001
RESPECT						
Midwives were respectful most of the time						
Agree Disagree/Unsure	985 (95.6) 45 (4.4)	979 (95.6) 45 (4.4)	1,060 (95.0) 56 (5.0)	928 (93.6) 63 (6.4)	990 (93.0) 75 (7.0)	P=0.01
Doctors were respectful most of the time						
Agree Disagree/Unsure	829 (95.1) 43 (4.9)	825 (95.8) 36 (4.2)	924 (95.4) 45 (4.6)	804 (91.4) 76 (8.6)	902 (91.4) 85 (8.6)	P<0.001
KINDNESS						
Midwives treated me with kindness most of the time						
Agree Disagree/Unsure	986 (95.8) 43 (4.2)	979 (95.7) 44 (4.3)	1,055 (94.5) 61 (5.5)	930 (93.8) 61 (6.2)	966 (91.1) 95 (9.0)	P<0.001
Doctors treated me with kindness most of the time						
Agree Disagree/Unsure	804 (92.6) 64 (7.4)	803 (93.7) 54 (6.3)	908 (94.2) 55 (5.7)	787 (89.9) 88 (10.1)	884 (90.0) 98 (10.0)	P=0.05

*χ^2 p-value reported for difference in proportions between IMD quintile 1 and IMD quintile 5

Overall, women from higher IMD quintiles reported feeling more satisfied with how the midwives and doctors communicated with them during labour and delivery, compared to women from lower quintiles (Figure 5).

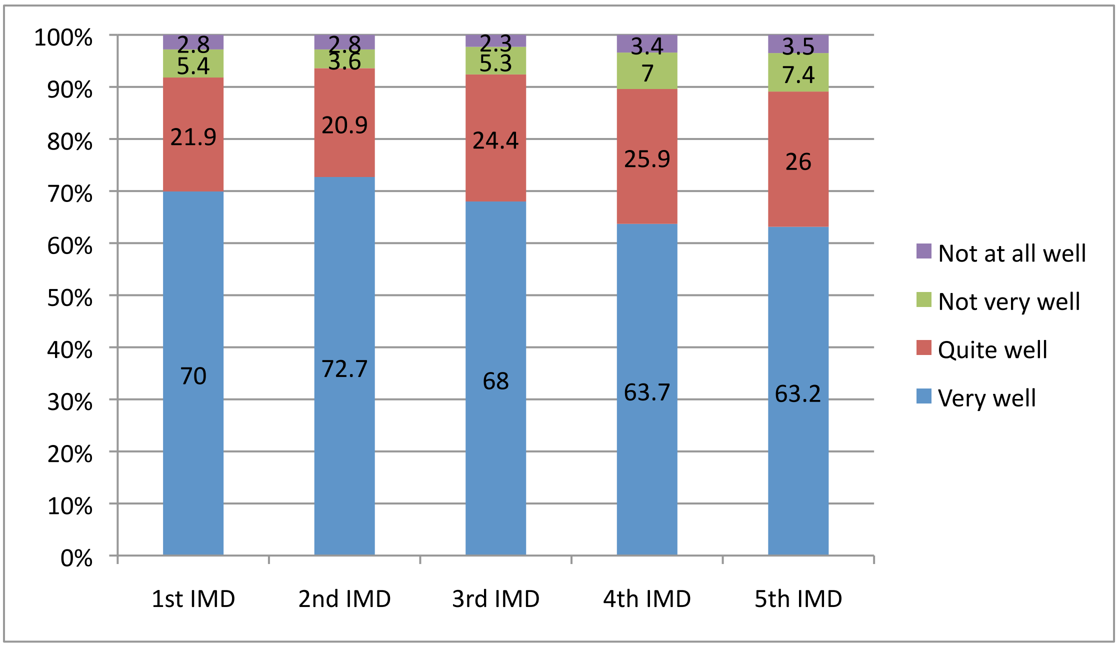

Figure 5. Women's reported satisfaction with how well doctors' and midwives' communicated with them during labour and delivery

Again, although differences were small, compared to women from higher quintiles, women from the 5th IMD quintile were more likely to report being left alone by the midwife looking after them during labour, after birth or during both these periods (p<0.001) (Table 42).

Table 42. Women left alone by their midwife during labour and delivery

Response	1ST IMD quintile	2ND IMD quintile	3RD IMD quintile	4TH IMD quintile	5TH IMD quintile	χ^2 p-value*
Not left alone	812 (78.8)	802 (78.3)	849 (76.5)	709 (71.7)	770 (72.6)	P<0.001
Left alone during labour	144 (14.0)	137 (13.4)	146 (13.2)	166 (16.8)	162 (15.3)	
Left alone after delivery	45 (4.4)	47 (4.6)	59 (5.3)	65 (6.6)	67 (6.3)	
Left alone during labour and after delivery	29 (2.8)	38 (3.7)	56 (5.1)	49 (5.0)	62(5.8)	

*χ^2 p-value reported for difference in proportions between IMD quintile 1 and IMD quintile 5

There was a trend towards women reporting that they felt less confident in and trusting of the health professionals during labour and delivery amongst the lower IMD quintiles compared to the higher IMD quintiles (Figure 6).

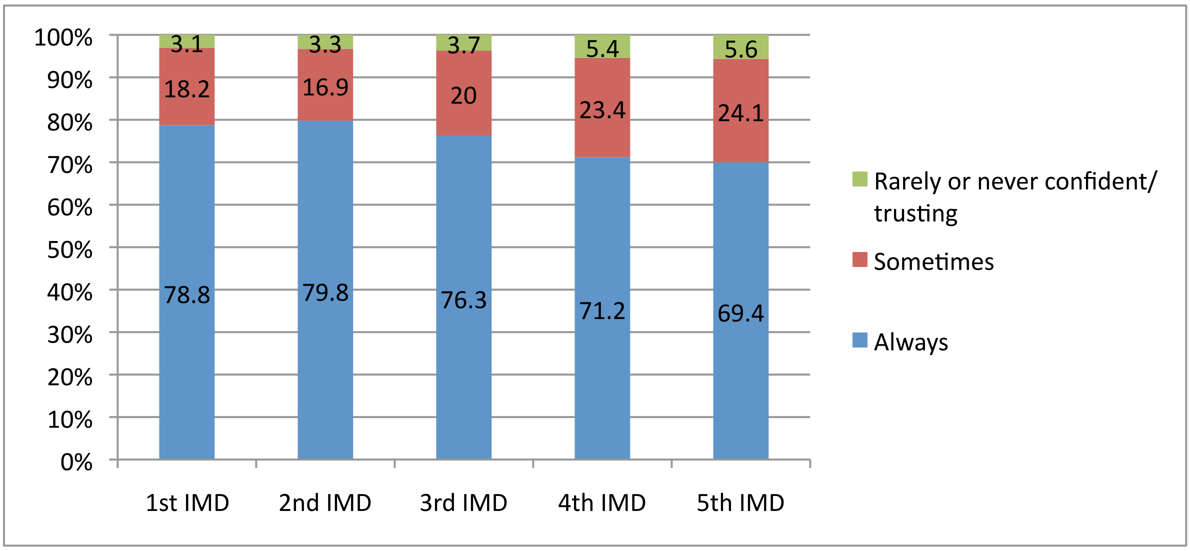

Figure 6. Women's reported trust and confidence in staff during labour and delivery

Postnatal care

There was no evidence of a difference between the highest and lowest IMD quintiles regarding perceptions of communication, respect and kindness from health professionals during postnatal care (Table 43).

Table 43. Communication and treatment during the postnatal period in hospital

Response	1ST IMD quintile	2ND IMD quintile	3RD IMD quintile	4TH IMD quintile	5TH IMD quintile	χ^2 p-value*
COMMUNICATION						
Hospital staff talked in a way I could understand						
Agree	913 (94.6)	914 (94.4)	992 (94.9)	871 (92.9)	939 (93.9)	P=0.50
Disagree/Unsure	52 (5.4)	54 (5.6)	53 (5.1)	67 (7.1)	61 (6.1)	
RESPECT						
Hospital staff were respectful most of the time						
Agree	865 (90.1)	893 (93.0)	956 (91.7)	834 (89.5)	902 (90.7)	P=0.68
Disagree/Unsure	95 (9.9)	67 (7.0)	87 (8.3)	98 (10.5)	93 (9.4)	
KINDNESS						
Hospital staff treated me with kindness most of the time						
Agree	857 (89.4)	897 (93.4)	956 (92.2)	831 (88.7)	898 (91.0)	P=0.23
Disagree/Unsure	102 (10.6)	63 (6.6)	81 (7.8)	106 (11.3)	89 (9.0)	

*χ^2 p-value reported for difference in proportions between IMD quintile 1 and IMD quintile 5

OVERALL EXPERIENCE

There was no significant difference between women from different IMD quintiles regarding their overall satisfaction with antenatal care (p=0.35) or postnatal care (p=0.84) however, there was a significant difference regarding care during labour and birth (p=0.03) (Table 44).

Table 44. Overall satisfaction with care

Overall satisfaction	1ST IMD quintile	2ND IMD quintile	3RD IMD quintile	4TH IMD quintile	5TH IMD quintile	χ^2 p-value*
Antenatal care						
Satisfied	925 (88.7)	907 (88.1)	973 (86.7)	868 (87.0)	936 (87.0)	
Dissatisfied	48 (4.6)	49 (4.8)	66 (5.9)	59 (5.9)	50 (4.7)	P=0.35
Indifferent	70 (6.7)	74 (7.2)	83 (7.4)	71 (7.1)	90 (8.4)	
Labour and delivery care						
Satisfied	920 (88.2)	908 (88.7)	972 (86.9)	849 (85.0)	905 (84.9)	
Dissatisfied	73 (7.0)	71 (6.9)	78 (7.0)	89 (8.9)	82 (7.7)	P=0.03
Indifferent	50 (4.8)	45 (4.4)	69 (6.2)	61 (6.1)	79 (7.4)	
Postnatal care						
Satisfied	797 (76.4)	808 (78.5)	861 (77.1)	730 (73.1)	810 (75.7)	
Dissatisfied	125 (12.0)	109 (10.6)	126 (11.3)	126 (12.6)	127 (11.9)	P=0.84
Indifferent	121 (11.6)	112 (10.9)	130 (11.6)	143 (14.3)	133 (12.4)	

*χ^2 p-value reported for difference in proportions between IMD quintile 1 and IMD quintile 5

Women were asked whether they felt that they were able to participate in decision-making processes about their care during pregnancy and birth. There was a significant difference between women from different IMD quintiles with nearly twice as many women in the 5th quintile reporting that they felt poorly involved in decision-making processes during pregnancy and labour compared to women from the 1st quintile (p<0.001) (Table 45).

Table 45. Involvement in decision-making during pregnancy and labour

Involved in decisions	1ST IMD quintile	2ND IMD quintile	3RD IMD quintile	4TH IMD quintile	5TH IMD quintile	χ^2 p-value*
Yes	649 (62.3)	671 (65.7)	678 (60.8)	598 (60.6)	633 (60.0)	
To some extent	324 (31.1)	278 (27.2)	354 (31.8)	281 (28.5)	303 (28.7)	P<0.001
No	68 (6.5)	73 (7.1)	83 (7.4)	108 (10.9)	199 (11.3)	

*χ^2 p-value reported for difference in proportions between IMD quintile 1 and IMD quintile 5

Compared to women from other quintiles, women from the 5th IMD quintile reported feeling that they were not given enough information to help them decide about their care (p=0.01), nor did they feel they were given information at the right time to decide about their care (p=0.01) (Table 46). Over 40% of women from the 5th quintile reported not being given enough information or only to some extent.

Table 46. Adequacy and timing of information received during pregnancy

Response	1st IMD quintile	2nd IMD quintile	3rd IMD quintile	4th IMD quintile	5th IMD quintile	χ^2 P-value*
Were you given enough information?						
Yes	669 (64.4)	681 (66.4)	717 (64.4)	614 (62.2)	625 (59.2)	
To some extent	296 (28.5)	273 (26.6)	302 (27.1)	279 (28.2)	317 (30.0)	P=0.01
No	74 (7.1)	72 (7.0)	94 (8.5)	95 (9.6)	114 (10.8)	
Was the information given at the right time to decide about care?						
Yes	644 (62.2)	660 (64.6)	692 (62.4)	609 (61.9)	619 (58.9)	
To some extent	310 (30.0)	288 (28.2)	323 (29.1)	273 (27.7)	305 (29.0)	P=0.01
No	81 (7.8)	74 (7.2)	94 (8.5)	102 (10.4)	127 (12.1)	

*χ^2 p-value reported for difference in proportions between IMD quintile 1 and IMD quintile 5

Perceptions of care adjective checklist

Using the 'perceptions of care during labour and birth' adjective checklist, women were asked to indicate how they felt about their care during labour and birth. Compared to women from higher quintiles, women from the 5th IMD quintile were less likely to describe staff as humorous, kind, considerate, supportive, warm and sensitive and more likely to describe them as rushed, insensitive, rude, offhand, inconsiderate, bossy and condescending (Table 47). Although overall, all women were more likely to choose the positive adjectives.

Table 47. Care received during labour and birth using an adjective checklist

Adjective	Response	IMD 1 n (%)	IMD 2 n (%)	IMD 3 n (%)	IMD 4 n (%)	IMD 5 n (%)	p-value*
Positive adjectives							
Humorous	Yes Other	503 (47.7) 552 (52.3)	518 (49.8) 523 (50.2)	519 (45.9) 612 (54.1)	404 (39.9) 609 (60.1)	411 (37.7) 680 (62.3)	P<0.001
Kind	Yes Other	370 (35.1) 685 (64.9)	407 (39.1) 634 (60.9)	443 (39.2) 688 (60.8)	354 (35.0) 659 (65.1)	316 (29.0) 775 (71.0)	P<0.001
Considerate	Yes Other	730 (69.2) 325 (30.8)	719 (69.1) 322 (30.9)	737 (65.2) 394 (34.8)	596 (58.8) 417 (41.2)	627 (57.5) 464 (42.5)	P<0.001
Supportive	Yes Other	883 (83.7) 172 (16.3)	865 (83.1) 176 (16.9)	905 (80.0) 226 (20.0)	803 (79.3) 210 (20.7)	827 (75.8) 264 (24.2)	P<0.001
Warm	Yes Other	707 (67.0) 348 (33.0)	751 (72.1) 290 (27.9)	747 (66.1) 384 (34.0)	639 (63.1) 374 (36.9)	642 (58.9) 449 (41.2)	P<0.001
Polite	Yes Other	674 (63.9) 381 (36.1)	679 (65.2) 362 (34.8)	753 (66.6) 378 (33.4)	674 (66.5) 339 (33.5)	723 (66.3) 368 (33.7	P=0.19
Sensitive	Yes Other	629 (59.6) 426 (40.4)	647 (62.2) 394 (37.9)	685 (60.6) 446 (39.4)	570 (56.3) 443 (43.7)	573 (52.5) 518 (47.5)	P<0.001
Informative	Yes Other	533 (50.5) 522 (49.5)	506 (48.6) 535 (51.4)	525 (46.4) 606 (53.6)	420 (41.5) 593 (58.5)	454 (41.6) 637 (58.4)	P<0.001
Negative adjectives							
Rushed	Yes Other	152 (14.4) 903 (85.6)	157 (15.1) 884 (84.9)	187 (16.5) 944 (83.5)	179 (17.7) 834 (82.3)	198 (18.2) 893 (81.9)	P=0.01
Insensitive	Yes Other	57 (5.4) 998 (94.6)	63 (6.1) 978 (94.0)	73 (6.5) 1,058 (93.6)	94 (9.3) 919 (90.7)	101 (9.3) 990 (90.7)	P<0.001
Unhelpful	Yes Other	50 (4.7) 1,005 (95.3)	57 (5.5) 984 (94.5)	63 (5.6) 1,068 (94.4)	70 (6.9) 943 (93.1)	73 (6.7) 1,018 (93.3)	P=0.02
Offhand	Yes Other	65 (6.2) 990 (93.8)	53 (5.1) 988 (94.9)	58 (5.1) 1,073 (94.9)	53 (5.2) 960 (94.8)	71 (6.5) 1,020 (93.5)	P=0.69
Rude	Yes Other	47 (4.5) 1,008 (95.5)	43 (4.1) 998 (95.9)	53 (4.7) 1,078 (95.3)	61 (6.0) 952 (94.0)	77 (7.1) 1,014 (92.9)	P<0.001
Inconsiderate	Yes Other	41 (3.9) 1,014 (96.1)	44 (4.2) 997 (95.8)	50 (4.4) 1,081 (95.6)	48 (4.7) 965 (95.3)	70 (6.4) 1,021 (93.6)	P=0.01
Bossy	Yes Other	99 (9.4) 956 (90.6)	87 (8.4) 954 (91.6)	123 (10.9) 1,008 (89.1)	103 (10.2) 910 (89.8)	146 (13.4) 945 (86.6)	P<0.001
Condescending	Yes Other	43 (4.1) 1,012 (95.9)	39 (3.8) 1,002 (96.3)	46 (4.1) 1,085 (95.9)	43 (4.2) 970 (95.8)	69 (6.3) 1,022 (93.7)	P=0.01

*p-value reported for non-parametric test for trend

ADJUSTED MULTIVARIABLE ANALYSIS

Antenatal, labour and postnatal care outcomes

Having adjusted for the effects of ethnicity, age and parity, the results of logistic regression showed that compared to women from the 1st IMD quintile, women from the 5th quintile were 60% less likely to have had any antenatal care (aOR 0.40; 95%CI 0.18 – 0.87), 38% less likely to have been seen by a health professional prior to 12 weeks gestation (aOR 0.62; 95%CI 0.45 – 0.85) and 47% less likely to have been able to see a health professional as early as they desired in their pregnancy (aOR 0.53; 95%CI 0.39 – 0.71) (Table 48).

Table 48. Antenatal care outcomes adjusted for ethnicity, age and parity

IMD quintile	Crude OR (95% CI)	Adjusted OR (95%CI)
Had antenatal care		
1	1.0	1.0
2	0.99 (0.39 – 2.49)	1.18 (0.45 – 3.06)
3	0.80 (0.34 – 1.91)	0.95 (0.40 – 2.27)
4	0.41 (0.19 – 0.89)	0.60 (0.27 – 1.35)
5	0.23 (0.11 – 0.48)	0.40 (0.18 – 0.87)
Seen by health professional before 12 weeks		
1	1.0	1.0
2	0.96 (0.69 – 1.33)	0.96 (0.69 – 1.35)
3	0.86 (0.63 – 1.18)	0.94 (0.68 – 1.30)
4	0.66 (0.49 – 0.90)	0.83 (0.60 – 1.14)
5	0.43 (0.33 – 0.58)	0.62 (0.45 – 0.85)
Able to see health professional as early as desired		
1	1.0	1.0
2	1.06 (0.77 – 1.45)	1.02 (0.74 – 1.41)
3	0.95 (0.70 – 1.29)	0.95 (0.70 – 1.31)
4	0.72 (0.54 – 0.97)	0.77 (0.56 – 1.04)
5	0.48 (0.37 – 0.64)	0.53 (0.39 – 0.71)
During my antenatal care, midwives talked in a way that I could understand		
1	1.0	1.0
2	0.86 (0.48 – 1.56)	0.93 (0.51 – 1.70)
3	0.66 (0.38 – 1.14)	0.77 (0.44 – 1.35)
4	0.54 (0.31 – 0.92)	0.75 (0.43 – 1.31)
5	0.45 (0.27 – 0.76)	0.72 (0.41 – 1.25)

Table 48 *continued*

IMD quintile	Crude OR (95% CI)	Adjusted OR (95%CI)
During my antenatal care, midwives were respectful most of the time		
1	1.0	1.0
2	1.19 (0.72 – 1.97)	1.23 (0.74 – 2.05)
3	0.75 (0.48 – 1.17)	0.84 (0.53 – 1.32)
4	0.62 (0.40 – 0.96)	0.75 (0.48 – 1.19)
5	0.66 (0.43 – 1.02)	0.95 (0.59 – 1.52)
During my antenatal care, doctors talked in a way that I could understand		
1	1.0	1.0
2	0.47 (0.26 – 0.82)	0.49 (0.28 – 0.86)
3	0.39 (0.22 – 0.67)	0.47 (0.27 – 0.82)
4	0.29 (0.17 – 0.50)	0.41 (0.24 – 0.72)
5	0.35 (0.20 – 0.60)	0.62 (0.35 – 1.10)
During my antenatal care, doctors were respectful most of the time		
1	1.0	1.0
2	0.74 (0.45 – 1.20)	0.77 (0.47 – 1.27)
3	0.62 (0.39 – 0.99)	0.70 (0.44 – 1.13)
4	0.66 (0.41 – 1.07)	0.80 (0.49 – 1.32)
5	0.55 (0.35 – 0.87)	0.80 (0.48 – 1.31)
Antenatal hospital admission		
1	1.0	1.0
2	1.03 (0.82 – 1.30)	1.03 (0.81 – 1.30)
3	0.98 (0.79 – 1.23)	0.93 (0.74 – 1.18)
4	1.23 (0.98 – 1.54)	1.06 (0.84 – 1.34)
5	1.47 (1.18 – 1.82)	1.20 (0.95 – 1.52)
Given enough information to decide about pregnancy care		
1	1.0	1.0
2	1.09 (0.91 – 1.31)	1.07 (0.89 – 1.29)
3	1.00 (0.84 – 1.20)	1.05 (0.87 – 1.25)
4	0.91 (0.76 – 1.09)	0.97 (0.81 – 1.17)
5	0.80 (0.67 – 0.96)	0.93 (0.77 – 1.13)

Compared to women from IMD 1, women from IMD 5 were also 28% (aOR 1.28; 95%CI 0.90 – 1.83) more likely to have been transferred during labour and 17% (aOR 1.17; 95%CI 0.94 – 1.45) more likely to have had a caesarean, although these results were not statistically significant. Women from the 5th quintile were also 45% less likely to have had a postnatal check with their doctor (aOR 0.55; 95%CI 0.42 – 0.70) compared to women from the 1st quintile (Table 49).

Following adjustment for ethnicity, age and parity there were no statistically significant differences between quintiles regarding their perception of the communication and respect they received from midwives and doctors during labour care.

Table 49. Labour and postnatal care outcomes adjusted for ethnicity, age and parity

IMD quintile	Crude OR (95% CI)	Adjusted OR (95%CI)
Transfer during labour		
1	1.0	1.0
2	0.99 (0.69 – 1.42)	1.00 (0.69 – 1.44)
3	1.27 (0.91 – 1.78)	1.18 (0.83 – 1.67)
4	1.44 (1.03 – 2.01)	1.25 (0.88 – 1.78)
5	1.54 (1.11 – 2.14)	1.28 (0.90 – 1.83)
Caesarean vs other mode of delivery		
1	1.0	1.0
2	0.92 (0.77 – 1.10)	0.97 (0.79 – 1.19)
3	1.01 (0.85 – 1.20)	1.17 (0.96 – 1.43)
4	0.92 (0.77 – 1.10)	1.04 (0.84 – 1.28)
5	0.88 (0.74 – 1.05)	1.17 (0.94 – 1.45)
Planned vs unplanned caesarean delivery		
1	1.0	1.0
2	0.93 (0.66 – 1.32)	0.89 (0.60 – 1.33)
3	1.16 (0.84 – 1.62)	1.18 (0.80 – 1.72)
4	2.07 (1.44 – 2.96)	2.02 (1.33 – 3.07)
5	1.38 (0.98 – 1.96)	1.38 (0.91 – 2.09)
During labour and birth, midwives talked in a way that I could understand		
1	1.0	1.0
2	0.93 (0.56 – 1.54)	0.99 (0.59 – 1.65)
3	0.98 (0.59 – 1.62)	1.09 (0.66 – 1.81)
4	0.61 (0.38 – 0.96)	0.83 (0.51 – 1.35)
5	0.47 (0.30 – 0.73)	0.64 (0.40 – 1.03)
During labour and birth, midwives were respectful most of the time		
1	1.0	1.0
2	0.99 (0.65 – 1.52)	1.03 (0.67 – 1.57)
3	0.87 (0.58 – 1.29)	0.96 (0.64 – 1.44)
4	0.67 (0.45 – 1.00)	0.85 (0.56 – 1.28)
5	0.60 (0.41 – 0.88)	0.86 (0.57 – 1.30)
During labour and birth, doctors talked in a way that I could understand		
1	1.0	1.0
2	1.13 (0.71 – 1.78)	1.20 (0.75 – 1.90)
3	0.99 (0.64 – 1.52)	1.13 (0.73 – 1.75)
4	0.51 (0.34 – 0.75)	0.64 (0.43 – 0.95)
5	0.53 (0.36 – 0.78)	0.75 (0.50 – 1.13)

Table 49 *continued*

IMD quintile	Crude OR (95% CI)	Adjusted OR (95%CI)
During labour and birth, doctors were respectful most of the time		
1	1.0	1.0
2	1.19 (0.76 – 1.87)	1.26 (0.80 – 1.99)
3	1.07 (0.69 – 1.64)	1.21 (0.78 – 1.87)
4	0.55 (0.37 – 0.81)	0.69 (0.46 – 1.02)
5	0.55 (0.38 – 0.80)	0.79 (0.52 – 1.18)
Had postnatal check-up		
1	1.0	1.0
2	1.08 (0.83 – 1.42)	1.10 (0.84 – 1.44)
3	0.93 (0.72 – 1.20)	0.96 (0.74 – 1.24)
4	0.73 (0.57 – 0.94)	0.77 (0.59 – 0.99)
5	0.49 (0.38 – 0.62)	0.55 (0.42 – 0.70)

Analysis using IMD as a continuous variable

Logistic regression, using IMD quintile as a continuous variable and adjusting for ethnicity, age and parity, demonstrated that with each increase in IMD quintile group (corresponding to a decrease in socioeconomic position) women were 25% (aOR 0.75; 95%CI 0.63 – 0.90) less likely to have had antenatal care and 15% (aOR 0.85; 95%CI 0.80 – 0.90) less likely to have had a routine postnatal check-up. Women were 4% (aOR 1.04; 95%CI 0.99 – 1.09) more likely to have had a caesarean birth and of those women that had a caesarean, 15% (aOR 1.15; 95%CI 1.05 – 1.27) more likely to have had an unplanned caesarean (Table 50). Additionally, with decreasing socioeconomic position women were generally more likely to report that they were not treated respectfully or spoken to in a way they could understand by doctors and midwives during their antenatal care.

Table 50. Antenatal, labour, delivery and postnatal outcomes across IMD quintiles

Outcome	Adjusted OR* (95% CI)
Had antenatal care	0.75 (0.63 – 0.90)
Seen by health professional before 12 weeks	0.89 (0.83 – 0.95)
Able to see health professional as early as desired	0.84 (0.79 – 0.90)
During my antenatal care, midwives talked in a way that I could understand	0.92 (0.81 – 1.04)
During my antenatal care, midwives were respectful most of the time	0.95 (0.85 – 1.05)
During my antenatal care, doctors talked in a way that I could understand	0.93 (0.83 – 1.04)
During my antenatal care, doctors were respectful most of the time	0.96 (0.87 – 1.07)
Antenatal hospital admission	1.04 (0.99 – 1.10)
Transfer during labour	1.07 (0.99 – 1.16)
Caesarean vs other mode of delivery	1.04 (0.99 – 1.09)
Planned vs unplanned caesarean section	1.15 (1.05 – 1.27)
During labour and birth, midwives talked in a way that I could understand	0.89 (0.80 – 0.99)
During labour and birth, midwives were respectful most of the time	0.95 (0.87 – 1.05)
During labour and birth, doctors talked in a way that I could understand	0.88 (0.80 – 0.97)
During labour and birth, doctors were respectful most of the time	0.89 (0.81 – 0.98)
Had postnatal check-up	0.85 (0.80 – 0.90)
Given enough information to decide about pregnancy care	0.98 (0.94 – 1.02)

*The adjusted OR represents the change in effect for a change in IMD quintile

WOMEN'S WORRIES ABOUT LABOUR AND BIRTH

Using the OWL scale, the results of unadjusted analysis revealed statistically significant differences between the highest and lowest quintiles regarding worries about 'having a long labour', 'not knowing how long labour would take', 'feeling embarrassed during labour/birth' and 'needing a caesarean' (Table 51). Women from the 5th quintile were more likely to report concern about not knowing who to contact, having a long labour, how long the labour would take, feeling embarrassed or needing a caesarean.

Table 51. Unadjusted chi-square analysis of women's worries about labour and birth

Response	1st IMD quintile	2nd IMD quintile	3rd IMD quintile	4th IMD quintile	5th IMD quintile	χ^2 p-value*
Not knowing when labour would start						
Worried	503 (48.8)	483 (47.6)	537 (48.4)	501 (50.3)	538 (51.0)	P=0.32
Not worried	528 (51.2)	532 (52.4)	573 (51.6)	496 (49.8)	518 (49.1)	
Getting to hospital in time						
Worried	340 (33.1)	337 (33.2)	367 (32.9)	349 (34.9)	379 (36.0)	P=0.17
Not worried	687 (66.9)	679 (66.8)	749 (67.1)	651 (65.10)	675 (64.0)	
Having to be induced						
Worried	503 (48.8)	499 (49.3)	563 (51.0)	504 (51.1)	535 (51.6)	P=0.20
Not worried	528 (51.1)	513 (50.7)	542 (49.1)	482 (48.9)	502 (48.4)	
Having a long labour						
Worried	649 (62.9)	622 (61.2)	726 (65.2)	652 (65.7)	727 (69.2)	p<0.001
Not worried	383 (37.1)	395 (38.8)	388 (34.8)	341 (34.3)	324 (30.8)	
Experiencing pain and discomfort of labour						
Worried	697 (67.5)	668 (65.6)	741 (66.3)	669 (67.0)	732 (69.3)	P=0.37
Not worried	336 (32.5)	351 (34.5)	376 (33.4)	329 (33.0)	324 (30.7)	
Getting effective pain relief						
Worried	459 (44.6)	429 (42.1)	489 (44.1)	439 (44.2)	470 (44.9)	P=0.88
Not worried	571 (55.4)	589 (57.9)	621 (56.0)	555 (55.8)	577 (55.1)	
Not knowing how long labour would take						
Worried	543 (52.6)	518 (51.1)	616 (55.4)	551 (55.3)	649 (61.8)	P<0.001
Not worried	489 (47.4)	495 (48.9)	496 (44.6)	446 (44.7)	402 (38.3)	
Feeling embarrassed						
Worried	232 (22.6)	216 (21.4)	259 (23.4)	264 (26.8)	299 (29.0)	P<0.001
Not worried	796 (77.4)	794 (78.6)	850 (76.7)	721 (73.2)	733 (71.0)	
Having a forceps or ventouse delivery						
Worried	592 (57.5)	563 (55.6)	645 (58.2)	597 (60.6)	625 (60.8)	P=0.13
Not worried	437 (42.5)	450 (44.4)	463 (41.8)	388 (39.4)	403 (39.2)	
Needing a caesarean section						
Worried	541 (52.4)	533 (52.2)	605 (54.7)	579 (58.1)	611 (58.6)	P=0.01
Not worried	491 (47.6)	489 (47.9)	501 (45.3)	417 (41.9)	432 (41.4)	

*χ^2 p-value reported for difference in proportions between IMD quintile 1 and IMD quintile 5

The results of logistic regression analysis, adjusted for ethnicity, maternal age and parity revealed no significant differences in women's worries between IMD quintiles (Table 52). Regression analysis was repeated using IMD as a continuous variable and the results remained non-significant (Table 52).

Table 52. Women's worries about labour and birth adjusted for ethnicity, age and parity

IMD quintile	Adjusted OR (95% CI)	Adjusted OR (95%CI) (IMD continuous)
Not knowing when labour would start		
1	1.0	
2	0.94 (0.78 – 1.12)	0.98 (0.94 – 1.02)
3	0.91 (0.77 – 1.09)	
4	0.92 (0.77 – 1.11)	
5	0.90 (0.75 – 1.09)	
Getting to hospital in time		
1	1.0	
2	1.00 (0.83 – 1.20)	1.01 (0.96 – 1.05)
3	0.97 (0.80 – 1.16)	
4	1.02 (0.84 – 1.23)	
5	1.02 (0.84 – 1.23)	
Having to be induced		
1	1.0	
2	1.03 (0.86 – 1.23)	1.01 (0.97 – 1.05)
3	1.06 (0.89 – 1.26)	
4	1.02 (0.85 – 1.22)	
5	1.05 (0.87 – 1.26)	
Having a long labour		
1	1.0	
2	0.89 (0.74 – 1.08)	1.03 (0.98 – 1.07)
3	0.99 (0.83 – 1.19)	
4	0.95 (0.79 – 1.16)	
5	1.11 (0.91 – 1.35)	
Experiencing pain and discomfort of labour		
1	1.0	
2	0.88 (0.73 – 1.07)	0.96 (0.92 – 1.01)
3	0.84 (0.70 – 1.02)	
4	0.81 (0.67 – 0.99)	
5	0.87 (0.71 – 1.07)	
Getting effective pain relief		
1	1.0	
2	0.88 (0.73 – 1.05)	0.98 (0.94 – 1.02)
3	0.91 (0.76 – 1.08)	
4	0.89 (0.74 – 1.07)	
5	0.90 (0.75 – 1.09)	

Table 52 *continued*

IMD quintile	Adjusted OR (95% CI)	Adjusted OR (95%CI) (IMD continuous)
Not knowing how long labour would take		
1	1.0	
2	0.91 (0.76 – 1.08)	1.02 (0.97 – 1.06)
3	0.98 (0.82 – 1.18)	
4	0.88 (0.73 – 1.06)	
5	1.10 (0.91 – 1.32)	
Feeling embarrassed		
1	1.0	
2	0.90 (0.73 – 1.13)	1.03 (0.98 – 1.08)
3	0.90 (0.72 – 1.11)	
4	1.02 (0.82 – 1.27)	
5	1.07 (0.86 – 1.33)	
Having a forceps or ventouse delivery		
1	1.0	
2	0.89 (0.75 – 1.07)	1.01 (0.96 – 1.05)
3	0.92 (0.77 – 1.10)	
4	0.98 (0.81 – 1.19)	
5	0.98 (0.81 – 1.19)	
Needing a caesarean section		
1	1.0	
2	0.98 (0.82 – 1.17)	1.03 (0.99 – 1.07)
3	1.01 (0.85 – 1.20)	
4	1.10 (0.92 – 1.32)	
5	1.09 (0.91 – 1.32)	

SUMMARY OF KEY FINDINGS

After adjusting for the effects of ethnicity, age and parity, the results of logistic regression showed that women from the 5th IMD quintile were 60% less likely to have had any antenatal care (aOR 0.40; 95%CI 0.18 – 0.87), 40% less likely to have been seen by a health professional prior to 12 weeks gestation (aOR 0.62; 95%CI 0.45 – 0.85) and 50% less likely to have been able to see a health professional as early as they desired in their pregnancy (aOR 0.53; 95%CI 0.39 – 0.71).

Although statistically non-significant, with each decrease in socioeconomic position women were 4% (aOR 1.04; 95%CI 0.99 – 1.09) more likely to have had a caesarean birth and amongst those women, they were 15% (aOR 1.15; 95%CI 1.05 – 1.27) more likely to have had an unplanned caesarean.

Women from the 5th quintile were also 45% less likely to have had a postnatal check with their doctor (aOR 0.55; 95%CI 0.42 – 0.70) compared to women from the 1st quintile. With each decrease in socioeconomic position, women were shown to be 15% (aOR 0.85; 95%CI 0.80 – 0.90) less likely to have had a routine postnatal check-up.

With decreasing socioeconomic position women were generally more likely to report that they were not treated respectfully or spoken to in a way they could understand by doctors and midwives during their antenatal care. Overall, with decreasing socioeconomic group women were 11% (OR 0.89; 95%CI 0.80 – 0.99) less likely to agree that midwives spoke in a way they could understand during labour and birth, 12% (OR 0.88; 95%CI 0.80 – 0.97) less likely to agree that doctors spoke in a way they could understand and 11% (OR 0.89; 95%CI 0.81 – 0.98) less likely to agree that doctors were respectful most of the time.

4.5 QUALITATIVE ANALYSIS – METHODS

The study design, participants and data collection for this analysis are as carried out in the 2010 NMS and are outlined in the section on Methods of the National Maternity Survey (page 104).

Research question

This analysis aimed to answer the question: what are the experiences of maternity care amongst women from the lowest socioeconomic position in the UK?

Theoretical foundation of the methodology

The analysis presented here is influenced by, but not restricted to, grounded theory. Grounded theory was developed by Glaser and Strauss in 1967 (Glaser and Strauss 1967) as a philosophical approach to qualitative research, at a time when quantitative methods of analysis predominated in health and social sciences research and qualitative methods were considered 'unscientific'. Their systematic approach emphasised the generation of discrete 'theories' from qualitative research that could help explain or illuminate the findings within the data (Silverman 2005). David Silverman explains that a simplified model of grounded theory involves three stages: "an initial attempt to develop categories which illuminate the data; an attempt to 'saturate' these categories with many appropriate cases in order to demonstrate their relevance; and developing these categories into more general analytic frameworks with relevance outside the setting" (Silverman 2005).

In reality, much qualitative research today generates interesting and important recommendations, ideas and philosophical explanations for people's experiences and life events, but rarely true theories. Aptly expressed by Bernie Carter, qualitative analysis is "about the representation or reconstruction of social phenomena", and "does not attempt to present reality: it is interpretive" (Lavender et al 2004). As a consequence, whilst employing several important principles of grounded theory, such as constant comparison, the data were analysed here using thematic analysis. This approach focuses on the themes that emerge from the data in addition to implicit theories that were understood prior to the analysis being conducted (Lavender et al 2004). In the analysis presented here, groups of ideas were gathered into sub-themes and groups of sub-themes into themes to form a meaningful interpretation of women's experiences of maternity care amongst the lowest socioeconomic group.

Sampling and data collection

Sampling for the purpose of this analysis was purposive, in that only the free-text responses of women from the lowest IMD quintile were included in the analysis. As such, the findings are not generalisable across the entire population but are designed to offer insight into the experiences of maternity care amongst women from the lowest socioeconomic group in the UK and add further layers of understanding and context to the findings of quantitative analysis.

The free-text questions from the NMS questionnaire that were used in this analysis related to labour and birth care, postnatal care and overall care. The questions asked were:

a) Is there anything else you would like to say about your care during labour and the birth of your baby?
b) Is there anything else you would like to say about you or your baby's postnatal care in the maternity unit (or hospital)?
c) If there is anything else you would like to tell us about your care while you were pregnant or since you have had your baby, please add your comments here.

This was the final question of the survey, followed by a blank text box covering one and a half pages.

The analysis focussed on the responses to the final question (c). Responses to questions (a) and (b) were analysed only for women who had responded to the final question (c) as the NMS dataset only stipulated if women had responded to question (c) and thus quantitative data on respondents to the free-text questions were only available in the NMS dataset for women who answered question (c). Availability of this data in order to explore the demographic characteristics of women who responded to the free-text question was considered an important aspect of the overall analysis.

Data management, coding and analysis

First, all the free-text responses were read and re-read several times in order to ensure thorough familiarity with the data and to gain a broad overview of the content and the types of themes expressed. Based on the content and general tone of the text, the responses were then sorted into largely positive, largely negative and mixed responses.

Next, the process of data coding was commenced, using a combined approach of open and selective coding. Having already conducted the quantitative analysis of data from the 2010 NMS, there were several themes that were expected to be present within the qualitative data and this allowed for selective coding of pre-specified ideas or sub-themes within these themes. In addition to this however, open or free coding allowed new and emergent ideas and concepts in the text answers to be coded.

The codes assigned to segments of text were largely descriptive (eg. communication with health professionals, antenatal support) or conceptual (eg. how women felt about breastfeeding), as opposed to factual or demographic. Once initial coding had commenced, a randomly-selected sample of 30 coded text responses were crosschecked by three senior researchers within the NPEU in order to verify the codes assigned and improve validity of the coding process. The senior researchers each discussed the data and codes with the primary researcher (A. Lindquist) and new suggestions were considered and incorporated into the coding framework where appropriate. Because the free text answers had not been typed up, the process of data coding was conducted free-hand in hard-copy, without the aid of any software package.

Constant comparison between and within participants' responses ensured consistency between the coding of similar ideas expressed by different people, and ensured that the process of analysis and the ongoing review of the coded themes was iterative and reflexive (Lavender et al 2004). Importantly, this approach ensured that the anticipated and emerging themes were constantly reviewed and 'tested' for robustness, and either strengthened or weakened by the evidence presented in the data. Reading, re-reading and coding continued until no new themes emerged. Care was taken during coding and analysis to identify any deviant cases within the data that differed sufficiently from the content of other responses and therefore warranted separate consideration. No deviant cases were identified.

As is characteristic of qualitative research, the analysis was largely inductive, with findings from the data used to form ideas and answers to the research question. However as previously stated, the findings from prior quantitative analysis of the 2010 NMS provided evidence for a number of expected themes, thus establishing a concurrent deductive process of analysis.

Following extensive reading of the responses and then subsequent coding based on the method of constant comparison and iteration, individual codes were grouped into sub-themes and these were then grouped into broad themes describing women's experiences of maternity care during their pregnancy, labour and birth and the postnatal period.

Based on the results of quantitative analysis and existing research, the anticipated overarching themes included:

a) antenatal preparation and support,

b) postnatal care and support and

c) the NHS and maternity services

The emergent themes included:

d) communication, respect and emotional support,

e) labour and intrapartum care, and

f) breastfeeding support and education

Once these themes were established, each text response was labelled with colour-coded index tabs according to the themes expressed, as a method of 'data display' (Lavender et al 2004). As the analysis progressed from fragmented, coded text to more meaningful, conceptual findings, these colour tabs were used as an easy method of referring back to segments of text that related to each theme.

Quotations were used to illustrate women's experiences of maternity care and the resulting themes. Spelling mistakes within quotes have been corrected and very minor grammatical errors amended. No other changes to the quotes were made. The ethnic group, age and parity of each woman quoted have also been included as part of the findings to provide further context for each quotation.

Researcher reflexivity

There are conflicting views about the role of the researcher in interview-based qualitative research and the value of personal investment in the interviewer-interviewee relationship (Oakley 1981). The challenges associated with this interpersonal interaction, specifically those faced when the interviewee asks questions in return of the researcher, do not apply when qualitative research is conducted using written free-text survey answers, as in the analysis presented here. Despite this, the universal process of qualitative analysis involving repeated readings of each response ensured that as the researcher, I became incredibly familiar with the experiences and reflections of this group of women and felt in many ways as though I had 'heard' their story. I didn't have the benefit of observing women's body language, gestures, tone of voice or emotion, which surely colours the qualitative research findings from interviews. However, it was very clear through women's writing and their use of adjectives and detailed description what their experience had been and whether they felt positive, negative, regretful, resentful, grateful or one of many other emotions.

Although there were many uplifting responses where women wrote about their positive experiences with health professionals, the health system and their own labour and birth, the overwhelming number of negative responses definitely impacted upon my own experience as the researcher. Additionally, despite having no personal experience of pregnancy or childbirth, I have worked for several years as a trainee obstetrician and am soon returning to clinical practice. I felt particularly upset and distressed reading about the way in which some women reported being spoken to by the midwives and/or doctors caring for them, especially during labour and in the postnatal context when women were clearly feeling vulnerable and in need of great care and sensitivity. These interactions seemed to be often in the context of short staffing but it was very clear that a few terse words and a general lack of empathy and consideration from staff members impacted greatly on women's sense of empowerment, control and their longer-term sense of wellbeing during this delicate time. It brought my full attention to the importance of calm, respectful and encouraging communication with patients throughout their pregnancy, birth and the months to follow and this will be a powerful lesson that stays with me in my future practice.

4.6 QUALITATIVE ANALYSIS – FINDINGS

DESCRIPTIVE ANALYSIS OF RESPONDENTS TO FREE-TEXT QUESTION

Descriptive analysis was conducted only for women who responded to the final question (c) as outlined in Section 4.5. Overall, 46.4% of respondents to the questionnaire responded to the final free-text question. Unadjusted analysis of the characteristics of women who responded to the free-text question showed that these women were significantly more likely to be older (>30 years), from higher IMD quintiles, of white ethnicity, in paid employment or on maternity leave, nulliparous, more highly educated and to have planned their pregnancy compared to those women who did not respond (Table 53).

Table 53. Demographic characteristics of respondents to the free-text question

Variable	Did not respond to free-text (%)	Responded to free-text (%)	χ^2 p-value*
IMD quintile			
1	624 (18.5)	355 (22.7)	P<0.001
2	665 (19.7)	299 (19.1)	
3	684 (20.3)	355 (22.7)	
4	663 (19.7)	286 (18.3)	
5	737 (21.8)	270 (17.3)	
Ethnicity			
White	2,814 (84.4)	1,393 (89.7)	P<0.001
Asian	280 (8.4)	92 (5.9)	
Black	152 (4.6)	44 (2.8)	
Other	89 (2.7)	23 (1.5)	
Employment status			
In paid employment	261 (7.9)	128 (8.3)	P<0.001
On maternity leave	2,036 (61.4)	1,062 (68.9)	
Housewife	788 (23.8)	287 (18.6)	
Education/Training	20 (0.6)	8 (0.5)	
Unemployed	210 (6.3)	57 (3.7)	
Age category			
<20	110 (3.3)	33 (2.1)	P<0.001
20 – 24	498 (14.9)	153 (9.8)	
25 – 29	890 (26.6)	335 (21.5)	
30 – 34	1,051 (31.4)	566 (36.3)	
≥35 years	803 (24.0)	473 (30.3)	
Level of education			
Left school ≤16 years	906 (27.2)	260 (16.7)	P<0.001
Did not leave school <16 years	2,420 (72.8)	1,299 (83.3)	
Pregnancy planning			
Planned	2,328 (72.0)	1,192 (79.4)	P<0.001
Unplanned	905 (28.0)	310 (20.6)	
Parity			
Nulliparous	1,600 (48.4)	815 (52.7)	P=0.01
Multiparous	1,706 (51.6)	732 (47.3)	

*χ^2 p-value reported for difference in proportion across groups

Respondents to the free-text question were also more likely to have had antenatal care and to have had an instrumental or caesarean delivery. Additionally, women who did not respond to the free-text question were more likely to have reported feeling satisfied overall with their maternity care during pregnancy, labour and birth and postnatally (Table 54).

Table 54. Care characteristics of respondents to free-text question

Variable	Did not respond to free-text (%)	Did respond to free-text (%)	χ^2 p-value*
First antenatal visit <12 weeks gestation			
No	354 (10.7)	134 (8.7)	P=0.03
Yes	2,953 (89.3)	1,412 (91.3)	
Had antenatal care			
No	63 (1.9)	16 (1.0)	P=0.03
Yes	3,290 (98.1)	1,545 (99.0)	
Overnight antenatal hospital admission			
No	2,734 (81.4)	1,271 (81.5)	P=0.95
Yes	625 (16.6)	289 (18.5)	
Transferred during labour			
No	2,730 (92.0)	1,219 (90.7)	P=0.15
Yes	237 (8.0)	125 (9.3)	
Mode of delivery			
Normal vaginal	2,148 (64.7)	909 (59.0)	P<0.001
Instrumental	394 (11.9)	206 (13.4)	
Caesarean	778 (23.4)	425 (27.6)	
Had postnatal check-up			
No	498 (14.9)	244 (15.6)	P=0.48
Yes	2,855 (85.2)	1,317 (84.4)	
Overall satisfaction with pregnancy care			
Satisfied	3,039 (90.6)	1,258 (80.8)	
Dissatisfied	97 (2.9)	162 (10.4)	P<0.001
Indifferent	220 (6.6)	137 (8.8)	
Overall satisfaction with care during labour and birth			
Satisfied	2,980 (89.1)	1,280 (82.4)	
Dissatisfied	185 (5.5)	175 (11.3)	P<0.001
Indifferent	181 (5.4)	98 (6.3)	
Overall satisfaction with postnatal care			
Satisfied	2,719 (81.2)	1,019 (65.5)	
Dissatisfied	270 (8.1)	299 (19.2)	P<0.001
Indifferent	358 (10.7)	239 (15.4)	

*χ^2 p-value reported for difference in proportion across groups

Amongst women from the 5th IMD quintile only, significant associations were found between response to the free-text question and level of education and employment status, with those who responded to the free-text question being more likely to have finished school after age 16 or be on maternity leave (Table 55).

Table 55. Demographic characteristics of IMD 5 respondents and non-respondents to free-text question

Variable	Did not respond to free-text (%)	Did respond to free-text (%)	χ^2 p-value*
Ethnicity			
White	506 (70.2)	202 (75.9)	
Asian	108 (15.0)	30 (11.3)	P=0.34
Black	79 (11.0)	25 (9.4)	
Other	28 (3.9)	9 (3.4)	
Employment status			
In paid employment	60 (8.4)	13 (4.9)	
On maternity leave	308 (43.2)	155 (58.9)	P<0.001
Housewife	237 (33.2)	73 (27.8)	
Education/Training	12 (1.7)	4 (1.5)	
Unemployed	96 (13.5)	18 (6.8)	
Age category			
<20	41 (5.6)	13 (4.9)	
20 – 24	173 (23.7)	54 (20.2)	P=0.21
25 – 29	227 (31.1)	75 (28.0)	
30 – 34	172 (23.6)	68 (25.4)	
≥35 years	116 (15.9)	58 (21.6)	
Level of education			
Left school ≤16 years	248 (34.4)	64 (24.1)	
Did not leave school <16 years	472 (65.6)	202 (75.9)	P<0.001
Pregnancy planning			
Planned	432 (61.6)	172 (68.0)	P=0.07
Unplanned	269 (38.4)	81 (32.0)	
Parity			
Nulliparous	347 (48.1)	140 (52.8)	P=0.19
Multiparous	374 (51.8)	125 (47.2)	

*χ^2 p-value reported for difference in proportion across groups

Women from the 5th IMD quintile who responded to the free-text question were more likely to report that they were dissatisfied overall with their antenatal, labour and birth and postnatal care and support (Table 56).

Table 56. Care characteristics of respondents and non-respondents to the free-text question amongst IMD 5

Variable	Did not respond to free-text (%)	Did respond to free-text (%)	χ^2 p-value*
First antenatal visit <12 weeks gestation			
No	116 (16.2)	39 (14.7)	P=0.57
Yes	602 (83.8)	227 (85.3)	
Had antenatal care			
No	26 (3.6)	8 (3.0)	P=0.65
Yes	703 (96.4)	260 (97.0)	
Overnight antenatal hospital admission			
No	558 (76.1)	211 (79.0)	P=0.34
Yes	175 (23.9)	56 (21.0)	
Transferred during labour			
No	594 (91.0)	210 (86.8)	P=0.07
Yes	59 (9.0)	32 (13.2)	
Mode of delivery			
Normal vaginal	473 (67.0)	156 (59.1)	P=0.06
Instrumental	73 (10.3)	38 (14.4)	
Caesarean	160 (22.7)	70 (26.5)	
Had postnatal check-up			
No	154 (21.1)	71 (26.4)	P=0.07
Yes	577 (78.9)	198 (73.6)	
Overall satisfaction with pregnancy care			
Satisfied	671 (91.4)	204 (76.1)	
Dissatisfied	14 (1.9)	34 (12.7)	P<0.001
Indifferent	49 (6.7)	30 (11.2)	
Overall satisfaction with care during labour and birth			
Satisfied	647 (89.0)	202 (75.7)	
Dissatisfied	31 (4.3)	40 (15.0)	P<0.001
Indifferent	49 (6.7)	25 (9.4)	
Overall satisfaction with postnatal care			
Satisfied	600 (82.3)	156 (58.2)	
Dissatisfied	58 (8.0)	63 (23.5)	P<0.001
Indifferent	71 (9.7)	49 (18.3)	

*χ^2 p-value reported for difference in proportion across groups

FINDINGS

The free-text responses were largely negative, with more than 50% of the written responses being entirely negative in their tone and content. The remaining responses were either entirely positive or mixed. The responses were typically between half and one full A4 page in length. However, positive experiences were often expressed only through single words ("fantastic", "excellent" for example). The women who expressed having had a negative experience generally wrote more, with a greater proportion of 2 and 3 page responses amongst the negative text responses. Although there was a broad range of experiences and events discussed, the coded content of the responses consistently fell within the themes outlined below. There were no cases that deviated sufficiently from these themes to warrant separate consideration. Table 57 shows the overall themes and corresponding sub-themes.

Table 57. Themes and corresponding sub-themes

Themes	Sub-themes
Communication, respect and emotional support	Reassurance, empowerment and respect
	Tailoring communication and care to individual patient needs
	Listening to and trusting patients
	Providing the opportunity to discuss unexpected or unforeseen events
	Involvement of partners and husbands
Antenatal care and preparation	Antenatal preparation and education
	Lack of reliability of healthcare professionals
	Continuity of care
Labour and intrapartum care	Support in early labour
	Traumatic birth experiences
	Pain relief
	Staff competence, skill and knowledge
	The role of student midwives
Breastfeeding support and education	Pressure to breastfeed
	Support in the very early stages of breastfeeding
	Seeking additional support and assistance

Table 57 *continued*

Themes	Sub-themes
Postnatal support and follow-up	Feeling neglected on the ward
	Need for greater assistance with basic baby care on the ward
	Contrast in care: NICU/SCBU vs postnatal ward
	Quality of care after hospital discharge
	Conflicting advice from health visitors and midwives
	Routine postnatal check-up
The National Health Service and maternity services	Women's experiences in relation to specific hospitals
	Staff shortages and system pressures
	Hospital hygiene

Communication, respect and emotional support

The most dominant and frequently-mentioned theme related to women's experiences of communication with and between health professionals, their perspectives on how they were treated, the level of respect they were shown and the emotional support they were offered by health professionals during their pregnancy, labour and birth and the postnatal period.

Reassurance, empowerment and respect

There was a strong thread throughout the responses relating to reassurance and empowerment. Women were more likely to report having had a negative experience when they felt they had been ignored, dismissed or treated like a child by the midwives and doctors caring for them, compared to women who had not experienced this treatment. This seemed to be most acutely felt during the early stages of labour and the early postpartum period when women typically feel very uncertain, vulnerable and often anxious.

There were a number of women who reported feeling very nervous in early labour and in need of reassurance after calling their midwife or the ward or presenting to the hospital labour ward, but were instead treated with a lack of respect and felt they were not properly listened to and assessed.

> "...when I first went into labour, the staff were rude and unhelpful and I thought it was thoughtless as it is pretty scary to go into labour for the first time and not be given support" *(White, age 26, primiparous)*
>
> "I felt that despite having what some would class as 'obvious' signs of labour, the staff were too quick to send me home...having diagnosed 'false labour' twice it was amazing how quickly it became 'silent labour' once the baby was born" *(White, age 32, primiparous)*
>
> "When the midwife finally returned my calls I was consistently told I was not in enough pain to be in labour...I was given no help and no advice and was left alone until the final stages of labour…" *(White, age 33, primiparous)*

During labour, many women felt poorly reassured and only 'vaguely cared about', and found this lack of support and encouragement very distressing:

> "I would have appreciated a midwife with me constantly, monitoring me and reassuring me that everything was alright" *(Asian, age 31, multiparous)*
>
> "…during labour I felt I wasn't cared about...it was a first experience for me so I was scared and nervous to start with and I just felt like no-one really cared" *(White, age 24, primiparous)*
>
> "During labour, patient care and reassurance was woefully inadequate and this resulted in a lot of stress to myself and my husband" *(White, age 35, primiparous)*
>
> "The midwife during labour made me feel very uncomfortable and like she had somewhere better to be" *(White, age 24, primiparous)*

Several women emphasised the long-term impact that poor treatment in hospital had on their memory of the whole labour and birth experience.

> "…most of the professionals I saw were fantastic, but the odd 2 or 3 people that were rude, insensitive and disrespectful ruined my whole experience, which I presume would be the case for many women at such a special but vulnerable time" *(White, age 33, multiparous)*

> "I and my husband felt sad and disappointed after the birth of our child for a couple of months in the way we were treated by the acting midwife in the labour ward. The midwives' treatment made things much worse than they needed to be for us…" *(Asian, age 32, multiparous)*

In contrast, women who were spoken to in a respectful manner, given timely advice and reassurance and offered more individualised care seemed to look upon their labour and birth experience much more positively. One woman wrote extensively about the excellent care she had received in hospital:

> "From my personal experiences, they [the midwives] are warm, friendly and extremely helpful people, they are good at their jobs and they help you to relax by having general conversations, it makes you feel comfortable. They also treat you as an individual and this puts you at ease with them" *(White, age 20, multiparous)*

Having a midwife that provided a calm presence and consistently showed patients respect and understanding was evidently appreciated by women during labour.

> "…the midwife during labour was fantastic – she stayed with us throughout, made us laugh, was very reassuring to both me and my husband...she talked me through my options and kept calm – it made labour a very positive experience" *(White, age 29, primiparous)*
>
> "I was very lucky to have the midwife I had to deliver my baby as she was very friendly and reassuring" *(White, age 21, primiparous)*

It was clear that women had the greatest respect for the midwives and doctors that they felt were professional in their manner and approach to patient care and this also resulted in more positive birth experiences. A number of women reported that their experiences were "amazing, supportive and professional" and that they "could not have asked for a more professional yet supportive team of people". Feeling that they were subjected to 'sloppy patient care' seemed to have a highly negative impact on women's experiences in hospital.

Following the birth of their baby, a large number of women reported feeling that the health professionals caring for them were insensitive to their needs and failed to provide the comfort and hands-on support they needed.

> "I feel midwives and doctors should be more tolerant and calm, understanding towards patients as they have just been through a great ordeal of having a baby…" *(Asian, age 32, multiparous)*
>
> "…the doctor was very pushy...he upset me and made me feel as if I was a child the way he talked to me" *(White, age 24, primiparous)*

Whilst recovering from a procedure (manual removal of placenta) and needing additional support and comfort, one woman wrote that she and her husband:

> "…found the staff to be a little insensitive after this...making remarks that we wouldn't be having anymore children after this. This resulted in me feeling like what had happened was my fault and that I shouldn't have more children" *(White, age 25, multiparous)*

Feelings of isolation, abandonment and perceived 'inconvenience' were often interwoven with women's experiences of reassurance. Several women specifically described how the staff made them feel during the early postpartum period:

> "…[they were] rude, unsympathetic and I felt like I was an inconvenience to them" *(White, age 25, multiparous)*
>
> "…midwife was very stressed, constantly complaining that she did not have a break throughout her shift…" *(Asian, age 28, primiparous)*
>
> "When I was taken back to the ward after my caesarean I was just left on my own and made to feel like a nuisance if I called for a nurse" *(White, age 25, primiparous)*
>
> "Because my baby was in special care I was left in a ward on my own. The nurses rarely came and made me feel like a nuisance when I asked about my baby who was in the opposite end of the hospital and I couldn't get there" *(White, age 25, primiparous)*
>
> "I personally think there should be an investigation on how the patients are treated while still in the hospital – myself and 2 other mothers were appalled at the aftercare" *(Other ethnic minority, age 31, multiparous)*

When told that her husband couldn't stay in hospital as it was against hospital policy, one woman asked:

> "Is it policy to leave a first-time mother exhausted, frightened and feeling like an inconvenience?" *(White, age 31, primiparous)*

On the postnatal ward, many women who experienced poor support and understanding or felt they were treated like children and given less one-on-one time with staff tended to reflect very negatively on their experiences. Several women reported feeling completely disempowered after calling for additional help on the postnatal ward, having experienced belittling treatment from health professionals:

> "I would press the nurse button to call a member of staff and be told off! At least on one occasion a member of staff left me in tears which still upsets me" *(Asian, age 23, multiparous)*
>
> "The postnatal midwife was very patronising, bossy and pushy...I couldn't ask her a question without her patronising remarks, making me feel stupid" *(White, age 20, primiparous)*
>
> "…a few times while I was in hospital I felt like I was being treated like a child and being told off for doing something or not doing something" *(White, age 23, primiparous)*
>
> "I found the consultant in charge of my care at the hospital rude, full of self-importance and she spoke to me like I was a child" *(White, age 33, multiparous)*

There was a sense that many women felt that the care and respect they received in labour was far greater than that offered on the postnatal ward:

> "The contrast between staff in the labour ward and the postnatal ward was vast…in the latter it felt like being on a conveyor belt, staff assumed you know how to feed, change a baby and made you feel stupid if you had to ask. Being treated like an individual rather than just another mother who's had a baby would count for a lot" *(White, age 32, primiparous)*

It seemed that the attitude of postnatal midwives was unpredictable however, with stark variation in women's experiences of the quality of postnatal care they received, even from different midwives on the same ward:

> "The care I received was excellent and I was very impressed with the amount of time and concern I was given" *(White, age 29, primiparous)*
>
> "…postnatal care was varied...some midwives were supportive and willing to listen, others could only be described as disinterested" *(White, age 43, multiparous)*

<u>Tailoring communication and care to individual patient needs</u>

There were a number of first-time mothers and women having their second or third children who reported specifically on the way they were treated and spoken to as a result of their parity, with health professionals either assuming too much or too little about their level of confidence and their needs. Overall, first-time mothers clearly reported that they had wanted to receive more care and consideration, in addition to more practical information.

> "I felt stupid to ask questions and at times I felt like I was just another mother not a first time mother" *(White, age 28, primiparous)*
>
> "…during pregnancy I felt I was not given enough information from my midwife considering I was a first-time mum, and found out most things by myself" *(White, age 25, primiparous)*
>
> "This is my first child so at first I felt as if I shouldn't have done certain things because of lack of experience and some of the hospital staff made me feel as though I was in the wrong" *(White, age 23, primiparous)*

One woman who felt she had had excellent antenatal care and clearly appreciated the level of attention she had received as a first-time mother wrote:

> "As this was my first pregnancy I was quite nervous and not sure what to expect during the pregnancy...all the midwives were exceptional and took time to explain and answer any queries" *(White, age 29, primiparous)*

In contrast, the responses from women having their second or third child were much more varied in how they expected or wanted to be spoken to, with some women wanting just as much support and reassurance as first-time mothers and others wanting their level of experience to be acknowledged and to be spoken to with respect and understanding. This feedback highlighted the importance of recognising individual patient needs and tailoring care and communication to meet those needs.

> "…the midwife said in a very patronising tone 'this is your 3rd baby, you should know when you're in labour, and you're not'" *(White, age 28, multiparous)*
>
> "I feel I had more home visits first time round and it doesn't follow that simply because you've had a baby before you're suddenly an expert and in need of less care/attention... I felt that my midwife was over-eager to pass me to the health visitor team…" *(White, age 36, multiparous)*
>
> "…because this was my third baby I did not need as much support as someone having their first child, however I did feel at times that some health professionals tend to treat everybody the same so I felt as if they were talking to me as a first-time mum...because I'm a stay at home mum, I sometimes had the impression I was being spoken to on a basic level and I felt I had to prove my intelligence so they would communicate with me more appropriately…" *(White, age 42, multiparous)*

Tailoring care to meet patient needs extended beyond the context of parity to encompass women who were in need of additional support and understanding from health professionals due to social circumstances.

> "I don't have contact with my mum and some midwives can be rude...I think they should sometimes remember they are some peoples only support during pregnancy and take care not to make individuals feel alone and isolated" *(White, age 26, primiparous)*
>
> "I was receiving counselling for depression and on no occasion did the midwife discuss this with me to see if I was ok...I even tried to tell her about it but she didn't seem too bothered…" *(White, age 24, primiparous)*

Listening to and trusting patients

A number of women expressed a sense of betrayal and disappointment at not being properly listened to by their health professionals at various stages and consequently experiencing an event or outcome that they felt could have been avoided. These women clearly felt that their opinion or concerns had been dismissed and that they were not given adequate explanation, assessment and reassurance.

> "I feel the condition I had could have been detected earlier if the midwives I saw at my GP had listened to me before it got so bad I had to be induced…" *(White, age 24, primiparous)*
>
> "They didn't do as I asked and I could feel everything...I couldn't go to the toilet for a month and half and had to sit on a rubber ring as they stitched the wrong place. And they would not stop when I asked, one midwife told the one that was doing the stitches to carry on when I said not to...I was and still am in pain" *(White, age 19, primiparous)*
>
> "…my son was born with SWCAH [Salt Wasting Congenital Adrenal Hyperplasia] and it took five trips and a very poorly baby for them to discover this...I was told I just had a sickly baby...if we had not have been so persistent he would have died" *(White, age 28, multiparous)*
>
> "I had quite nasty chest pains which I had in my previous pregnancy as well. The consultant did not do any investigations about that as it was done in my previous pregnancy...I thought she should have as it could be anything different from the previous time" *(Asian, age 27, multiparous)*

Traumatic birth experiences and communication

Almost all the traumatic experiences mentioned by women related to their labour and birth. There was a strong sense that the communication from health professionals at the time of the event had a major impact on women's impression of how bad or traumatic the episode was, and certainly influenced their perspective of their whole birth experience.

One woman was highly traumatised by her interactions with one doctor during labour and felt that she had been mistreated and subjected to very poor communication. This woman felt that she had not been given an adequate explanation for the management administered, and seemed to be much more distressed and upset by the inadequate communication than by the labour ending in an emergency caesarean:

> "When I was put in an assessment room I was seen by one of the doctors and was placed on a monitor with straps around my belly. This was not explained why and due to me being in pain I was very constricted and couldn't move. The doctor looked at the monitor and rudely advised me I was not having contractions...this left me feeling worried and unsupported. A midwife later advised me that the monitor had just been misplaced on my belly and wasn't picking them up. My labour was long and ended in emergency c-section...I do feel that the belt monitor restricted my movement and contributed to my failing to progress...I asked about the monitor several times but was never told why I was on it" *(White, age 33, multiparous)*

Another woman's account of her experiences emphasised that poor communication tends to have an even greater negative impact in stressful situations compared to when all is going to plan:

> "I was only in hospital 50mins before having an emergency section – the midwife, though aware of the problem, could not be easily found when the problem worsened then behaved in a rude, abrupt way – the staff were all panicking around me which frightened me badly...it was one of the most traumatic experiences of my life" *(White, age 40, multiparous)*

There were several other women who had experienced traumatic events, of varying severity, and were deeply disappointed with the lack of care and attention they were given and again, the inadequate communication received.

> "…the only bad part of my experiences was with one doctor that examined me shortly after arriving at the unit. She not only hurt me to the point of me crying during her examining me, she also did not say a word to me. She did not explain why she had to repeat the examination that the midwife had already done...soon after she finished the examination she left the room without saying a word to me" *(White, age 20, multiparous)*

> "The clinical team were rude and spoke in their own language...[after repair of vaginal tear] I was left shaken and traumatised, they didn't even wait until the drug had made me numb to continue stitching, I yelled repeatedly to stop but they carried on ignoring me…they have violated my trust leaving me shaken and traumatised" *(Asian, age 21, primiparous)*
>
> "Had I received the care and consideration expected from a midwife, I believe this [traumatic birth experience] could have been different. It will be months, maybe years before I am back to normal" *(White, age 34, multiparous)*

One woman reflected on feeling 'bullied' into her care and seemed to feel out of control during her labour when the midwife called for additional help. It seemed that this experience was largely due to the absence of clear communication from any of the health professionals caring for her.

> "In the late stages of labour my midwife called an obstetrician for advice. After two pages there was no response so they hit the 'panic button'. This resulted in a speedy response although the sheer number of doctors made me feel insecure and worried. At this stage I felt bullied into my care…" *(White, age 36, primiparous)*

In contrast, there were a number of women who experienced traumatic events, but who received high-quality care, were given appropriate information and the opportunity to discuss the event subsequently with their midwife or doctor. Their reflections on the experience were significantly less negative and devoid of anger, emphasising that patients' can be much more accepting of outcomes, adverse or otherwise, when provided with adequate explanation and allowed to reach an appropriate level of understanding of the circumstances.

> "As my labour did not go entirely to plan (!) ~ more medical intervention etc ~ I do feel very grateful to the staff at the hospital for allowing us the time to come to our own conclusions...and I believe this ultimately had an effect on the positive outcome for me of the labour" *(White, age 32, parity unknown)*

Providing the opportunity to discuss unexpected or unforeseen events

Although there is some controversy surrounding the efficacy of true 'psychological debriefing' and the merits of early vs later counselling and single vs repeated sessions (Rose et al 2009), the majority of women who experienced unforeseen or adverse health outcomes in this survey population seemed to place great value on receiving considered explanations of the events and being given the opportunity to discuss what happened to them with the health professionals caring for them. In obstetrics, where adverse outcomes can be highly unpredictable and potentially life-threatening, the process of de-briefing is particularly important.

A number of women suggested that they were 'suspicious' about the circumstances surrounding the adverse outcome they experienced, leading to a loss of trust in the team of health professionals caring for them and a negative perspective of their birth experience more generally. This sense of suspicion and the ensuing loss of trust seemed to result directly from a paucity of communication, in particular the absence of any opportunity to have a discussion with their doctors or midwives at an appropriate interval after their birth, and ask questions surrounding the events.

> "I was told I needed to have my baby early due to small size, lack of fluid and decay in the placenta but when she was born she was a perfect size for 31 weeks and on examination the placenta was fine so I felt I was mistreated" *(White, age 25, primiparous)*
>
> "We feel we were not properly informed about how my situation after birth resulted the way it did. There was a lot of panic and indecisiveness and we were never really given an explanation for why two separate, large pieces of placenta were left inside me and why I wasn't taken to theatre sooner" *(White, age 25, multiparous)*
>
> "…[weeks after birth] they found out I had retained placenta and I was given an emergency operation. The only thing the doctors told me later was that this kind of thing happens sometimes, which I don't think so, it was just a mistake they're trying to cover up" *(Black, age 28, multiparous)*

A number of women received standard care for their particular condition or situation but seemed to have not been given adequate explanation as to why such a procedure had to be followed, the risks of alternative management and implications for future pregnancies.

> "My baby was breech and I felt fairly forced to have a caesarean as it was 'best for baby' but very little information was given to me on other options, even though I did ask" *(White, age 31, multiparous)*
>
> "As I had pre-eclampsia and emergency caesarean I would have liked more information about the dangers or likelihood of this happening again and if it would have been possible to self-elect future caesareans" *(White, age 35, primiparous)*
>
> "My labour was long and ended in an emergency caesarean due to failure to progress – but I do feel that due to me having to be on a belt monitor the whole duration this restricted my movement and contributed to my failure to progress. I asked about the monitor several times but was never told why I was on it" *(White, age 33, multiparous)*

Involvement of partners and husbands

It was clear throughout the text responses that women who had a partner or husband greatly appreciated their involvement, and in particular, the effort made by health professionals to include them in conversations and care planning. Women who felt that their partner or husband had been appropriately acknowledged and included by the treating team generally had much more positive reflections on their care and their interactions with health professionals. This feedback was limited but was most frequently mentioned in the context of antenatal care and care throughout labour and birth.

Unfortunately, the majority of women who mentioned the involvement of their husband or partner felt that they had been either ignored or neglected, and this was particularly distressing for women when there had been an adverse outcome and their partner/husband received inadequate information or support.

> "…my partner came to all but one of my appointments. Every time we saw the midwife at the GP surgery, we both felt like he was ignored" *(White, age 23, primiparous)*

"…during this time [antenatal care] my husband was completely ignored" *(White, age 25, primiparous)*

"…she [the midwife] was impolite and unwilling to give any answers to my husband's questions...she made my husband feel very uncomfortable, even scared" *(White, age 32, primiparous)*

"I think Dads should be checked after the labour as my fiancé was left for 3 hours holding our newborn whilst I was in recovery..." *(White, age 26, primiparous)*

"My partner was left alone in the delivery suite while I was in theatre, he was told that the operation [manual removal of placenta] would take about an hour, but two hours later no-one had been to inform him how things were going...he had to find staff to ask himself" *(White, age 25, multiparous)*

"My partner would like you to know the stress he was under whilst I was being treated in such a dismissive way, it made things very hard for him, seeing me so scared" *(White, age 31, primiparous)*

Antenatal care and preparation

Having found from the quantitative analysis that the odds of women having had any antenatal care, being able to see a health professional as early as desired in their pregnancy and seeing a health professional for their initial consultation prior to 12 weeks gestation were significantly reduced with lower socioeconomic position, it was of great interest whether the qualitative analysis reflected these findings. Indeed, inadequate antenatal preparation and support, a lack of reliability of antenatal midwives and poor continuity of care were the strongest sub-themes to emerge in relation to antenatal care and preparation and suggested that the poor antenatal attendance and care amongst this socioeconomic group were more likely to have resulted from poor quality of care than from inadequate access to services.

Antenatal preparation and education

There was a clear sense throughout the responses that women generally wanted antenatal care and sought it out, but that they felt frustrated at the barriers they faced and the lack of interest they were shown by health professionals. The major issues expressed related to women not being able to see their midwife when they wanted, not feeling comfortable to ask questions (especially of a personal nature) and not receiving adequate information and education during their appointments.

> "Whilst pregnant I could not see a midwife when I needed" *(White, age 23, primiparous)*
> "during my pregnancy I felt unsure and scared...I wish I had been given more appointments" *(Other ethnic minority, age 28, primiparous)*
> "She (midwife at GP surgery) didn't make me feel comfortable...I didn't feel that I could talk to her about any queries I had or any worries I may have had" *(White, age 24, primiparous)*
> "My midwife never had time to answer all important questions, she used to say 'next time we can talk about it'...unfortunately it was never next time" *(White, age 32, primiparous)*
> "…it felt like going straight in and out and on to the next person, there was not time for a chat or to explain anything" *(White, age 24, multiparous)*
> "At my 38 week check I had expected a detailed discussion of onset of labour and a chance to ask questions or concerns. The midwife checked my BP and any engagement then started writing the notes 'client feels well and FHH via Doppler 120-127bpm. Client aware of signs of labour to contact delivery suite if in labour'. This was written before I had been asked anything except to lie down for monitoring...I was incensed by this as I had expected to be asked about my birth plan and if I knew what to expect" *(White, age 31, multiparous)*

Amongst the women who mentioned a paucity of antenatal care or education, there were several who proceeded to discuss their birth experience and who clearly felt unprepared, overwhelmed, scared and highly anxious. This may have been due to a multitude of other factors but it does not seem unreasonable to suggest that poor antenatal preparation may have resulted in less acceptance of birth experiences that didn't "go as planned" or of true adverse outcomes.

> "I would be glad if I was provided with information about other mothers' experiences during labour – I didn't know it was normal to bleed before labour (was it called a 'show'?) and I didn't know what labour was like, my midwife kept saying 'every woman is different, every baby is different' but I just needed an idea/example" *(Other ethnic minority group, age 25, primiparous)*

There were many women who clearly felt that their antenatal care was purely an administrative process of filling in forms, without an appropriate amount of time or effort dedicated to patient care and education. One woman wrote:

> "I did not feel that the antenatal care provided by midwives was thorough enough...literally ticking boxes in the blue notes...I eventually arranged a consultant appointment for myself as reassurance. I feel that had I had a dedicated and more competent midwife for most of my antenatal checks, I would not have needed additional medical support or information... antenatal care in the UK has been structured in such a way that completing forms, ticking boxes and carrying out screening tests have taken precedence over dedicated and informed care. In my experience, the quantity both in terms of amount and duration of antenatal checks was sufficient but the quality was lacking" *(White, age 31, multiparous)*

One woman aptly captured the importance of health-seeking behaviour in her comment about antenatal care:

> "Overall I felt pretty well looked after and cared for but I do think this is partly to do with my own efforts in finding information and understanding processes" *(White, age 32, parity unknown)*

Lack of reliability of health professionals

Reliability and accessibility of midwives was another dominant concern expressed by a number of women, with several references to cancelled appointments and many references to difficulty getting in contact via telephone once already assigned to a midwife. The inability to contact midwives by phone was obviously distressing for many women, particularly after an unexpected event or symptom and a number of women were obviously disappointed by their midwives lack of follow-up.

> "…there was one stage when I rang the midwife and asked her to call me back (left a message) as I had concerns, it was 4 days later when she called me, by which stage I had already gone to the local PAU (Pregnancy Assessment Unit) to be checked" *(White, age 29, multiparous)*
>
> "At 13 weeks I had a big bleed. I had no number for my midwife so was rushed straight to hospital...luckily everything was fine. I managed to find a number for my midwife and called and left a message but no call came back from the midwife and no questions about how I was when I saw her next – I found this sad and upsetting that she didn't seem to care" *(White, age 30, multiparous)*
>
> "My allocated midwife was very unhelpful. I didn't see her much and she cancelled appointments" *(Black, age 20, primiparous)*
>
> "It was difficult to contact a community midwife because there was difficulty with anyone answering the phone" *(White, age 27, multiparous)*
>
> "I had a few worries during my pregnancy but found it very difficult to get hold of any midwives so I had to go to the doctor every time I was worried about anything" *(White, age 22, primiparous)*
>
> "I always found my midwife to be helpful however she provided me with a contact number in case of emergency and the three occasions I tried to contact her I always found her to be switched off with no voicemail facility" *(White, age 25, primiparous)*
>
> "On several occasions official errors were made regarding my appointments causing me and my partner to take time off work and travel to the clinic only to find out there had been an error" *(Other minority ethnic group, age 36, multiparous)*

Continuity of care

There were no responses relating to continuity of care amongst the women who reported entirely positive experiences. This may have been because they had experienced better continuity of care or simply because their positive outcome had masked possible concerns they might have had about not having received ongoing and consistent care from the same team.

Amongst those reporting negative and mixed experiences however, a lack of continuity of care was mentioned by a large number of women as impacting negatively on their experiences of antenatal and labour care. These women clearly felt frustrated and disappointed by having to explain their story over and over again to different health professionals. Amongst the women who experienced adverse events the lack of continuity of care featured prominently in their responses.

> "In total I saw 5 midwives so I could not build a nice relationship with her and felt I was left to get on with it...I did not have a phone number for her either so I could not ring when I had any concerns" *(White, age 25, primiparous)*
>
> "During pregnancy I would have wished to have access to care by the same team. I always saw a different midwife, therefore I had to repeat always the same things" *(White, age 37, primiparous)*
>
> "My biggest complaint is the inconsistency, you can find a midwife who is lovely and helpful and others are detached and rushed with no intention to help – part of the problem is that you never see the same midwife so no relationship can be built, you feel that mostly they are just filling in forms" *(White, age 36, multiparous)*
>
> "I felt in my care the most irritating thing was the different number of midwives [I saw] during my pregnancy. How can I build a relationship of trust if I never see the same person again? I had to keep explaining things over and over again to different midwives" *(Asian, age 33, multiparous)*

A number of women mentioned feeling sorry or disappointed not to have someone familiar caring for them during labour, at a time when they needed it most.

> "I would have really appreciated the support and consistency of someone who would have known us throughout the span of my pregnancy" *(White, age 32, parity unknown)*
>
> "…please think about increasing continuity of care – it would be reassuring to be able to meet the labour ward midwives before being in labour, even if they aren't responsible for antenatal care" *(White, age 37, multiparous)*
>
> "…you have the same midwife for almost 8 months and when you need help the most you have it by a different midwife" *(White, age 28, multiparous)*

One woman felt that she would have appreciated having postnatal follow-up and care with the same midwife that had cared for her antenatally:

> "The aftercare I received from the midwives was good however I would have liked to have had my own [antenatal] midwife visit as I had built up a relationship with her during the 9 months of pregnancy" *(White, age 28, primiparous)*

Labour and intrapartum care

Generally, women felt as though they had been treated well during labour with the experience described by many women as "amazing", "excellent", "brilliant" and "as good as labour could be". Despite this, there were several main themes that emerged from the data as genuine concerns for women and in most cases, impacted significantly on their experience of labour and birth.

Support in early labour

In the early stage of labour, many women mentioned their fear and sense of vulnerability and their disappointment at the lack of care they'd received, mostly in not feeling as though their midwife had properly listened to their concerns. Several women's responses illustrated this experience very clearly:

> "The day before I gave birth I was experiencing a constant pain in my abdomen and a lot of mucous with more blood than usual was gushing out. Out of mere concern I

telephoned my midwife and told her, she replied with 'it sounds like you've had a show but don't go to hospital, if you go into labour ok otherwise I'll see you on Thursday'! She was so unhelpful and if I had listened to her I would have had my baby at home" *(Black, age 20, primiparous)*

"The only thing that let it (my pregnancy experience) down was the assessment clinic when I first went into labour. The staff were rude and unhelpful and I thought it was thoughtless as it is pretty scary to go into labour for the first time and not be given support" *(White, age 26, primiparous)*

There was a number of women who had called the hospital or their midwife in early labour and had been told not to worry as they didn't seem to be in 'proper' labour, but who subsequently went on to have their baby at home. These stories emphasise the significance of women's instinct in labour and the need for health professionals to trust patients' own judgement.

"…'it's your first baby, you don't know what labour is like, take a couple of paracetamol and call back in an hour'....my baby was born 20 minutes later, hypothermic and not breathing...it was a very distressing time, it was 25 minutes before the ambulance arrived" *(White, age 38, primiparous)*

"I wasn't that impressed with the maternity unit as I went in once I had a show, was having contractions very close together but they sent me home and within an hour my waters had broken and I ended up having my baby at home...I should have been in hospital...speaking to other mums there had been a lot of mums having babies at home because they had been sent home...don't think this is very good!" *(White, age 36, multiparous)*

"They sent me home despite telling them I was in a lot of pain...contractions came thick and fast at home and my partner called the hospital again and they asked him if I could wait a few more hours! He said he wanted someone to come and see me but they said no-one was available now...I felt the baby coming and my partner called the ambulance, they arrived just as the head was emerging" *(White, age 25, multiparous)*

"At my 40+4 check-up I asked for a sweep, on examination I was 4cm dilated but was still sent home...as a result my baby was born in my living room...I just thank God there were no complications" *(White, age 33, multiparous)*

Pain relief

Pain relief was a theme that arose several times in the context of labour and birth and was closely associated with women's experiences of feeling traumatised and 'out of control'. In each case, women expressed feeling as though they had either been deprived of pain relief altogether, had not been offered appropriate pain relief options or had been 'bullied' into making a decision that was not what they wished for. There was a general sense amongst the responses that midwives were, overall, "reluctant to offer pain relief".

> "I feel that even though the epidural is given as 'an official' choice for pain control midwives have a sort of attitude that makes you feel bad for wanting one. You certainly have to be extremely determined to have one in order to get one...I had an epidural and it was great...I think the epidural should become a lot more available than it is at the moment" *(White, age 29, primiparous)*
>
> "Why is appropriate pain relief [epidural] seen as optional?" *(White, age 40, multiparous)*
>
> "The midwife acted like I asked for $1000000 when I asked for stronger pain relief and she refused" *(White, age 27, multiparous)*
>
> "My labour was awful...I was refused an epidural as not enough staff and I will never have another baby due to this" *(White, age 29, multiparous)*
>
> "During the contractions I was really in pain, I couldn't cope with it and was waiting for 3 hours or more for an epidural. I was bleeding and full of fear when they kept telling me that there wasn't the room to do the epidural" *(White, age 26, primiparous)*
>
> "I coped for so long without pain relief even though I wanted it because no-one came to check my progress. My mum finally got a midwife to come and check me and I was 8cm dilated..." *(White, age 24, primiparous)*
>
> "It [labour] was the worst experience of my life..all the consultant orders to provide epidural and medication were ignored by the midwife" *(Asian, age 35, multiparous)*
>
> "I was advised by my consultant to be given epidural during labour [due to medical conditions]...when I was taken into the labour room in the delivery unit led by consultants/doctors there were no doctors only midwives. I was not given an epidural and my BP was shooting up with the pain. Then I was given gas and air which was not working for me" *(Asian, age 35, multiparous)*

One woman questioned the purpose of having a birth plan and preparing for labour if patient requests are just ignored on the day:

> "I discussed my birth plan with my midwife at home and she recommended I ask for the diamorphine when I first arrive and also use gas and air...upon arrival I did this and was told I must try gas and air first even though this was not what I had planned. What is the use of a birth plan if it is dismissed?" *(White, age 27, primiparous)*

Staff skill and competence

Closely related to the accounts of traumatic birth experiences was the theme of staff competence and skill. Women's feedback on traumatic events was frequently related to their feeling that the outcome could have, or should have been avoided. Having endured an outcome or event that they considered to be avoidable, they were left questioning the skill and competence of the health professionals caring for them.

> "My midwives did not realise my baby was breech until I was 7 days over my due date. I was not pleased with this as I could have had a c-section much earlier than 41+2 weeks" *(White, age 32, primiparous)*
>
> "I had an undiagnosed breech baby despite having seen the midwife 2 days before giving birth – this should have been discovered before I went into labour – I was 10cm when I arrived at hospital in labour, I was examined and it was only then that the breech position was detected...I was then rushed into theatre which I found very distressing" *(White, age 33, primiparous)*
>
> "I felt let-down about the type of labour I had as during my pregnancy the midwife had stated that she thought it was a big baby but they still let me go two weeks over, meaning I had a 10lb 2oz baby and had a horrendous time....so bad I don't think I would have another, which is upsetting since I always wanted a big family" *(White, age 22, primiparous)*
>
> "At 10cm I started pushing and I could feel something was wrong but my midwife kept telling me there wasn't...after 1 hour and 45 mins pushing I finally saw a doctor who informed me my baby was stuck and in a difficult position and couldn't possibly be born without help!! After 39 hours of labour my baby was finally born with forceps...I felt neglected or like no-one cared" *(White, age 24, primiparous)*

"I also want to mention the incompetence of the doctors who dealt with me during labour. I got 3 epidurals and not even one was given to me properly" *(White, age 32, primiparous)*

"Concerning my baby's birth injury which I think is negligent because they knew the baby was big, they should have offered my caesarean to prevent this Erb's palsy which she sustained" *(Black, age 29, multiparous)*

"Overall my labour was great although I had problems after the midwife didn't explain why my placenta got stuck or the procedure used to remove it or why they tore me" *(White, age 20, primiparous)*

<u>The role of student midwives</u>

Interestingly, a number of women mentioned the involvement of a student midwife during labour as having greatly enhanced their experience. Student midwives on labour ward would rarely be assigned more than one patient to care for per shift and as such, are able to provide one-on-one, consistent care throughout labour. The comments from women about student midwives highlighted the significance of having continuity of care not only during the antenatal period but also during labour.

"The student midwife who led my delivery was fantastic" *(White, age 26, primiparous)*

"I was pleased with the student midwife who was also there during my labour/birth who was very supportive…she made me feel comfortable" *(Black, age 31, primiparous)*

"One of the things I recommend to everyone is having a student nurse (midwife). If I hadn't had one with my first birth I truly believe I wouldn't have made it into a room before labouring! I do not think student midwives get enough thanks" *(White, age 23, multiparous)*

Breastfeeding support and education

In the UK, the Department of Health "promotes breastfeeding as the preferred method of infant feeding", however initiation rates are low and attrition rates at 6 weeks are high (Campbell 1996, Renfrew 2011).

Pressure to breastfeed

There was a very strong sentiment expressed by many women that they were given no option but to breastfeed, regardless of how successful or challenging they were finding it. Very few women felt that they were encouraged to breastfeed but also offered an alternative if breastfeeding was not proving possible for various reasons. Several women reported that they had persisted with breastfeeding as they felt they had no other option, but when their baby failed to gain adequate weight they were forced to adapt to bottle-feeding without support and guidance, or were readmitted to hospital which was evidently distressing and in their opinion, could have been avoided.

> "I found the NHS was much stronger on 'propaganda' telling you to breastfeed than on offering real help" *(White, age 34, primiparous)*
>
> "Whilst I realise that health professionals are trained to promote 'breast is best', I think it is important to support mothers in their choice whatever that may be" *(White, age 34, multiparous)*
>
> "I feel that too much emphasis is put on women to breastfeed despite this not being suitable for everyone. I think the breastfeeding option is pushed too much onto women and not enough time and support is given to women who opt to bottle/formula feed" *(White, age 29, multiparous)*
>
> "…midwives pushed breastfeeding too much! My baby would not attach and feed and lost quite a bit of weight but rather than support me and advise me to use formula they told me to persist and didn't give options (4 midwives!)" *(White, age 23, primiparous)*
>
> "We were sent home before my baby had fed....he then didn't feed for 3 days and lost a lot of weight...he ended up jaundiced and we had to go straight to hospital" *(White, age 40, multiparous)*

One woman eloquently summarised her experiences with the following passage:

> "Too much pressure is applied (by midwives) in regards to breastfeeding. It is consistent with all midwives, no information is provided on any other form of feeding ie. mixed feeding (breast and bottle) or formula only...An under-researched/rash decision is therefore made when breastfeeding is abandoned as no alternatives have been discussed. I've felt bullied into breastfeeding at all costs....would have preferred some

discussion whilst pregnant on other forms of feeding than just breastfeeding" *(Asian, age 34, multiparous)*

Support in the very early stages of breastfeeding

One of the primary reasons for women feeling under-confident, anxious and overwhelmed by breastfeeding seemed to be the lack of support, guidance, encouragement and one-on-one time provided in the very early postpartum stage when feeding is first established. Feeling alone and neglected, with no other options but to keep trying was very upsetting for women and seemed to impact negatively on their confidence and their postnatal experience generally.

> "I was left to cope alone almost immediately after I gave birth...I was left for 8 hours to cope with feeding my baby every two hours, without any guidance or help" *(White, age 31, primiparous)*
>
> "There is such a big thing about breastfeeding...women need more support with this after the birth it just feels like health professionals just want to tick the 'breastfeeding box' to reach government targets" *(White, age 27, primiparous)*
>
> "Whilst I was in the maternity unit my baby had not eaten for 14 hours and no-one helped me to breastfeed...I had to struggle on my own" *(Asian, age 24, primiparous)*
>
> "Breastfeeding advice needs to improve. No point in just having posters up and 10 people telling different things – every hospital needs one or more breastfeeding consultants, who stays with mother and baby and shows you how to breastfeed!" *(White, age 39, primiparous)*
>
> "I feel I've failed as a mum because I've not been able to breastfeed my son" *(White, age 20, primiparous)*
>
> "No staff to help me breastfeed and when they did, only 5 minutes and different advice each time!" *(White, age 34, primiparous)*

Receiving dedicated and consistent advice had a major effect on women's experience of breastfeeding and those who expressed the most positive feedback had all had a midwife or breastfeeding consultant spend time with them individually until they were confident with feeding.

"We experienced great difficulty breastfeeding this time, my baby lost a lot of weight but all the midwives, doctors and health visitors were very supportive during this worrying and frustrating time. I cannot thank them enough!" *(White, age 40, multiparous)*

Seeking additional support and assistance

Having felt inadequately prepared to continue feeding at home post-discharge, several women reported needing further assistance but not knowing where or how to access community breastfeeding support. Those that did know of services often felt they were inappropriate (breastfeeding cafes) or clearly not well publicised enough.

"…breastfeeding cafes are all very well, but most people will encounter problems in the early days when they may not be able to get out and about" *(White, age 34, primiparous)*

"I needed more help with my breastfeeding. I feel guilty sometimes because I couldn't breastfeed my baby, there was not much help out there" *(Asian, age 36, multiparous)*

One woman who sought out help from a breastfeeding support group was delighted with the help and advice she received, but was the only person to mention accessing this service. It is possible that these services are not widely available, are poorly publicised amongst women in need or are not sought out by the people needing their support.

"I think more care could be given helping breastfeeding mothers, learning how/what works/helps. Luckily for me I called a support group and was given a very helpful book! But if the health authorities want to encourage breastfeeding then more help is needed with feeding technique etc" *(White, age 35, primiparous)*

Highlighting the issue of cost and paying for additional help, one woman aptly wrote:

"We were able to pay for advice, many people would not be so lucky" *(White, age 34, primiparous)*

Postnatal support and follow-up

For many mothers, first-time or otherwise, the early postpartum period is when they need the greatest level of support, encouragement and education. In the absence of adequate family and social supports, midwives and health visitors are the primary source of support for many women during this time. Unfortunately the responses amongst this group of women, the most vulnerable group, were predominantly negative, with concerns relating mostly to feeling neglected on the ward, assistance with the care of their baby and following discharge from hospital, the quality of care in the community, conflicting advice from midwives and health visitors and routine follow-up at 6-8 weeks postpartum.

Feeling neglected on the ward

Women commonly reported feeling very alone and neglected during the first few days or hours after giving birth, especially for those with few social supports. Many women specifically commented that nursing staff on the ward were "rarely around to help". This was a frightening experience and added to the feeling of bewilderment for many women.

> "…the only person who came and talked to me was the cleaner, who arranged for me to get toast and showed me where the toilet was" *(White, age 27, multiparous)*
>
> "You are left to fend for yourself far too much" *(White, age 33, primiparous)*
>
> "I felt forgotten about as no-one came to see me for hours" *(White, age 28, multiparous)*
>
> "I was left to cope with the care of my baby without guidance or help for days" *(White, age 31, primiparous)*

A number of women also reported feeling neglected not because of a lack of staff or contact, but because of the attitude of the midwives caring for them who seemed completely disinterested in their care.

> "After the birth of my son, the midwives remained disinterested in my care. I had to chase them for my medication...there appeared to be plenty of staff at the hospital but their priority did not appear to be patient care" *(White, age 33, primiparous)*
>
> "…the care was the minimum you can get" *(White, age 37, primiparous)*

"Being my first baby I sometimes felt alone and tearful. When I asked for help some midwives seemed uninterested" *(White, age 35, primiparous)*

Not receiving adequate and timely pain relief on the ward was another reason for a number of women feeling neglected in their postnatal care, with a number of women reporting that they had requested pain relief but had to wait several hours before receiving any attention.

"The midwives never came to see me when I needed them and was in pain" *(White, age 23, multiparous)*

Several women expressed tremendous dissatisfaction with the care they had received on the postnatal ward and had discharged themselves early as a result.

"I felt alone and staff rarely came to see me. This is the reason I left the hospital earlier than I felt I should have" *(White, age 24, primiparous)*

Need for greater assistance with basic baby care on the ward

In line with feelings of neglect, many women reported receiving inadequate assistance with basic baby care on the ward. It seemed that many midwives assumed women knew how to bath and even hold their baby, when in fact a great deal more support was required with these things, especially for first-time mothers. Several experienced mothers reported having to step-in and assist new mothers on the ward with caring for their baby.

"…would be nice if someone would give help on best ways to wash and look after your baby" *(White, age 39, multiparous)*

"No-one gave advice on nappies/dressing/holding or anything else even though I was a first-time mum" *(White, age 37, primiparous)*

"I think the hospital staff should ask new mothers if they need help with certain things...I had to ask in the hospital to be shown how to bath our baby" *(White, age 24, primiparous)*

> "I felt that as this is my first baby more time and advice, both verbal and practical needs to be given, everything is new and overwhelming...I was shown only once how to bathe my baby" *(White, age 28, primiparous)*
>
> "The staff did not help me look after my baby eg. did not show me how to change a nappy" *(White, age 28, primiparous)*
>
> "I found I was helping other young mothers to do things (bathing baby etc)...I was lucky as I had already had 2 children that I knew what to do but for a new mother I would hate to think" *(White, age 32, multiparous)*

Contrast in care: NICU/SCBU vs postnatal ward

The quality of care received by women on the postnatal ward contrasted drastically with their reports about the care received by many women and their babies in the Neonatal Intensive Care Unit (NICU) or Special Care Baby Unit (SCBU). Almost universally, women who had babies admitted to NICU or SCBU reported excellent care from the nurses and doctors on those units, and in particular felt that they had received appropriate information and explanations, dedicated care and genuine respect and support as the parents of the baby in special care.

> "My baby was given the best care on SCBU and all the staff were very helpful and extremely informative, also they spoke in a very positive manner" *(White, age 20, primiparous)*
>
> "My baby went straight to NICU...staff were supportive and thoughtful" *(White, age 31, primiparous)*
>
> "Nurses in the neonatal unit (NICU) were fantastic, couldn't wish for better care" *(White, age 38, primiparous)*
>
> "The NICU staff were excellent at caring for my son however the (postnatal ward) midwives continued to deliver a very inferior and unacceptable level of service" *(White, age 33, primiparous)*
>
> "The staff on SCBU were more concerned re: my postnatal recovery (following caesarean) than some of the postnatal staff" *(White, age 43, multiparous)*
>
> "…the staff of SCBU are fantastic!" *(White, age 20, primiparous)*
>
> "The NICU nurses caring for my son were excellent, but the midwives provided little care at all for myself and my son" *(White, age 33, primiparous)*

Quality of care after hospital discharge

Women's experience of postnatal care in the community was varied with some women reporting high-quality or adequate care and many others feeling that they were not adequately supported. There was also a number of women who felt that the midwives and health visitors who visited them were inadequately informed or trained to answer important questions relating to the early postpartum stage, leaving them feeling like they had to seek out additional support elsewhere.

> "I would have liked more support after coming home, more visits maybe? I did not really have anyone to talk to about what happened and how I felt and how I was" *(Asian, age 25, primiparous)*
>
> "Care after birth has been very hit and miss...midwives and health visitors making appointments and then not turning up for them" *(White, age 38, primiparous)*
>
> "I was unimpressed with the midwives postnatally (in our area). They lacked knowledge and generally an empathetic attitude...I received one visit from a health visitor which was essentially a form-filling exercise and a waste of time" *(White, age 37, primiparous)*
>
> "…the health visitors were totally useless: they lost my paperwork, were unable to answer simple questions about breastfeeding and sleeping, patronising and rude, distant and uninterested, gave conflicting information" *(White, age 35, primiparous)*
>
> "I have no faith in the Health Visitors, they have no time for you...I have felt very alone after the birth of my first baby" *(White, age 29, primiparous)*
>
> "…only seen the health visitor twice in the first month and a half and have not seen her since" *(White, age 19, primiparous)*
>
> "I've been going through a hard time after the birth, feeling depressed since I had her and haven't spoken to anyone...because I get talked to like I'm making it up. I think midwives and health visitors need to remember this and be more understanding" *(Black, age 25, primiparous)*

For women who had had prolonged postnatal stays in hospital due to maternal or fetal illness, or who had specific circumstances requiring additional care, there was clearly an unmet need for additional support and engagement with community services post-discharge. A number of women in this scenario reported feeling like they had been 'lost' in the system, and despite needing additional care, in fact received much less than other women who'd had uncomplicated deliveries.

> "Due to the complications of my pregnancy and labour and my babies being in SCBU, I was under hospital and obstetric care for most of the time – I feel this led to little or no contact with community services...which added to the feeling that my pregnancy was not 'normal' and added to my feelings of isolation and dislocation as a parent of premature babies" *(White, age 33, primiparous)*
>
> "I was unable to attend the scheduled antenatal classes as my baby was premature and no alternative/additional help has been offered...the midwife only visited once after my son was born" *(White, age 33, primiparous)*
>
> "After I left hospital with twins I felt I had no support or help which was promised in the hospital...considering I had twins I thought this would be a top priority for them to look after us" *(White, age 21, primiparous)*
>
> "I suffered from PND (postnatal depression) with my first and second...they should give you more support if you already have depression. No support was offered from our midwife" *(White, age 19, multiparous)*

Delayed postnatal follow-up was a very strong theme, with women very clearly expecting to be contacted or visited within a few days post-discharge but instead finding that it was weeks later, by which stage they had had to seek out assistance and advice from other people.

> "I was very disappointed with the care after having a baby. The first time I saw a midwife after being discharged from hospital was 10 days which I think is outrageous after having a c-section" *(White, age 33, primiparous)*
>
> "After I had my baby I was told a health visitor would visit me when she was 2 weeks old but nobody came. I contacted my midwife and she called the health visitor who said she had lost my notes" *(White, age 20, primiparous)*
>
> "My midwife wasn't informed by the doctor at the hospital that I was discharged, therefore I waited 7 days until a community midwife came to check me and my son" *(White, age 26, multiparous)*
>
> "Have not seen a health visitor since my baby has been born and she is now 3 months old...I have called and they haven't done anything or explained why they haven't been to see us!" *(White, age 21, primiparous)*

> "My health visitor did not make contact with me until my baby was 3 weeks old...when I finally did get a visit it felt very rushed and I was asked questions that in my opinion were 2 weeks too late" *(White, age 28, primiparous)*
>
> "When I had my baby the health visitor was meant to come out and did not come therefore nobody saw me or my baby til the 8 week check with the doctor, I was disappointed with this" *(White, age 22, multiparous)*

The feedback from several women who had had very positive experiences with their postnatal midwife or health visitor, highlighted the important and unique role these professionals can play in providing opportunities for de-briefing and emotional support.

> "I have a lovely health visitor who has helped me understand what happened wasn't my fault and informed me of people I can talk to should I feel the need to find out more" *(White, age 25, multiparous)*
>
> "Since giving birth I have received very helpful support from the midwives and health visitors that have been to see me" *(White, age 30, primiparous)*

There were several women who responded very candidly about their financial circumstances and their need for additional social and welfare supports. It didn't seem that any of these women had been given advice or direction by their hospital or community postnatal team as to where or how to access additional help and whether they could be eligible for government benefits.

> "…we are struggling with money and not able to get any extra help despite all the taxes we paid! I may have to go back to work earlier as twins are so expensive" *(White, age 35, primiparous)*
>
> "My income is low and I am depressed, my husband is a student and both of us we are not entitled to public funds...we live in a room with the new baby, am so unhappy about our living (circumstances), am on maternity leave without being paid...we are really suffering" *(Black, age 23, primiparous)*

Conflicting advice from health visitors and midwives

One issue that recurred throughout the responses was women receiving conflicting advice from postnatal health professionals (specifically midwives and health visitors) and consequently, feeling very confused, overwhelmed and uncertain about what advice to follow.

> "After birth, midwives (at home) were lovely but I was given different information....express, don't express, weight loss normal, another said not normal" *(White, age 24, primiparous)*
>
> "The health visitor offered little support, gave conflicting advice to the midwives and only visited once...she bombarded me with leaflets about where to go for care but offered little constructive advice and I was given no information about how to care for my baby" *(White, age 36, primiparous)*
>
> "There is often an inconsistency of information between midwives and health visitors" *(White, age 38, primiparous)*

Routine postnatal check-up

Many women reported not knowing they needed a 6-week postnatal check-up and those who did, often reported feeling let-down that they hadn't been contacted by their GP to arrange the appointment. There was a sense that these women hadn't been advised during their antenatal care that this was standard procedure and certainly hadn't thought about arranging the appointment themselves.

> "I was not aware that I needed to go for a check-up 6 weeks after delivery...I feel this should have been made clear to me at the hospital just after delivery of my baby" *(Black, age 41, multiparous)*
>
> "I was quite disappointed that I was not offered a six-week check and that my baby was 3 months old before he got to have his check" *(White, age 28, multiparous)*
>
> "When I was due to have a 6-8 week check-up I never got one because of poor communication. The hospital did not contact my GP to say I had my baby and so it took another 4 weeks until my information was given to my GP" *(White, age 17, multiparous)*

The National Health Service and maternity services

Recent NHS-budget cuts have once again highlighted the extreme pressures that the UK National Health Service continues to face and the consequent challenges in providing high-quality, timely healthcare for the whole population (Appleby et al 2009). An overwhelming number of women mentioned their maternity and birth experiences directly in the context of the pressures on maternity services, in particular staff shortages and hospital hygiene.

Women's experiences in relation to specific hospitals

It is important to emphasise in the first instance that the responses from women regarding the state of the hospital they attended and their impressions of staff pressures seemed to be highly hospital-specific. For example, amongst the many generally negative responses, there were a number of specific hospitals that were named repeatedly. In addition to this however, there were a large number of women who made the effort to write about their positive experiences of a particular hospital, clinic or trust and to express how thankful they were for the high-quality care they received. This contrast of responses highlighted that the negative feedback, whilst extensive, is not universal across England.

Several women reported feeling very satisfied and happy with their first encounter with NHS services:

> "I had never been in hospital before the birth of my baby and now I feel that we are fortunate to have the NHS which I found to be excellent" *(White, age 35, primiparous)*
>
> "My care proved that the NHS is worth every penny!" *(White, age 29, primiparous)*

Staff shortages and system pressures

For many women, the shortage of midwives was immediately apparent and quite shocking to them in hospital, causing them concern about the level of care they were receiving as a consequence. This was almost universally related to the postnatal ward setting.

> "…maternity ward so understaffed – 3 staff to 30 mothers!" *(White, age 34, primiparous)*
>
> "I would have appreciated more kindness from the health professionals I saw following the birth of my baby...the post-natal ward was a highly stressful experience in which I was only occasionally supported. Staffing levels were clearly too low for the number of patients on the ward and staff were, as a result, rushed, unfriendly and unsympathetic" *(White, age 30, primiparous)*
>
> "Staff were either rude or so stressed that I did not feel in safe hands" *(White, age 36, multiparous)*
>
> "I think aftercare for new mothers needs to be vastly improved...everything is rushed, women coming in and out as quickly as they possibly can" *(White, age 22, multiparous)*
>
> "The midwives seemed very busy and very stressed...I only seemed to get their attention when I had an epidural and had to be constantly monitored" *(White, age 24, primiparous)*

As a result of staff shortages, many women reported having had to wait for a long time on the postnatal ward for assistance with baby care and their own care, pain relief or discharge from hospital.

> "…staff didn't attend to me very well, leaving me to clean my bed and waiting sometimes for an hour for my call to be answered" *(White, age 37, multiparous)*
>
> "We were kept waiting unintentionally and uninformed of what was going on...and we just left the hospital because we were very fed up with waiting" *(White, age 35, primiparous)*
>
> "…hospital unit seemed to be understaffed. Midwives were too busy which resulted in procedures/checks/tests/pain relief not provided when needed" *(Asian, age 34, multiparous)*

Several women reported feeling that they were hurried out of the hospital door well before they were ready to be discharged, due to staff shortages and the constant pressure for beds.

> "I felt rushed a lot of the time to get on my feet and that I should leave hospital...maternity ward felt like a conveyor belt of women having their babies and then leaving as soon as possible" *(White, age 40, multiparous)*
>
> "Although I was relieved to be told I could go home a day after my caesarean, this was realistically too early...the manner in which I was told I could go home was harsh and abrupt, the midwife said 'I don't mean to be rude but we need your bed, if your baby has fed you can go home'" *(Other ethnic minority group, age 27, primiparous)*
>
> "There weren't enough midwives on the ward and I didn't get the proper care I needed. I feel as though I shouldn't of been allowed home as early...I had to go back into hospital with blood clots on my lungs" *(White, age 23, multiparous)*

A number of women commented on having had several children at the same hospital and felt that the care they received had deteriorated over that period of time.

> "I have 3 children and can honestly say that the care diminishes each time I have a baby" *(White, age 36, multiparous)*
>
> "I have found that in the last 12 years things have really changed in maternity care...in my last pregnancy I was given a lot of information and support before, during and after the birth" *(Other ethnic minority group, age 31, multiparous)*
>
> "My experience of pregnancy, labour and postnatal care has changed a lot since having my last two children...there was not a lot of people I could go and talk to...it felt like going straight in and out and on to the next person, there was no time to chat or explain anything" *(White, age 24, multiparous)*

Fortunately, there were also many women who seemed to have been very aware of the shortage of staff and the incredible pressures they were facing in hospital, but who still experienced high-quality care and consequently felt great respect for the staff who made an effort to provide the best possible level of care and support for their patients despite the pressures on the system.

> "The staff I encountered always gave the best care that they could given how short-staffed they were" *(White, age 33, multiparous)*
>
> "…the staff seemed busy but still helpful and kind" *(White, age 31, primiparous)*
>
> "During my labour I was not aware of how stretched midwives were, the ward was shut to new patients but all professionals were calm and sensitive to me and my partner" *(White, age 32, primiparous)*
>
> "The midwife in charge of my labour was lovely but tired and overworked – she tried not to show this" *(White, age 21, multiparous)*
>
> "I feel there was not enough midwives on the maternity ward and delivery suite...I have no complaints about any of the staff just that they are under-staffed and stretched so thin and it makes it hard for them to do their job" *(White, age 31, multiparous)*
>
> "The midwife with me during labour was excellent but unfortunately very overstretched due to understaffing. I felt this meant I did not get her full attention but this was due to circumstances beyond her control" *(White, age 29, multiparous)*
>
> "I know that midwives are very busy and over-worked. I think this is unfair to them. How can they stay passionate about their job if they feel too much pressure?" *(Other ethnic minority group, age 28, primiparous)*

Hospital hygiene

Again, women's impression of the level of hygiene and cleanliness of the delivery rooms and hospital wards was highly variable but multiple women mentioned their horror and disgust at the state of the hospital they attended. This definitely impacted on women's memories of their birth and hospital experience.

> "The ward was not clean: blood on the toilet, unclean sheets on my bed, poo on the floor...very poor hygiene to take a newborn baby into...I was going to stay overnight until I saw the ward" *(White, age 33, multiparous)*
>
> "My delivery room wasn't cleaned properly after delivery which caused me concern as my blood was spattered around the room and equipment" *(White, age 23, primiparous)*
>
> "I think for baby wards there should be extra time for cleaning and women should be asked if they need bedding changed. I spent 3 days in dirty bedding and they were only changed because I did them myself" *(White, age 22, multiparous)*

> “I do find it insulting that the hospital is so filthy – when we went for our first scan last ` year we even found discarded surgical gloves strewn in the corridor” *(White, age 41, multiparous)*

Final feedback

There were a number of women who wrote very positively about having the opportunity to give feedback on their experiences of maternity care through the NMS questionnaire and who were hopeful that their feedback and that of other women will lead to improvements in the quality and standard of maternity care in the UK in the future. There were two main issues that women mentioned in their ‘closing remarks’, illustrated by the following quotations.

First, the quality of communication and interaction with health professionals:

> “I think it is very sad that friendly, competent staff are the minority and I hope you will use your survey results to improve maternity care in the UK” *(Other minority ethnic group, age 27, primiparous)*
>
> “The most shocking thing when you find out you are pregnant and you start accessing the National Health Service is that everyone is there to fill in a questionnaire or tick the boxes, and no-one actually asks how are you feeling” *(White, age 36, multiparous)*

and second, the quality of resources and staff shortages:

> “More investment in equipment and staffing is essential to improve the quality of care for women and babies” *(White, age 30, primiparous)*

SUMMARY OF KEY FINDINGS

Communication, respect and emotional support was the most dominant theme throughout the responses with particular emphasis on reassurance, empowerment and respect, tailoring communication and care to patient needs, listening to and trusting patients, providing the opportunity to discuss unexpected or unforeseen events, and involvement of partners and husbands. **Antenatal care** was frequently discussed in the context of antenatal preparation and education, lack of reliability of health professionals, and continuity of (antenatal) care. **Labour and intrapartum care** was described as a positive experience by many women however, amongst those reporting mostly negative experiences the most overwhelming themes were the need for support in early labour, traumatic birth experiences, poor provision of pain relief, concern about staff skill and competence, and the positive role of student midwives. **Breastfeeding support and education** was a very prominent feature of women's postnatal experiences with a focus on pressure to breastfeed, the need for greater support in the very early stages of breastfeeding, and the need to seek additional support and assistance. Reflecting many of the concerns raised in the context of breastfeeding, women's responses regarding **postnatal support and follow-up** centred around feeling neglected on the ward, the need for greater assistance with baby basics and care on the ward, the contrast in care between the high quality of care on NICU/SCBU and the generally poor quality of care on the postnatal ward, generally poor quality of care after hospital discharge, conflicting advice from health visitors and midwives, and for some, ignorance about the need for a routine postnatal check-up. Many of the concerns discussed by women related in some way to the **NHS and maternity services.** Within this theme itself the specific issues raised throughout the responses were staff shortages and system pressures, with many women's experiences related to specific named hospitals, and concerns about hospital hygiene.

4.7 DISCUSSION

Results

The findings from the 2010 National Maternity Survey provided clear evidence in support of the hypothesis that women from lower socioeconomic groups are less likely to report seeking healthcare in pregnancy early and regularly, receive the same quality and type of care as other women during pregnancy and childbirth, and to report being treated with respect and kindness by healthcare professionals throughout the continuum of pregnancy through to the postnatal period.

Comparison with ONS national statistics on live births by characteristics of the mother for 2010, demonstrated that the NMS study cohort was a close reflection of the population of women giving birth for that year (Redshaw and Heikkila 2010). This was reassuring that the findings were representative of the general population, despite the response rate of 54%. The mean age of NMS respondents was 30.6 years, compared to a national standardised mean age of 29.5 years (Office for National Statistics 2011b). In 2010, the ONS reported that “84% of babies were registered by parents who were married, in a civil partnership or co-habiting” (Office for National Statistics 2011b), compared with 90.6% amongst the NMS respondents. The ONS also reported that 25.1% of births in 2010 were to mothers born outside the UK (Office for National Statistics 2011a), with 20.3% of NMS respondent women born outside the UK.

A number of studies in the UK have suggested that “as many as 30-40% of pregnancies that end in childbirth are unplanned” (Carson et al 2011, Farrow et al 2002, Fleissig 1991, Lakha and Glasier 2006). The Millennium Cohort Study, a nationally representative prospective cohort study of 18,552 families across the UK, found that 41% of the children in the study were born after an unplanned pregnancy (Carson et al

2011). In contrast, only 24.6% of women who responded to the NMS reported that the pregnancy was unplanned. The questions in both surveys were phrased very similarly – “Did you plan to become pregnant with this baby (or was this a surprise)? Yes/No”. The difference in responses between survey populations may reflect the increased likelihood of women who had planned their pregnancy to respond to the NMS maternity survey, as opposed to those for whom the pregnancy was unplanned.

The NMS analysis demonstrated that women from the lowest IMD quintile were more likely than women from the highest quintile to be younger, of non-white ethnicity, born outside the UK, need assistance speaking English, have no formal education beyond age 16, be single or co-habiting with their partner and to report that the pregnancy was unplanned. These findings reflect those of the ‘Poverty and Social Exclusion’ project in Northern Ireland, which showed the greatest risk of poverty is associated with being female, age 16-24 years, separated or divorced, unemployed and of lower education level (Office of the First Minister and Deputy First Minister 2005, Hillyard et al 2003).

Although the difference between women in the different deprivation quintiles in the unadjusted analyses was, in some instances small in absolute terms, even when statistically significant, there was a consistent trend towards poorer outcomes and experiences amongst the women from the lowest socioeconomic group. For example, these women were less likely to have had any antenatal care, to have been seen for their first consultation before 12 weeks gestation, attended antenatal classes, have had the recommended dating and anomaly ultrasound scans during pregnancy and to have been seen by a midwife or GP for a routine 6-8 week postnatal review.

Furthermore, women from IMD 5 were more likely be admitted to hospital overnight, be transferred during labour and were generally less likely to agree that midwives and doctors talked to them in a way they could understand and treated them with respect during antenatal care, labour and delivery and the postnatal period. Of note, there were no differences revealed between women in the different IMD quintiles regarding worries about labour and birth.

Clearly, other factors may have confounded the relationship between IMD and health-seeking behaviour and the care received. To explore these effects, an adjusted multivariable analysis was carried out using logistic regression. The adjusted analysis confirmed that independent of ethnicity, age and parity, women from the lowest socioeconomic group felt they received poorer antenatal, labour and postnatal care across a range of measures compared to women from higher socioeconomic groups, and generally felt that they were not treated with adequate respect, kindness and understanding by the health professionals caring for them. These findings reflect those of the large national survey of women conducted throughout England in 2007 by the Healthcare Commission which also showed that ethnic minority women, single mothers and those who ceased formal education at an earlier age access maternity services later, have poorer maternal health outcomes and report poorer experiences across a range of aspects of maternity care (Raleigh et al 2010).

Health-seeking behaviour

Overall, only 3.6% of women from the 5th IMD quintile did not attend any antenatal check-ups. However, having adjusted for other factors, compared to women from the highest IMD quintile, women from the 5th quintile were 60% less likely to have had any antenatal care and 38% less likely to have been seen by a health professional before 12 weeks gestation. Importantly, this relationship was part of a trend as with each decrease in socioeconomic position, as defined by IMD quintile, women were 25% less likely to have had any antenatal care and 11% less likely to have been seen before 12 weeks gestation.

Research conducted by Rowe et al in 2008 using data from the 2006 NMS, showed that the odds of late attendance/antenatal booking were nearly six times higher for black women and twice as high for women living alone suggesting that this issue is universal across disadvantaged groups in the UK, although the size of the differences suggest there have been improvements with time. Similarly, the aforementioned Healthcare Commission survey reported that single women were almost 50% less likely to access care within 12 weeks of pregnancy than women with a partner (Raleigh et al 2010).

Differences continued to be apparent across IMD quintiles in the NMS analysis for postnatal care outcomes, with women from the 5th IMD quintile 45% less likely to have had a check-up at 6-8 weeks postpartum compared to women from IMD 1 and overall there was a 15% decrease in the odds of having a postnatal check-up with each decrease in IMD quintile. A formal check-up at 6-8 weeks postpartum is a key component of the UK's NICE postnatal clinical guidelines, in order that the health of the baby and mother is thoroughly reviewed and that parents are given the opportunity to ask about any concerns that may have arisen since birth (NHS NICE 2006). A formal postnatal review is also an important aspect of early parenting, as it allows health professionals to advise parents on the future care of their baby and to assess developmental milestones and refer to other support and health services where appropriate. The results of this survey indicate however, that a number of women are 'slipping through the net' in postnatal care, especially those from the lowest socioeconomic group (over a fifth of women from IMD 5 reported no postnatal check-up), and calls into question whether this issue relates to health-seeking behaviour or in fact reflects aspects of service provision and access barriers for this group of women.

The qualitative findings added further depth to these results in a number of ways. It was evident from many women's responses that they were eager to receive antenatal care during their pregnancy but faced significant challenges with getting in contact with community midwives, cancelled appointments, a lack of continuity of care and that they often felt they were rushed through their appointments without adequate opportunity to ask questions. Despite seeking antenatal care, it seemed that many of these women felt let-down by the care they received and felt they were poorly prepared for pregnancy, labour and caring for their baby as a result. These findings echo those of the Healthcare Commission survey, which reports that “8% of women did not recall being given details of a midwife to contact if they were worried during pregnancy and of those who did make contact, only 28% said the help they received was only sometimes, or not at all helpful” (Raleigh et al 2010, Duff 2011).

There was a general sense amongst the open written responses that a substantial proportion of women from the 5th IMD quintile did not know about the need to have a 6-8 week postpartum check-up and rarely sought out further postnatal care. Many women commented on the poor quality and/or delayed postnatal care they received in the community immediately post-discharge from hospital, yet few reported going to their GP or community midwife centre for additional care and many reported frustration or disappointment at not being contacted by their GP or midwife to arrange an appointment. It seemed that these women hadn’t been informed either during their antenatal care or in hospital after the birth that it is standard practice to have a check-up at 6-8 weeks and there was clearly a great deal of confusion about who held responsibility for organising this appointment. It is likely that this process differs between NHS trusts but the specific practices should be made clear to those receiving care within each trust.

The issue of seeking additional healthcare and assistance also emerged from the qualitative data in the context of breastfeeding, where many women reported difficulties breastfeeding and inadequate assistance but few women indicated that they had sought out additional, external assistance. It seemed likely that many of these women did not know who to contact for additional support but the handful of women who reported contacting the Breastfeeding Support Network were incredibly positive about the help and guidance they had received. The issue of paying for additional help was mentioned several times throughout the text responses and raised the question that perhaps many of these women were unable to pay for additional help and did not know of any free breastfeeding-support services in their local area if indeed such services existed.

Quality and type of treatment received

For those who received antenatal care, compared with women from the highest quintile, women from the 5th IMD quintile were 47% less likely to be able to see a health professional as early as they desired in their pregnancy, with the likelihood decreasing by 16% with each decrease in IMD group. The qualitative findings strongly suggested that women perceive that staff shortages and NHS system pressures had a significant influence on their experiences of the quality of care they received, the number of appointments they had, and their interactions with health professionals. Additionally, there were several women that reported having had more than one baby at the same hospital several years apart and who felt that the standard and quality of care they received had deteriorated during the intervening years.

The findings also suggest that women from the 5th IMD quintile were much more likely to experience a range of events during pregnancy and labour that collectively indicate an increased risk of severe maternal morbidity amongst these women. For example, although not statistically significant, with each decrease in socioeconomic position (IMD quintile) women were 4% more likely to have been admitted to hospital overnight during the antenatal period, 7% more likely to have been transferred during labour and 4% more likely to have had a caesarean than a normal or instrumental delivery. For women who had a caesarean delivery, they were 15% more likely with each decrease in socioeconomic position to have had an unplanned emergency rather than a planned elective procedure.

This finding is in contrast with recent research conducted in Scotland by Fairley et al, which showed that despite social differences in emergency caesarean section rates in the early 1980's, by 1999-2000 there was no evidence of a social gradient in unplanned emergency caesarean-section rates in Scotland (Fairley et al 2011). The authors highlight that "rising emergency caesarean section rates have been shown to be related to increasing maternal age" and that mothers in the highest socioeconomic group have been shown to be older than those in lower classes (Smith et al 2008). The findings in the analysis presented here however suggest that older maternal age does not result in a higher rate of emergency caesareans amongst women from the highest socioeconomic group.

The study by Fairley et al showed that "women in the most deprived areas were less likely to have elective caesareans than women in the most affluent areas" (Fairley et al 2011), a finding that is in keeping with earlier research conducted in the UK by Barley (Barley et al 2004) and Alves (Alves and Sheikh 2005). In contrast, the results of the analysis presented in this chapter show that having adjusted for age and a range of other factors women from the lowest socioeconomic group had a higher chance of having a planned or unplanned caesarean than women from other socioeconomic groups.

Interestingly, the qualitative findings suggested that for women who did have a caesarean, planned or emergency, the quality of care and communication they received from health professionals during and after the birth had a far greater impact on their impressions of their birth experience than the caesarean itself. Furthermore, a number of women who had received standard care for a particular condition (caesarean delivery for breech presentation for example) expressed great dissatisfaction with the care they received, largely due to not being given adequate explanation of why a particular clinical decision was made by the treating team. These findings emphasise the importance of dedicated and sensitive intrapartum and postpartum care, especially for those women with maternal or neonatal complications. The qualitative findings also strongly suggest that amongst mothers who had babies in SCBU or NICU, the care they received from the neonatal nurses and doctors was far superior to the care they received on the postnatal ward. This finding may provide some insight into the results of recent research in the UK which showed that once admitted to SCBU/NICU, there was no difference in outcomes for neonates across different socioeconomic groups (Smith et al 2009) – a major contrast to the results presented in this chapter.

Quality of care and communication

The quantitative findings relating to care and communication during labour and birth gave an initial indication of the pertinence of this issue to the maternity experiences of women from the lowest socioeconomic group. Overall, with decreasing socioeconomic group, women were 11% less likely to agree that midwives spoke in a way they could understand during labour and birth, 12% less likely to agree that doctors spoke in a way they could understand and 11% less likely to agree that doctors were respectful most of the time.

These results were emphasised with full impact in the longer text responses, with communication, respect and emotional support being clearly the most dominant theme. Many women wrote specifically about how they were spoken to and treated by the health professionals caring for them, what they said and how it made them feel. Whilst not universally negative, the most commonly mentioned concerns related to women feeling like they had not been properly listened to, were treated in a patronising and belittling manner, not adequately reassured and encouraged when they were most anxious and uncertain, ignored and neglected and not given the opportunity to debrief and ask questions about their experiences and the events surrounding their birth.

There are likely to be multiple reasons for these findings, however the qualitative text highlighted several plausible explanations. First, as mentioned earlier, documented staff shortages and pressure on NHS services (Finlayson et al 2002a) would indeed impact on the provision of services, the stress levels of staff and their consequent interactions with patients and families (Ashcroft et al 2003). The labour ward is typically one of the busiest departments of any hospital and with the added burden of severe staff shortages, midwives and doctors undoubtedly struggle at times to provide the dedicated one-on-one care they would ideally like to be able to provide. Research conducted by Ashcroft et al in 2003 concluded that "midwives are fundamental components in the system of intrapartum care, and the system cannot operate safely and effectively when the number of midwives is inadequate and they are poorly deployed" (Ashcroft et al 2003).

Underlying the issue of system pressures however, seemed to be a deeper and much more entrenched culture relating to patient care. The overwhelming number of women who wrote about the way they were treated poorly and the detail they provided of the events suggested that these women were indeed subjected to generally sub-standard delivery of care, at a time when many of them would have been vulnerable and in great need of compassion, support and reassurance. This was particularly evident through women's accounts of traumatic birth experiences, especially where they felt they had been ignored or not given adequate explanation for the events surrounding the birth.

Finally, the lack of continuity of care from health professionals throughout women's pregnancy, labour and postnatal care appeared to impact significantly on their impressions of the quality of communication and care they received throughout this time. Women were disappointed and sometimes distressed by having to "explain their story" numerous times to different professionals, by receiving care from "complete strangers" during labour and birth and by having to start an entirely new patient-carer relationship during the postnatal period. Many women felt that they were just another person in a long line of others during their pregnancy care and birth, as a direct result of not having consistent care from someone with whom they had built a trusting relationship with over time.

Issues relating to continuity of care and communication were illustrated particularly well through the responses about breastfeeding. Despite the evident pressure they felt to breastfeed, many women reported feeling disappointed by how little support they received with breastfeeding and about being given different, often conflicting advice from different midwives, the dismissive way in which they were often spoken to and the lack of education they were offered, especially about alternatives to breastfeeding.

The myriad benefits of breastfeeding for infants are well-understood and researched, and are particularly significant amongst vulnerable and low-income women (Raisler et al 1999, American Academy of Paediatrics 1997). A study conducted in 2005 looking at breastfeeding in an urban context in the UK found that only 24% of infants were still breastfed at 6 weeks, and that "infants in the most affluent quintile were three times more likely to be initially breastfed ($p<0.001$) and five times more likely to still be breastfeeding at 4 months ($p=0.001$) compared with infants in the most deprived quintile" (Wright et al 2006). Evidence from the Infant Feeding Survey 2010 conducted throughout the UK showed that the incidence of breastfeeding remains highest amongst mothers in managerial and professional occupations, with breastfeeding initiation rates of 90% amongst these women compared with 71% amongst those who have never worked (Renfrew 2011). The survey did not report rates of continuation of breastfeeding.

Research conducted in 2000 in the United States similarly demonstrated that women who were older, white, non-Hispanic, college-educated and married were more likely to breastfeed than formula feed at hospital discharge (Khoury et al 2005). Their study findings also supported the "need for healthcare system interventions, family interventions and public health education campaigns to promote breastfeeding in low-income women" (Khoury et al 2005).

In keeping with these findings, the Department of Health for England has invested significant resources over recent years in breastfeeding support and education in an attempt to improve breastfeeding initiation rates and address rising attrition rates at 6 weeks postpartum (Hamlyn et al 2002). Despite this, there remain enormous challenges in teaching new mums to breastfeed confidently and ensure adequate weight-gain for their babies, especially when system pressures in the NHS demand that some women are discharged from hospital as early as 6 hours postpartum. From the survey responses, it appears that these challenges are as great as ever before with many women feeling frustrated at the lack of external support for breastfeeding, in addition to appropriate information and education about breastfeeding alternatives.

NMS: strengths and limitations

One of the primary benefits of the survey methodology was that alongside quantitative check-box answers, it also gave women the opportunity to write freely about their experiences of maternity care and provide feedback in a way they may not have otherwise had the opportunity to do. It was clear from the free-text responses that the process of writing feedback, as opposed to being interviewed in person, was both non-intimidating and seemingly cathartic. Women appeared to be very honest and were inclined to give highly critical feedback, perhaps more so than they might have been in an interview. Several women mentioned that they hadn't spoken about their concerns with anyone and were grateful for the opportunity the survey provided.

It was also evident that a number of women from non-English speaking backgrounds, despite having somewhat limited English writing skills, were still inclined to write a response if there was something significant that they wanted to say, positive or negative. It may be the case that many more non-English speaking women were not able or inclined to write but there was no indication that this group was completely excluded from the analysis. Importantly, a telephone interpreter service was provided for women who needed help completing the survey in English and this ensured that women from non-English speaking backgrounds were not excluded from being able to participate in the survey. Similarly, there were many responses from women who did not appear to have strong writing skills but who wanted to give feedback, and were able to do so in their own way without having to attend an interview or clinic.

Importantly, the survey gave all these women the unique opportunity to reflect on their experiences of pregnancy, labour, birth and postnatal care and give anonymous and honest feedback. For those who had had negative experiences particularly, it was obvious that many of these women used this opportunity to debrief and unload the weight of their concerns and disappointment. By asking an open-ended question at the beginning of the free-text section, women's responses were not limited in any way to just issues of interest to professionals, as can occur during interviews (Ziebland and McPherson 2006), and a holistic view of what really happened in maternity care for these women was able to emerge (Pope and Campbell 2001).

Despite these evident advantages, there were a number of important limitations that required careful consideration during analysis and review. First, the usable survey response rate was only 54.1%. Research by David Asch et al in 1997 suggested that the mean response to mailed surveys published in medical journals is about 60% (Asch et al 1997). Asch pointed out that response rates "vary according to subject and techniques used" and that "written reminders with a copy of the instrument and telephone reminders are each associated with response rates about 13% higher than those not using these techniques" (Asch et al 1997). Despite issuing several written reminders and additional copies of the questionnaire to non-respondents to the NMS, the response rate failed to reach 60%. It was felt by the primary NMS research team that this may have been a result of the timing of the survey, as it was first mailed out in the midst of bad weather in the winter of 2010 and it is possible that some of the questionnaires are likely to have not even reached participants' houses.

Demographic data from the ONS on non-respondents to the survey showed that there were a higher proportion of women from IMD quintiles 4 and 5 who did not respond to the survey. Only summary data of other variables (age group, marital status etc) were provided for non-respondents. Although weighting of non-respondents is sometimes used as a method of accounting for 'missing data' in survey research, the availability of only IMD quintile for individual non-respondents meant that this was the only variable for which the results could be weighted. As the primary variable of interest, it seemed inappropriate to weight for IMD quintile as this process would have most likely increased the gradient across quintiles and potentially artificially exaggerated the disparities found. As a result, the data were analysed without weighting.

Second, there were a number of important survey limitations that impacted on the analysis in different ways. The very nature of survey research, relying on self-report of conditions and experiences, brought with it a number of limitations relating to *reporting accuracy*. The questions about past medical conditions and previous pregnancy complications relied upon completed free-text responses and were thus particularly problematic from an accuracy perspective. These variables were consequently excluded from the analysis presented here. A more accurate method may have been to ask closed questions, such as 'In your previous pregnancy, did you receive treatment or monitoring for any of the following conditions: pre-eclampsia Y/N, retained placenta Y/N, major postpartum haemorrhage Y/N etc'.

Other issues of reporting accuracy related more to the actual survey questions, not to the issue of self-reporting. Responses to questions about the husband/partner's perception of care and communication were of questionable authenticity, given that it was most likely in the vast majority of cases that the questionnaire was completed in full by the woman herself, as it was indeed addressed to her. The responses were therefore likely to be from the woman's perspective on behalf of their partner/husband and could not really be taken as a true representation of the partner's experiences.

The *clarity of survey questions* was another area of concern and ultimately led to the removal of several questions from the analysis. Considerable effort had been made by the researchers to explain and define most terminology used throughout the survey, however there were still terms such as 'nuchal scan' that were not defined. This may have presented a challenge for women from non-English speaking backgrounds and women with limited literacy skills answering the questionnaire. Phrases such as 'specialist facilities' were also not defined and it seemed that the responses to questions that used this phrase were largely misinterpreted. These questions were therefore removed from the analysis which was unfortunate, since the likelihood of women from different socioeconomic groups giving birth where specialist facilities were available would have been interesting to explore, especially given that these women have been shown to be at greater risk of adverse outcomes.

Furthermore, the 'double-questions' that were asked about communication may have been confusing for women and could have been simplified. Consecutive questions were phrased, 'Midwives talked to me in a way I could understand: agree/disagree/not sure' followed by 'One or more midwives did not talk to me in a way I could understand: agree/disagree/not sure', which made the purpose of the section much less transparent and difficult to comprehend. These questions were developed from early cognitive interviews during the planning of the 2006 NMS and from assessing the qualitative responses of women to the 1995 survey, in which many women suggested that despite good care overall, the treatment they received from one person had ruined or impacted significantly upon their whole experience of maternity care. In the 2010 NMS, these questions were therefore designed to allow women to express general satisfaction with their experiences and treatment, whilst still being able to indicate whether one or more people treated them differently/poorly. Nevertheless, despite this being the intention this may have led to some confusion.

For a number of questions, it would have been very helpful if an overarching yes/no question was asked initially, before further details were sought. For example, the questions about labour explored many aspects of induction but at no point was the question asked ‘Did your labour start naturally? Y/N’ or ‘Was your labour induced? Y/N’. For those that were induced, further questions about method of induction could then have been asked. As a result, it was very difficult to tease out those women who had been induced from those whose labour started naturally but had been augmented.

The use of ‘unsure’ as an answer category for many questions was included in order to avoid manufacturing or forcing respondents to answer ‘yes’ or ‘no’ when they simply could not remember. However, for straightforward questions such as ‘Did you have any antenatal check-ups?’, it seemed unnecessary that ‘not sure’ was offered as an optional answer and the analysis of these questions was much less clear as a result.

Another potential limitation of this study relates to the socioeconomic classification used to stratify participants, the Index of Multiple Deprivation. Whilst the IMD has been shown to be a robust measure of socioeconomic position in England, especially where individual-level data are not available (Pattenden et al 1999, Spencer et al 1999), it is based on area-level information and can thus fail to capture the characteristics of socioeconomic disadvantage at the individual-level, especially in inner city areas where areas of great wealth sit immediately alongside areas of great deprivation. This was exemplified by the comments of some women from the lowest IMD quintile about paying for additional postnatal care ("we were able to pay for advice, many people would not be so lucky"), which would not be possible for the majority of families who were truly disadvantaged.

Information about women's employment status was available from the survey data, however the use of these occupational categories as the measure of socioeconomic position also had limitations. Unlike in the UKOSS studies, occupational group in the NMS was collected only for the mother's occupation, with no information collected about their partner or husband's occupation. Thus if a woman reported that she was unemployed at the time of the survey, there was no indication as to whether her husband was also unemployed or was in fact, a professional in paid employment. In pregnancy, 'maternity leave' can also prove to be a misleading category as it implies that the woman is in paid employment, but without any further information their occupation cannot be classified into a more meaningful category. In this survey, occupational group failed to provide a picture that would represent the social and economic circumstances of the whole household and was therefore also limited in its use as an indicator of maternal socioeconomic position.

Despite the advantages of anonymity and easy access to the primary data needed for area-based socioeconomic classification, several systematic limitations of the IMD have been presented in the published literature, both following its initial inception in 2000 and its revisions in more recent years. The main concerns raised relate to (a) the overestimation of deprivation in particular circumstances, (b) the emphasis on communities beyond urban centres and (c) the shortcomings of the IMD's 'accessibility to services' domain.

Since the same people or households may be represented in more than one dimension of deprivation, the potential for the IMD to overestimate deprivation has been raised as a potential issue (Noble et al 2006). However, the researchers who developed the IMD believe that if a family or area experiences more than one form of deprivation, this is worse than experiencing a single measure of deprivation; “to be poor *and* ill is surely worse than just experiencing one of these deprivations on their own” (Noble et al 2006).

Unlike earlier deprivation indices in the UK such as the ‘Social Class based on Occupation’ and ‘Socioeconomic Groups’, the IMD makes an attempt to capture socioeconomic circumstances characteristic of communities beyond urban centres, such as ex-mining communities, coastal towns and rural areas (Deas et al 2003). This reflects political pressures in the UK for the “government to divert resources beyond major cities” (Deas et al 2003). There is much criticism of this shift in emphasis however, with some parties suggesting the IMD consequently fails to accurately assess deprivation in areas located in major cities in England. A critique of the IMD by Deas et al published in 2003 after the first IMD was developed, highlights the main issues that lend the IMD to downplay the “extent and intensity of deprivation in major urban centres” (Deas et al 2003). Deas et al argue that the IMD does not take account of the “size of the deprived population”, except at the ward level when scores are sometimes aggregated to form a ‘district value’. Deas et al propose that the impact of having 30% of households classified as deprived is different for a district of 200,000 than for one of 20,000 and thus discriminates against larger metropolitan areas (Deas et al 2003). The exclusion of ‘crime and degraded physical environments’ in earlier IMD measures was also highly criticised as working to the disadvantage of urban areas and ignored the evidence that “crime levels are correlated to deprivation and to problematic neighbourhood contexts” (Deas et al 2003). This deficit was recognised by the IMD research team and subsequent IMD indices have included ‘crime’ and ‘living environment’ as separate domains in the Index.

The final limitation of the IMD relates to the 'accessibility to services' domain, measured, in part, by the physical distance to various services. Deas et al argue that accessibility is "as much a result of socio-cultural constraints as physical distance", citing that distance to a primary school, one of the measures, does not imply that the "quality of education is necessarily adequate" (Deas et al 2003). The access domain is negatively related to all other dimensions measured for London wards, as areas with high levels of access-deprivation are generally the outer wards where residents are least deprived (Deas et al 2003). Deas et al suggest that to be access-deprived in an affluent area is worse than being access-deprived in a deprived area due to the poorer provision of public transport in affluent areas where presumably more people drive cars. They argue that the accessibility domain should therefore "take account of both the provision of and dependence on public transport, and of the quality of services themselves" (Deas et al 2003).

Despite these potential limitations, the availability of IMD quintile for every survey-respondent to the NMS and the absence of more accurate individual-level information on socioeconomic position made the IMD the most appropriate socioeconomic measure to use in this analysis.

Implications of the NMS study findings and conclusion

The latest report from the UK's Confidential Enquiry into Maternal Deaths clearly showed that social disadvantage is a risk factor for maternal death, with unemployed women almost six times more likely to die than women from any category of employment (Lewis 2011). The results presented in Chapter Three of this thesis demonstrated that the risk of severe maternal morbidity may be significantly higher amongst women from the lowest socioeconomic group, compared to women from the highest group, and the results presented in this chapter have provided insight into some of the potential reasons underlying these social disparities in maternal health in the UK.

In summary, whilst this is a highly complex issue the findings from this analysis suggest that several factors, including higher rates of unplanned pregnancy, no antenatal care or late engagement with antenatal care, transfer during labour, caesarean section delivery rates and poor communication and care from health professionals, may collectively contribute towards poorer maternal outcomes amongst women from the lowest socioeconomic group in the UK. Additionally, these findings add further weight to past research into neonatal outcomes by socioeconomic group which has suggested that the disparities identified in neonatal health may be partly due to differences in mother's access to and use of antenatal healthcare services (Manning et al 2005).

Resolving the root cause of these disparities (that is socioeconomic disadvantage) on a national scale is unattainable in the short-term. However, having identified that poorer women seem to have poorer maternal outcomes despite universal healthcare, the most important next step is the planning and development of strategies to address possible reasons for these differences in healthcare delivery and outcomes. The key issues emerging from this analysis that need to be addressed include (a) the need for a change in culture and attitude of health professionals towards pregnant women from lower socioeconomic groups, (b) improving continuity of maternity care and service provision, (c) better targeted maternal public health education and (d) revision of the allocation and organisation of NHS resources, guidelines and maternity services with greater focus on socially disadvantaged women. As has been suggested in the existing literature, the social gradient in health is not inevitable and can be modified. Australia, like the UK, also provides healthcare free at the point of access but has a significant private health system infrastructure in addition to the universal public system. The question considered next is, does the division between private and public maternity care affect outcomes for women from different socioeconomic groups in Australia and does it produce a more or less pronounced social gradient in maternal outcomes compared with the UK?

CHAPTER FIVE: Risk of severe maternal morbidity by socioeconomic group in Australia (Analysis of data from the Victorian Perinatal Data Collection database)

5.1 INTRODUCTION

Social disadvantage and health outcomes in Australia

Australians generally enjoy high standards of living and have one of the longest life-expectancies at birth in the world, at just over 80 years (The United Nations Development Programme 2006). Despite this, vast disparities exist between different groups of Australians, with average life expectancy of Indigenous Australians for example 17 years less than that of non-Indigenous Australians (Autralian Institute of Health and Welfare 2011).

In a recent Australian editorial, Michael Marmot emphasised that this gap in life expectancy "bespeaks large social inequalities" in Australian society, arising from the circumstances in which "people are born, grow, live, work and age" (Marmot 2011). Marmot ascribes the poor state of health of Indigenous Australians to two influential factors, social disadvantage and the "particular relationship of Indigenous Australians to mainstream society" (Marmot 2011).

Life expectancy is not the only outcome that differs strikingly between Indigenous and non-Indigenous Australians, with many adverse health outcomes shown to be far more frequent and severe amongst Indigenous Australians (Marmot 2011, Australian Bureau of Statistics 2008). Consequently, the majority of health research investigating the impact and role of social disadvantage in Australia focuses exclusively on the context of

Indigenous health. Whilst these issues are of paramount importance and demand focussed attention and commitment from researchers and policy-makers alike, research into the social disparities in health outcomes amongst the broader Australian population is limited in its depth and scope.

Research conducted in 2000 into "socioeconomic status and health in Australia" reported that, despite substantial improvements in the health of "all segments of the Australian population in previous years, there has also been an increase in socioeconomically-related mortality inequalities for some conditions" (Turrell and Mathers 2000). Just as research has shown in the United States and the UK, the authors of this Australian publication highlighted that "socioeconomically disadvantaged groups are more likely to engage in health-damaging behaviours, experience poorer psychosocial health, make less use of the healthcare system for preventive purposes and have a more adverse risk factor profile" (Turrell and Mathers 2000).

A recent report commissioned by Catholic Social Services Australia on the "distribution of disadvantage in Australia", found that pockets of concentrated and severe disadvantage "have become entrenched across rural, remote and suburban Australia" with just "1.7% of postcode areas accounting for more than seven times their share of top rank positions on the major causes of intergenerational poverty" (Catholic Social Services Australia 2007). The lead researcher, Professor Tony Vinson, pointed out that "despite Australia's recent strong economic growth, some communities remain caught in a spiral of low school attainment, high unemployment, poor health, high imprisonment rates and child abuse" (Catholic Social Services Australia 2007). In Victoria, where adequate surveys have been conducted, the report found that "one third (33.1%) of all communities suffer 'low social cohesion' where inadequate levels of trust and resources make it more difficult for individuals and families to overcome the individual and family problems that lead to poverty" (Catholic Social Services Australia 2007).

Maternal health and socioeconomic position in Australia

In 2009, the Labour Government released the 'National Women's Health Policy' to guide improvements in the "health and wellbeing of all women in Australia, especially those at greatest risk of poor health" (Australian Government Department of Health and Ageing 2010). Sexual and reproductive health is identified as one of the four priority areas of the policy and issues relating to access to resources and the difference in health outcomes between the lowest and highest socioeconomic groups are discussed. Specific reference is made to social determinants of health, with the policy aiming to "highlight the social determinants having the greatest impact on women's lives" (Australian Government Department of Health and Ageing 2010). The policy emphasises the effect of social disadvantage on access to health services and sexual health information and resources, however there is no mention of the impact of social disadvantage on maternal health outcomes, particularly the risk of pregnancy and childbirth-related morbidity. Existing Australian research into this issue dates to well over a decade ago.

A study conducted in South Australia in 1988 looked at the difference in neonatal outcomes between low and high socioeconomic position mothers, as defined by an area-based classification, and found an increased risk of all adverse neonatal outcomes associated with lower socioeconomic position (Jonas et al 1992a); conditions of maternal morbidity were not investigated. Another study conducted in 1989 in Brisbane explored the impact of socioeconomic position, defined by family income, maternal education and paternal occupational status on perinatal outcomes. The research found that class differences in pregnancy outcome were in fact attributable to the mother's personal characteristics (BMI, parity etc), since the association between outcome and social class was weakened when adjusted for these factors (Morrison et al 1989).

Despite routine collection of maternal and perinatal information in all Australian States and Territories, this widespread data infrastructure has not yet been used to explore as its primary aim, the impact of demographic characteristics such as socioeconomic position on maternal outcomes.

The Consultative Council on Obstetric and Perinatal Mortality and Morbidity and the Victorian Perinatal Data Collection unit

In 2008, the Victorian Perinatal Data Collection (VPDC) unit was established by State legislation under the *Public Health and Wellbeing Act 2008,* sitting within the function of the Consultative Council on Obstetric and Perinatal Mortality and Morbidity (CCOPMM), which is responsible for monitoring and reporting trends in maternal and perinatal health in Victoria. The VPDC was established as a population-based surveillance system to collect and analyse information about and in relation to the health of mothers and babies in order to contribute to improvements in their health.

Since 1982, details of all births in Victoria have been collected and stored by the State Department of Health. In 2008, these birth data were transferred to the VPDC unit who have since been responsible for the collection, storage and analysis of the Victorian data. The data are collected via a birth report (Appendix 3) which requests information on obstetric conditions, procedures and outcomes, neonatal morbidity and birth defects relating to every birth in Victoria of at least 20 weeks gestation, or if gestation is unknown, babies of at least 400gms birth weight. Birth reports are completed at the time of delivery by the midwife caring for the mother, regardless of the place of birth and whether care is public or privately funded; thus information about all mothers and babies is included.

The majority of data items, of which there are over 100, comply with the National Perinatal Minimum Data Set and are sent to the National Perinatal Statistics Unit at the University of New South Wales in Sydney for the production of the annual report on Australia's mothers and babies.

Coding severe maternal morbidity in VPDC (ICD-10 codes)

Data from all Victorian birth reports relating to obstetric complications, past pregnancy complications and co-existing medical conditions are coded by VPDC staff using ICD-10 codes. Validation of reporting and coding at the VPDC unit is performed using a multi-tiered approach. First, data are checked for completeness and accuracy upon submission to the VPDC unit and any inconsistencies or incomplete data are queried with the reporting hospital. Data are double-entered into the VPDC database and cleaned extensively at the end of each calendar year. Second, validation of the number of births reported to the VPDC compared to the number of births recorded at each hospital in the State is undertaken each year. The most recent study (unpublished) in 2008 showed that 99.5% of births were reported to the VPDC without prompting and the remainder reported after the validation process highlighted that they had been omitted. Third, validation of the quality and reliability of the perinatal data is performed through regular projects designed to verify the accuracy of coding. According to the VPDC the most recent study found that the accuracy of most items is excellent, although some morbidity items are under-reported. Finally, there is a staff midwife at the VPDC who is responsible for liaising with reporting midwives at all hospitals in Victoria, providing guidance on definitions and completion of items and preparing lectures on the VPDC and birth report for nursing students at a number of universities in the State.

Measuring socioeconomic position in VPDC

As with all research that uses routinely-collected population data, the definition of socioeconomic position and other demographic characteristics has to rely on existing information collected on the birth report.

In Australia, socioeconomic position is typically defined in population research by the area-based measure, Socio-Economic Indexes for Areas (SEIFA). SEIFA was first developed by the Australian Bureau of Statistics from national Census information in the 1980's, and has since been modified and refined multiple times (Australian Bureau of Statistics 2006). The SEIFA currently in use was released in 2006.

SEIFA 2006 comprises four indices, each summarising a different aspect of the socioeconomic conditions of an area. These indices include (a) Index of Relative Socioeconomic Disadvantage (IRSD), (b) Index of Relative Socioeconomic Advantage and Disadvantage (IRSAD), (c) Index of Economic Resources (IER) and (d) Index of Education and Occupation (IEO). Additionally, these indices are available for different geographical areas: Census Collection District (the smallest area-level), Statistical Local Area, Local Government Area, Postal Area (based on Collection Districts approximated to Australian Postcode areas) and State Suburbs (the largest area-level) (Australian Bureau of Statistics 2006).

A SEIFA score is created using Census information about the people and households in a particular area, and is "standardised against a mean of 1000 with a standard deviation of 100" (Australian Bureau of Statistics 2006). As a result, the average SEIFA score will be 1000 and the middle two thirds of SEIFA scores will fall approximately between 900 and 1100. Deciles of SEIFA scores are commonly used for analysis, with the distribution of scores divided into ten equal groups.

The analysis presented in this chapter uses the Index of Relative Socioeconomic Disadvantage (IRSD) index, which focuses on relative disadvantage and "summarises a wide range of information about the economic and social resources of people and households within an area" (Australian Bureau of Statistics 2006). There are 17 different measures summarised in the IRSD index, including low income, low education, high unemployment and unskilled occupations (Australian Bureau of Statistics 2006). A high score represents a relative lack of disadvantage, for example an area with few households with low income or few people in low skilled occupations. A low score indicates relatively greater disadvantage, for example an area with many households with low income or many people with no qualifications.

For ease of analysis and to allow comparison with the measure used for the analysis in Chapter Four on the National Maternity Survey, quintiles of IRSD scores (paired deciles) have been used in this analysis. The deciles were measured at the Postal Area level as this is the smallest area information available in the VPDC dataset.

Ethics approval and consent

Ethics approval for this project was granted by the Southern Health – Health Research Ethics Committee in December 2011. All personal identifiers were removed from the database prior to release for analysis and thus individual participant consent was not required.

5.2 AIMS AND OBJECTIVES

This study was performed as a case-control analysis using data from the Victorian Perinatal Data Collection database on all maternities in Victoria during the period January 1st 2006 to December 31st 2008. This study aims to investigate severe maternal morbidity amongst women in Victoria and to quantify the associated risk factors, including socioeconomic position. The specific research questions are:

1) What is the incidence of severe maternal morbidity amongst women in Victoria?
2) What is the risk of severe maternal morbidity amongst women from different socioeconomic groups in Victoria?
3) What other factors increase the risk of women developing severe maternal morbidities during pregnancy and childbirth?

5.3 METHODS

Research design

This study used data from the VPDC database from 2006-2008. At the time of analysis, data from 2009 onwards had not been converted into an electronic format suitable for statistical analysis and were thus unable to be used in this study.

Case identification

In the analysis presented here, the definition of severe maternal morbidity is based (with some modification) on the validated, composite Australian Maternal Morbidity Outcome Indicator (MMOI) developed by Roberts et al in 2008 (Roberts et al 2008). Diagnostic and procedural ICD-10 codes (International Classification of Disease) from the 'events of labour', 'obstetric complications' and 'postpartum complications' fields from the VPDC database were used to collectively define 'severe maternal morbidity' (Table 58). Several procedural codes from the MMOI definition were not coded in the VPDC database and thus had to be excluded from the definition used in this analysis. These procedure codes included assisted ventilation, dialysis, re-closure of disrupted caesarean-section wound and repair of ruptured or inverted uterus.

Table 58. ICD-10 diagnostic and procedural codes collected in the VPDC database used to define severe maternal morbidity

Diagnoses	ICD-10 codes
Acute abdomen	K35, K37, K65.0, K65.9, N73.3, N73.5
Acute renal failure	O90.4, N17, N19, N99.0
Acute psychosis	F53.1, F23
Cardiac arrest, failure or infarction	O89.1, O74.2, O90.3, I21, I42, I43, I46, I50, J81
Cerebral oedema or coma	G93.6, R40.2
Disseminated intravascular coagulation	D65
Cerebrovascular accident	I60-I64
Major complications of anaesthesia	O74.0, O74.2, O74.3, O89.0-O89.2, O29.0-O29.2
Obstetric embolism	O88
Shock	R57, O75.1, T80.5, T88.6
Sickle cell anaemia crisis	D57.0
Status asthmaticus	J46
Status epilepticus	G41
Uterine rupture	O71.0, O71.1
Procedures	**Australian Classification of Health Interventions ICD-10 Procedure codes**
*Assisted ventilation, including tracheostomy**	*13857-00, 13879-00, 13882-00, 13882-01, 13882-02, 92038-00, 92039-00, 92040-00, 92041-00, 41880-00, 41883-00, 41883-01, 90179-06, 92046-00, 92047-00*
Curettage in combination with general anaesthetic	16564-00-01, 35640-00-03, 92514-10-99, 92502-00-03
*Dialysis**	*13100, 13112-00, 90351-00, 13109-00, 13109-01, 13110-00*
Evacuation of haematoma	90484-00, 90484-01, 90484-02, 30394-00
Hysterectomy	35653-00 to 03
Procedures to reduce blood flow to uterus	34103-12, 33833-03, 35321-00, 33845-00, 30385-00, 35759-00
*Re-closure of disrupted CS wound**	*30403-03*
Repair of bladder or cystostomy	90480-00, 37004-03, 37004-02, 37011-00, 37008-01
Repair of intestine	30566-00, 30375-19, 30565-00, 32069-00, 30375-24, 32003-00, 32000-00, 32003-01, 32000-01, 32005-01, 32004-01, 32006-00, 32006-01, 32005-00, 32004-00, 32012-00, 32009-00, 30375-25, 43816-02
*Repair ruptured or inverted uterus**	*90478-00, 16570-01*
Transfusion of blood or coagulation factors	13706-01, 13706-02, 13706-03, 92061-00, 92062-00, 92206-00

*Procedure codes in *italics* were not included in this analysis

Data collection and variables

The analysis presented here relied on existing information recorded in the electronic VPDC database from 1st January 2006 through 31st December 2008 and included all maternities in Victoria during that time. No additional data were sought from alternative sources.

The birth report completed for the VPDC database includes clinical details of each woman's pregnancy, birth and past obstetric history, in addition to demographic information about their ethnic background, Indigenous status, age, gravidity, marital status and residential locality. Age was only available in the database as 'age group' and was therefore analysed as a categorical variable. BMI and smoking status were not collected on the birth report and were therefore not available for analysis.

The analytic variable 'maternal medical condition' was based on the presence of conditions classified as a positive medical history in the UKOSS analysis in Chapter Three, and was extracted from the database using the appropriate ICD-10 codes (Table 59). Past obstetric history was limited to number of past caesarean sections, past ectopic pregnancies and past spontaneous abortions (miscarriage) based on information available in the dataset.

Not all variables in the dataset had missing data recorded. This was because for some variables, specifically the clinical outcomes, there was no provision on the original birth report for midwives to specify 'missing' or 'unknown' and in these cases, missing information defaulted to the 'no' category in the VPDC dataset. IRSD was missing only in instances where a woman's residential postcode was not provided on her birth report. Baseline sub-categories for each variable were selected based on which group was the largest or which group was known to have the lowest risk of maternal morbidity (Table 59).

Table 59. Variables used in the analysis of VPDC data and corresponding sub-categories

Variables of interest	Sub-categories for analysis	
Age group (mother)	1	<20 years
	2	20-24
	3	25-29 (baseline)
	4	30-34
	5	≥35 years
	.	Unknown
Admission to ICU or HDU	0	No (baseline)
	1	Yes
Birth plurality	0	Singleton pregnancy (baseline)
	1	Multiple pregnancy
Country of birth (region)	1	Australia (baseline)
	2	Oceania, including NZ
	3	UK
	4	Europe
	5	Middle East
	6	North America
	7	South America
	8	Africa
	9	Asia
	.	Unknown
Ultrasound before 13 weeks gestation	0	Yes (baseline)
	1	No
	.	Unknown
Indigenous status (mother)	0	Non-ATSI (baseline)
	1	Aboriginal or Torres Strait Islander (ATSI)
	.	Unknown
Marital status	0	Married (baseline)
	1	Single
	2	De facto (living with partner)
	.	Unknown
Maternal medical conditions (based on ICD-10 coded data in the database)	0	Nil (baseline)
	1	Cardiac disease Pre-existing diabetes Epilepsy Pre-existing essential hypertension Haematological disorders (bleeding diatheses) Past thrombotic event (DVT, stroke, PE) Mental illness
Method of birth	0	Vaginal delivery (spontaneous/instrumental) (baseline)
	1	Planned caesarean
	2	Unplanned caesarean
Maternal morbidity (events of labour/obstetric complications/ postpartum complications)	0	Nil morbidity (baseline comparison group)
	1	As outlined in Table 58

Table 59 *continued*

Variables of interest	Sub-categories for analysis	
Residential postcode		Converted into 4-digit SEIFA score then into corresponding IRSD deciles and quintiles
Parity	0 1	Multiparous (baseline) Primiparous
Patient accommodation class	0 1	Public healthcare (baseline) Private healthcare
Previous abortions (spontaneous)	0 1 2	Nil (baseline) 1 – 2 past spontaneous abortions ≥ 3 past spontaneous abortions
Previous caesarean	0 1	No (baseline) Yes (≥ 1)
Previous ectopic pregnancies	0 1	Nil (baseline) ≥ 1 past ectopic pregnancies

Data extraction, coding and cleaning

Data extraction and removal of identifying variables was performed by VPDC staff in Melbourne prior to release of data for this study. Each woman was assigned a SEIFA IRSD deprivation score by the VPDC unit based on the postcode of her address at the time of delivery. Data cleaning, coding and analysis was subsequently performed by the primary researcher (A. Lindquist) using STATA 11.0, including the rearrangement of IRSD scores into deciles and quintiles, as per the standard classification for Victoria.

Study size and power

All electronic records available in the VPDC database from 2006-2008 were analysed, which included 1,119 maternities with at least one maternal morbidity (cases) and 209,941 maternities with no maternal morbidity (controls). Table 60 gives the range of odds ratios detectable as statistically significant at $p<0.05$ for a range of risk factor prevalence estimates in the controls for a study power of 80% and 90%, derived using STATA. For example, for exposures with a prevalence of 20% in the controls, the analysis has 80% power to detect as statistically significant (at $p<0.05$) an odds ratio of 1.23 or greater and 90% power to detect as statistically significant (at $p<0.05$) an odds ratio of 1.26 or greater.

Table 60. Power profile with a fixed sample size of 1,119 cases and 209, 941 controls

Risk factor prevalence in the controls (%)	Odds ratio (OR) detectable by the study with 80% power*	Odds ratio (OR) detectable by the study with 90% power*
1.0	≥ 2.0	≥ 2.21
3.0	≥ 1.55	≥ 1.66
5.0	≥ 1.42	≥ 1.50
10.0	≥ 1.30	≥ 1.36
15.0	≥ 1.25	≥ 1.30
20.0	≥ 1.23	≥ 1.26
30.0	≥ 1.20	≥ 1.23
40.0	≥ 1.19	≥ 1.22
50.0	≥ 1.19	≥ 1.22
60.0	≥ 1.19	≥ 1.23
70.0	≥ 1.21	≥ 1.25
80.0	≥ 1.25	≥ 1.29
90.0	≥ 1.36	≥ 1.43

*OR derived using STATA 11.0

STATISTICAL ANALYSIS

Incidence and descriptive analysis

The incidence of severe maternal morbidity as cases per 100,000 maternities was calculated for (a) morbidity overall within the cohort, (b) each individual condition or procedure and (c) overall morbidity within each socioeconomic group (IRSD quintile). Instances of maternal morbidity were not mutually exclusive with some women having ≥2 different conditions. Incidence was calculated for individual conditions as cases per 100,000 maternities, and morbidity overall was calculated using total women with morbidity. Confidence intervals (95%CI) were derived based on the exact binomial distribution.

The characteristics of women with severe morbidity were described and the unadjusted risk of morbidity associated with individual characteristics was assessed using chi-square analysis and univariable logistic regression to generate odds ratios (OR) and their 95% confidence interval. The effect of individual variables on the relationship between socioeconomic position (IRSD quintile) and risk of morbidity was also tested in separate bivariable regression models. Unadjusted risk factor profiles were assessed separately for cases of severe morbidity and controls using chi-square analysis.

Rather than analysing the data as a cohort study using poisson regression, the decision was made to define women as being 'cases of maternal morbidity' and to compare them to women without maternal morbidity (controls) using logistic regression. This case-control approach to the analysis was chosen to enable straightforward comparison of the results with the results of the UKOSS case-control study reported in Chapter Three.

Multivariable model-building

Based on the results of unadjusted analysis and on pre-existing knowledge of risk factors for severe maternal morbidity, potential confounders were selected *a priori* for inclusion in the multivariable model. The *a priori* variables were Indigenous status (ATSI), country of birth, age group, co-existing medical condition and multiple pregnancy. Additional variables to be explored in the model as potential confounders or effect modifiers were past caesarean section, parity, past ectopic pregnancy and past spontaneous abortions (miscarriage). Patient accommodation class (public/private) was considered to be a proxy for socioeconomic position and was not included in the model.

Despite a much smaller proportion of missing data across all variables, missing data were dealt with in the same manner as in the UKOSS analysis in Chapter Three by using proxy indicators to denote 'missing' as separate sub-categories within each variable.

Multivariable analysis was performed using unconditional logistic regression in order to calculate adjusted OR with 95% confidence intervals. All variables analysed were categorical. Using a similar technique to that used for the analysis of UKOSS cases in Chapter Three, *a priori* variables were added individually in turn to the model and likelihood ratio tests were conducted after each addition to test the effect of the addition of individual variables on the fit of the model. The additional variables were then added in turn and only those variables demonstrating a statistically significant effect ($p<0.05$) on the fit of the data were retained in the model.

There were no continuous variables in the dataset and thus tests for departure from linearity were not performed. Using likelihood ratio tests, interactions in the data were tested between socioeconomic position and all other variables in the model. For these purposes statistical significance was defined by $p<0.01$. No significant interactions were found.

5.4 RESULTS

The overall patient population comprised 211,060 women, including 1,119 women with severe maternal morbidity. The dataset also included a total of 1,002 women who underwent a termination of pregnancy post-20 weeks gestation.

INCIDENCE ESTIMATES

The incidence of maternal morbidity overall was 530.2 per 100,000 maternities (0.53%) (Table 61). The incidence of individual conditions was highest for procedure-related morbidity (357.7 per 100,000), which included 590 cases of blood transfusion (280 per 100,000). Rates were also high for uterine rupture (57.8 per 100,000), major cardiac event (26.1 per 100,000), disseminated intravascular coagulation (DIC) (24.6 per 100,000), acute abdomen (23.7 per 100,000) and obstetric embolism (22.7 per 100,000).

Table 61. Incidence of individual conditions and overall maternal morbidity

Morbidity category	**Number of cases per condition (N=211, 060)**	**Incidence per 100,000 maternities (95%CI)**
Acute abdomen	50	23.7 (17.6 – 31.2)
Acute renal failure	24	11.4 (7.3 – 16.9)
Acute psychosis	8	3.8 (1.6 – 7.5)
Cardiac arrest/failure/infarction	55	26.1 (19.6 – 33.9)
Cerebral oedema or coma	1	0.5 (0.01 – 2.6)
Disseminated intravascular coagulation	52	24.6 (18.4 – 32.3)
Cerebrovascular accident	11	5.2 (2.6 – 9.3)
Major complications of anaesthesia	18	8.5 (5.1 – 13.5)
Obstetric embolism	48	22.7 (16.8 – 30.2)
Shock	35	16.6 (11.6 – 23.1)
Status asthmaticus	1	0.5 (0.01 – 2.6)
Status epilepticus	2	1.0 (0.02 – 3.4)
Uterine rupture	122	57.8 (48.0 – 69.0)
Morbidity (procedure codes)	755	357.7 (332.7 – 384.1)
Including transfusion	*590*	*280.0 (257.9 – 303.5)*
Total women with morbidity	**1,119**	**530.2** (499.6 – 562.1) **0.53%**

The incidence varied by socioeconomic group from 432 cases per 100,000 maternities amongst the 3rd quintile to 673 per 100,000 amongst the 4th quintile (Table 62). The incidence was 517 cases per 100,000 maternities amongst the lowest socioeconomic group (5th quintile).

Table 62. Incidence of severe maternal morbidity amongst IRSD socioeconomic quintiles

IRSD quintile	**Number of cases (N)**	**Incidence per 100,000 maternities (95%CI)**
1 (Least deprived)	209 (45,376)	460.6 (400.4 – 527.3)
2	246 (44,670)	550.7 (484.2 – 623.8)
3	156 (36,104)	432.1 (367.1 – 505.3)
4	241 (35,763)	673.9 (591.7 – 764.2)
5 (Most deprived)	231 (44,602)	517.9 (453.4 – 589.0)
Missing	36 (4,545)	792.1 (555.4 – 1,094.9)

DESCRIPTIVE ANALYSIS

There was a significant univariable association between IRSD quintile and likelihood of being a case (p<0.001) (Table 63). Unadjusted regression analysis suggested that women in the 2nd quintile had a 20% increased odds of being a case (OR 1.20; 95%CI 1.00-1.44), the 4th quintile 47% (OR 1.47; 95%CI 1.22-1.77), the 5th quintile 13% (OR 1.13; 95%CI 0.93-1.36) and those with missing SEIFA data a 73% increased odds (OR 1.73; 95%CI 1.21-2.46). The OR for women in the 3rd quintile was 0.94 (95%CI 0.76-1.15).

The overall proportion of women in public care (136,665; 64.8%) was much higher than in private care (74,395; 35.3%) and there was a higher proportion of cases than controls in public care (67.1% vs 64.7% respectively) (Table 63). Thus cases were 10% less likely to be in private care than controls (OR 0.90; 95%CI 0.79-1.02).

There was a higher proportion of women aged <20 years in the case group (3.6%) but the distribution of cases and controls was otherwise similar across each age group (Table 63). There was a u-shaped relationship between age and morbidity, although the excess odds amongst women <20 years was not statistically significant. Cases were 1.29 (95%CI 0.92-1.80) times more likely than controls to be aged <20 years and 1.23 (95%CI 1.05-1.44) times more likely to be aged 35 years and over, compared to the baseline group aged 25-29 years.

The distribution of case and control women across ethnic groups was similar and the univariable association between country of birth region and morbidity was of borderline statistical significance (p=0.06) (Table 63). Compared to Australian-born women, the unadjusted analysis showed that the odds of being a case was lower amongst women from all other country groups although was only statistically significant for women from the Middle East (OR 0.44; 95%CI 0.24-0.80). The OR for women with missing country of birth data was 0.40 (95%CI 0.10-1.60).

There was a higher proportion of cases amongst Indigenous Aboriginal and Torres Strait Islander (ATSI) women, whose unadjusted risk of severe morbidity was 2.23 (95%CI 1.47-3.38) compared to non-Indigenous women (Table 63). The odds of morbidity for women with unknown ATSI status was 1.33 (95%CI 0.19-9.50).

Women were predominantly married (151,245; 71.7%) and unadjusted analysis showed that the relationship between outcome and marital status was not statistically significant.

Table 63. Unadjusted analysis of odds of morbidity associated with demographic characteristics

Variable	N (%)	Cases N=1,119	Controls N=209,941	Unadjusted OR (95%CI)	χ^2 p-value
Socioeconomic category (IRSD quintile)					
1 (Least deprived)	45,376 (21.5)	209 (18.7)	45,167 (21.5)	1.0	
2	44,670 (21.2)	246 (22.0)	44,242 (21.2)	1.20 (1.00-1.44)	P<0.001
3	36,104 (17.1)	156 (13.9)	35,948 (17.1)	0.94 (0.76-1.15)	
4	35,763 (16.9)	241 (21.5)	35,522 (16.9)	1.47 (1.22-1.77)	
5 (Most deprived)	44,602 (21.1)	231 (20.6)	44,371 (21.1)	1.13 (0.93-1.36)	
Missing	4,545 (2.2)	36 (3.2)	4,509 (2.2)	1.73 (1.21-2.46)	
Patient accommodation class					
Private	74, 395 (35.3)	368 (32.9)	74,027 (35.3)	0.90 (0.79-1.02)	P=0.10
Public	136,665 (64.8)	751 (67.1)	135, 914 (64.7)	1.0	
Age category					
<20 years	5, 822 (2.8)	40 (3.6)	5,782 (2.8)	1.29 (0.92-1.80)	
20-24 years	24,090 (11.4)	103 (9.2)	23,987 (11.4)	0.80 (0.64-1.00)	
25-29 years	53,162 (25.2)	284 (25.4)	52,878 (25.2)	1.0	P<0.001
30-34 years	74,191 (35.2)	339 (30.3)	73,852 (35.2)	0.86 (0.73-1.00)	
≥ 35 years	53,787 (25.5)	353 (31.6)	53,434 (25.5)	1.23 (1.05-1.44)	
Missing	8	0	8	Omitted	

Table 63 *continued*

Variable	N (%)	Cases N=1,119	Controls N=209,941	Unadjusted OR (95%CI)	χ^2 p-value
Country of birth (region)					
Australia	155,654 (73.8)	860 (76.9)	154,794 (73.7)	1.0	
Oceania	5, 816 (2.8)	24 (2.1)	5,792 (2.8)	0.75 (0.50-1.12)	
UK & Ireland	5,407 (2.6)	29 (2.6)	5,378 (2.6)	0.97 (0.67-1.41)	P=0.06
Europe	6,087 (2.9)	23 (2.1)	6,064 (2.9)	0.68 (0.45-1.03)	
Middle East	4,495 (2.1)	11 (1.0)	4,484 (2.1)	0.44 (0.24-0.80)	
North America	1,297 (0.6)	6 (0.5)	1,291 (0.6)	0.84 (0.37-1.87)	
South America	1,270 (0.6)	3 (0.3)	1,267 (0.6)	0.43 (0.14-1.33)	
Africa	5,320 (2.5)	28 (2.5)	5,292 (2.5)	0.95 (0.65-1.39)	
Asia	24,808 (11.8)	133 (11.9)	24,675 (11.8)	0.97 (0.81-1.17)	
Missing	906 (0.4)	2 (0.2)	904 (0.4)	0.40 (0.10-1.60)	
Aboriginal and Torres Strait Islander status (ATSI)					
Non-ATSI	208,934 (98.9)	1,095 (97.9)	207,839 (99.0)	1.0	
ATSI	1,982 (1.0)	23 (2.1)	1,959 (0.9)	2.23 (1.47-3.38)	P<0.001
Missing	144 (0.1)	1 (0.1)	143 (0.1)	1.33 (0.19-9.50)	
Marital status					
Married	151,245 (71.7)	795 (71.1)	150,450 (71.7)	1.0	
Single	28,084 (13.3)	145 (13.0)	27,939 (13.3)	0.98 (0.82-1.17)	P=0.58
De facto	31,259 (14.8)	178 (15.9)	31,081 (14.8)	1.08 (0.92-1.28)	
Missing	472 (0.2)	1 (0.1)	471 (0.2)	0.40 (0.06-2.86)	

*χ^2 p-value reported for difference in proportion between cases and controls (column 3 and 4) across sub-categories of each variable

The majority of women were multiparous (119,784; 56.8%) and the odds of maternal morbidity did not vary by parity (Table 64). As would be expected, the majority of pregnancies were singleton (207,308; 98.2%), and the unadjusted odds of morbidity amongst women with multiple pregnancies was 2.39 times higher (OR 2.39; 95%CI 1.77-3.21) than for those with singleton pregnancies.

The vast majority of women had no significant co-existing medical condition reported (191,696; 90.8%) and compared with controls, case women were 48% more likely (OR 1.48; 95%CI 1.24-1.76) to have a medical condition (Table 64). Nearly three quarters of women had had an ultrasound prior to 13 weeks gestation (151,362; 71.7%). There was no obvious association between severe morbidity and ultrasound by 13 weeks.

The univariable association between past caesarean section and outcome was highly significant, with cases 62% more likely to have had ≥1 past caesareans (OR 1.62; 95%CI 1.41-1.87) (Table 64). Cases were 29% more likely to have a history of 1-2 past spontaneous abortions (OR 1.29; 95%CI 1.12-1.48) and 74% more likely to have had ≥3 past spontaneous abortions (OR 1.74; 95%CI 1.23-2.46). Cases were 63% more likely to have had ≥ 1 past ectopic pregnancies (OR 1.63; 95%CI 1.09-2.42). With regards to mode of delivery, case women were significantly more likely to have had an unplanned emergency caesarean and to have been admitted to ICU or HDU (Table 64).

Table 64. Unadjusted analysis of odds of morbidity associated with clinical characteristics

Variable	N (%)	Cases N=1,119	Controls N=209,941	Unadjusted OR (95%CI)	χ^2 p-value
Parity					
Multiparous	119,784 (56.8)	628 (56.1)	119,156 (56.8)	1.0	P=0.67
Primiparous	91,276 (43.3)	491 (43.9)	90, 785 (43.2)	1.03 (0.91 – 1.16)	
Multiple pregnancy					
No	207,308 (98.2)	1,073 (95.9)	206,235 (98.2)	1.0	P<0.001
Yes	3, 752 (1.8)	46 (4.1)	3, 706 (1.8)	2.39 (1.77-3.21)	
Co-existing medical condition					
No	191,696 (90.8)	974 (87.0)	190,722 (90.9)	1.0	P<0.001
Yes	19,364 (9.2)	145 (13.0)	19,219 (9.2)	1.48 (1.24-1.76)	
Ultrasound before 13 weeks gestation					
Yes	151,362 (71.7)	827 (73.9)	150,535 (71.7)	1.0	
No	55,253 (26.2)	276 (24.7)	54,977 (26.2)	0.91 (0.80-1.05)	P=0.12
Missing	4,445 (2.1)	16 (1.4)	4,429 (2.1)	0.66 (0.40-1.08)	
Past caesarean section					
0	178,203 (84.4)	862 (77.0)	177,341 (84.5)	1.0	P<0.001
≥1	32,857 (15.6)	257 (23.0)	32,600 (15.5)	1.62 (1.41-1.87)	
Past ectopic pregnancy					
0	208, 101(98.6)	1,094 (97.8)	207,007 (98.6)	1.0	P=0.05
≥1	2,959 (1.4)	25 (2.2)	2, 934 (1.4)	1.63 (1.09-2.42)	
Past spontaneous abortion					
0	166,659 (79.0)	827 (73.9)	165,832 (79.0)	1.0	
1 – 2	40,560 (19.2)	259 (23.2)	40,301 (19.2)	1.29 (1.12-1.48)	P<0.001
≥3	3,841 (1.8)	33 (3.0)	3,808 (1.8)	1.74 (1.23-2.46)	
Mode of delivery					
Vaginal/ Instrumental	146,478 (69.4)	563 (50.3)	145,915 (69.5)	1.0	P<0.001
Planned caesarean	34,966 (15.6)	224 (20.0)	34,742 (16.6)	1.67 (1.43-1.95)	
Unplanned caesarean	29,616 (14.0)	332 (29.7)	29,284 (14.0)	2.94 (2.56-3.37)	
ICU/HDU admission					
No	209,568 (99.3)	850 (76.0)	208,718 (99.4)	1.0	
Yes	1,492 (0.70)	269 (24.0)	1,223 (0.6)	54. 01 (46.57-62.64)	P<0.001

*χ^2 p-value reported for difference in proportion between cases and controls (column 3 and 4) across sub-categories of each variable

In the bivariable analysis, there were no variables that had a particularly significant impact on the relationship between socioeconomic position and the odds of severe morbidity except age which produced a minimal increase in the odds for all quintiles (Table 65).

Table 65. Individual effects of each variable on odds of morbidity across IRSD quintiles

IRSD 2 OR (95%CI)	IRSD 3 OR (95%CI)	IRSD 4 OR (95%CI)	IRSD 5 OR (95%CI)	Missing IRSD OR (95%CI)
IRSD quintile				
1.20 (1.00-1.44)	0.94 (0.76-1.15)	1.47 (1.22-1.77)	1.13 (0.93-1.36)	1.73 (1.21-2.46)
IRSD quintile / Country of birth				
1.20 (0.99-1.44)	0.94 (0.77-1.16)	1.47 (1.22-1.78)	1.16 (0.96-1.41)	1.72 (1.20-2.45)
IRSD quintile / ATSI				
1.20 (0.99-1.44)	0.93 (0.76-1.15)	1.45 (1.20-1.75)	1.11 (0.92-1.33)	1.65 (1.15-2.36)
IRSD quintile / Age				
1.24 (1.03-1.49)	0.98 (0.79-1.20)	1.55 (1.29-1.88)	1.19 (0.98-1.44)	1.83 (1.28-2.61)
IRSD quintile / Marital status				
1.20 (1.00-1.44)	0.94 (0.76-1.16)	1.47 (1.22-1.77)	1.13 (0.94-1.37)	1.73 (1.21-2.48)
IRSD quintile / Medical condition				
1.19 (0.99-1.43)	0.93 (0.76-1.15)	1.45 (1.20-1.74)	1.12 (0.92-1.35)	1.65 (1.16-2.36)
IRSD quintile / Parity				
1.20 (0.99-1.44)	0.94 (0.76-1.15)	1.47 (1.22-1.77)	1.13 (0.93-1.36)	1.73 (1.21-2.46)
IRSD quintile / Multiple pregnancy				
1.20 (1.00-1.44)	0.94 (0.77-1.16)	1.47 (1.22-1.77)	1.13 (0.94-1.37)	1.73 (1.22-2.47)
IRSD quintile / Past caesarean section				
1.20 (1.00-1.44)	0.95 (0.77-1.16)	1.48 (1.23-1.78)	1.14 (0.94-1.37)	1.75 (1.23-2.49)
IRSD quintile / Past ectopic pregnancy				
1.20 (1.00-1.44)	0.94 (0.76-1.16)	1.47 (1.22-1.77)	1.13 (0.93-1.36)	1.73 (1.21-2.53)
IRSD quintile / Past spontaneous abortion				
1.20 (1.00-1.45)	0.94 (0.77-1.16)	1.47 (1.22-1.77)	1.13 (0.94-1.36)	1.75 (1.23-2.50)

Characteristics of case and control women

Amongst the cases, women from the 5th IRSD quintile were significantly more likely than women from the highest quintile to be public patients, younger on average, from Oceania, Europe, the Middle East, Africa or Asia, of ATSI background, single or in a de facto relationship, and to have not had an ultrasound before 13 weeks gestation (Table 66). Cases with missing socioeconomic data were more likely than cases with complete data to be private patients, aged 30-34 years, Australian-born, Aboriginal or Torres Strait Islander, in a de facto relationship, and to have had an ultrasound before 13 weeks (data not shown).

Table 66. Characteristics of cases by IRSD socioeconomic quintile

Variable	IRSD 1 (Least deprived)	IRSD 2	IRSD 3	IRSD 4	IRSD 5 (Most deprived)	Missing IRSD	χ^2 p-value*
Patient accommodation class							
Private	115 (55.0)	99 (40.2)	55 (35.3)	51 (21.2)	39 (16.9)	9 (25.0)	P<0.001
Public	94 (45.0)	147 (59.8)	101 (64.7)	190 (78.8)	192 (83.1)	27 (75.0)	
Age category							
<20 years	2 (1.0)	2 (0.8)	3 (1.9)	13 (5.4)	17 (7.4)	3 (8.3)	
20-24 years	5 (2.4)	20 (8.1)	12 (7.7)	25 (10.4)	37 (16.0)	4 (11.1)	P<0.001
25-29 years	40 (19.1)	60 (24.4)	46 (29.5)	81 (33.6)	46 (19.9)	11 (30.6)	
30-34 years	66 (31.6)	83 (33.7)	40 (25.6)	73 (30.3)	63 (27.3)	14 (38.9)	
≥ 35 years	96 (45.9)	81 (32.9)	55 (35.3)	49 (20.3)	68 (29.4)	4 (11.1)	
Missing	Nil						
Country of birth (region)							
Australia	148 (70.8)	192 (78.1)	128 (82.1)	205 (85.1)	155 (67.1)	32 (88.9)	
Oceania	5 (2.4)	6 (2.4)	1 (0.6)	5 (2.1)	6 (2.6)	1 (2.8)	p<0.001
UK/Ireland	12 (5.7)	6 (2.4)	4 (2.6)	3 (1.2)	3 (1.3)	1 (2.8)	
Europe	4 (1.9)	6 (2.4)	4 (2.6)	0	9 (3.9)	0	
Middle East	0	1 (0.4)	3 (1.9)	4 (1.7)	3 (1.3)	0	
North Am.	2 (1.0)	1 (0.4)	0	1 (0.4)	2 (0.9)	0	
South Am.	0	0	0	0	3 (1.3)	0	
Africa	4 (1.9)	2 (0.8)	5 (3.2)	5 (2.1)	11 (4.8)	1 (2.8)	
Asia	34 (16.3)	32 (13.0)	11 (7.1)	18 (7.5)	37 (16.0)	1 (2.8)	
Missing	0	0	0	2 (0.9)	0	0	
Aboriginal and Torres Strait Islander status (ATSI)							
Non-ATSI	208 (99.5)	245 (99.6)	152 (97.4)	236 (97.9)	223 (96.5)	31 (86.1)	
ATSI	0 (0.0)	1 (0.4)	4 (2.6)	5 (2.1)	8 (3.5)	5 (13.9)	P=0.01
Missing	1 (0.5)	0	0	0	0	0	

Table 66 *continued*

Variable	IRSD 1 (Least deprived)	IRSD 2	IRSD 3	IRSD 4	IRSD 5 (Most deprived)	Missing IRSD	χ^2 p-value*
Marital status							
Married	175 (83.7)	177 (72.0)	111 (71.2)	167 (69.3)	143 (61.9)	22 (61.1)	
Single	9 (4.3)	27 (11.0)	21 (13.5)	39 (16.2)	44 (19.1)	5 (13.9)	P<0.001
De facto	25 (12.0)	42 (17.1)	24 (15.4)	35 (14.5)	43 (18.6)	9 (25.0)	
Missing	0	0	0	1 (0.4)	0	0	
Parity							
Primiparous	95 (45.5)	113 (45.9)	73 (46.8)	107 (44.4)	92 (39.8)	11 (30.6)	P=0.29
Multiparous	114 (54.6)	133 (54.1)	83 (53.2)	134 (55.6)	139 (60.2)	25 (69.4)	
Co-existing medical condition							
No	185 (88.5)	211 (85.8)	141 (90.4)	208 (86.3)	202 (87.5)	27 (75.0)	P=0.31
Yes	24 (11.5)	35 (14.2)	15 (9.6)	33 (13.7)	29 (12.6)	9 (25.0)	
Ultrasound before 13 weeks							
Yes	158 (75.6)	188 (76.4)	107 (68.6)	193 (80.1)	154 (66.7)	27 (75.0)	
No	45 (21.5)	56 (22.8)	48 (30.8)	45 (18.7)	73 (31.6)	9 (25.0)	P<0.001
Missing	6 (2.9)	2 (0.8)	1 (0.6)	3 (1.2)	4 (1.7)	0	
Multiple pregnancy							
No	205 (98.1)	237 (96.3)	150 (96.2)	229 (95.0)	219 (94.8)	33 (91.7)	P=0.69
Yes	4 (1.9)	9 (3.7)	6 (3.9)	12 (5.0)	12 (5.2)	3 (8.3)	
Past caesarean section							
No	161 (77.0)	189 (76.8)	116 (74.4)	192 (79.7)	178 (77.1)	26 (72.2)	P<0.001
Yes	48 (23.0)	57 (23.2)	40 (25.6)	49 (20.3)	53 (22.9)	10 (27.8)	
Past ectopic pregnancy							
0	205 (98.1)	239 (97.2)	156 (100.0)	236 (97.9)	223 (96.5)	35 (97.2)	P=0.45
≥1	4 (1.9)	7 (2.9)	0	5 (2.1)	8 (3.5)	1 (2.8)	
Past spontaneous abortion							
0	155 (74.2)	189 (76.8)	114 (73.1)	179 (74.3)	161 (69.7)	29 (80.6)	
1-2	45 (21.5)	53 (21.5)	40 (25.6)	50 (20.8)	65 (28.1)	6 (16.7)	P=0.01
≥3	9 (4.3)	4 (1.6)	2 (1.3)	12 (5.0)	5 (2.2)	1 (2.8)	

*χ^2 p-value reported for difference in proportions between IRSD quintile 1 and IRSD quintile 5

Compared with control women from the highest IRSD quintile, control women from the lowest socioeconomic quintile were significantly more likely to be public patients, younger on average, from Oceania, Europe, the Middle East, Africa and Asia, of ATSI background, single, multiparous, have a co-existing medical condition, to have not had an ultrasound before 13 weeks and to have not had any past caesarean deliveries (Table 67). Control women with missing socioeconomic data were more likely to be < 20 years old, Australian-born, ATSI or have missing ATSI-status data, be in a de facto relationship and to have a co-existing medical condition (data not shown).

Table 67. Characteristics of controls by IRSD socioeconomic quintile

Variable	IRSD 1 (least deprived)	IRSD 2	IRSD 3	IRSD 4	IRSD 5 (Most deprived)	Missing IRSD	χ^2 p-value*
Patient accommodation class							
Private	27,416 (60.7)	18,395 (41.4)	12,116 (33.7)	7,267 (20.5)	7,543 (17.0)	1,290 (28.6)	P<0.001
Public	17,751 (39.3)	26,029 (58.6)	23,832 (66.3)	28,255 (79.5)	36,828 (83.0)	3,219 (71.4)	
Age category							
<20 years	350 (0.8)	716 (1.6)	898 (2.5)	1,422 (4.0)	2,063 (4.6)	333 (7.4)	P<0.001
20-24 years	1,796 (4.0)	3,767 (8.5)	3,889 (10.8)	5,648 (15.9)	8,110 (18.3)	777 (17.2)	
25-29 years	7,820 (17.3)	10,984 (24.7)	9,420 (26.2)	10,571 (29.8)	12,809 (28.9)	1,274 (28.3)	
30-34 years	18,609 (41.2)	17,034 (38.3)	12,988 (36.1)	11,144 (31.4)	12,748 (28.7)	1,329 (29.5)	
≥ 35 years	16,591 (36.7)	11,922 (26.8)	8,753 (24.4)	6,737 (19.0)	8,641 (19.5)	790 (17.5)	
Missing	1	1	0	0	0	6 (0.1)	
Country of birth (region)							
Australia	33,510 (74.2)	34,367 (77.4)	27,476 (76.4)	27,965 (78.7)	27,483 (61.9)	3,993 (88.6)	P<0.001
Oceania	1,023 (2.3)	1,091 (2.5)	1,020 (2.8)	985 (2.8)	1,530 (3.5)	134 (3.0)	
UK/Ireland	1,915 (4.2)	1,319 (3.0)	980 (2.7)	603 (1.7)	489 (1.1)	72 (1.6)	
Europe	1,554 (3.4)	1,229 (2.8)	1,065 (3.0)	783 (2.2)	1,387 (3.1)	46 (1.0)	
Middle East	423 (0.9)	419 (0.9)	542 (1.5)	689 (1.9)	2,400 (5.4)	14 (0.3)	
North Am.	492 (1.1)	306 (0.7)	217 (0.6)	148 (0.4)	118 (0.3)	10 (0.2)	
South Am.	267 (0.6)	291 (0.7)	229 (0.6)	220 (0.6)	252 (0.6)	8 (0.2)	
Africa	899 (2.0)	789 (1.8)	730 (2.0)	714 (2.0)	2,133 (4.8)	27 (0.6)	
Asia	5,005 (11.1)	4,485 (10.1)	3,561 (9.9)	3,230 (9.1)	8,254 (18.6)	140 (3.1)	
Missing	70 (0.2)	128 (0.3)	128 (0.4)	188 (0.5)	325 (0.7)	65 (1.4)	
Aboriginal and Torres Strait Islander status (ATSI)							
Non-ATSI	45,055 (99.8)	44,239 (99.6)	35,734 (99.4)	34,042 (98.7)	43,504 (98.1)	4,265 (94.6)	P<0.001
ATSI	97 (0.2)	167 (0.4)	199 (0.6)	463 (1.3)	840 (1.9)	193 (4.3)	
Missing	15 (0.03)	18 (0.04)	15 (0.04)	17 (0.1)	27 (0.1)	51 (1.1)	
Marital status							
Married	37,360 (82.7)	33,687 (75.8)	25,363 (70.6)	22,892 (64.4)	28,540 (64.3)	2,608 (57.8)	P<0.001
Single	2,696 (6.0)	4,614 (10.4)	4,767 (13.2)	6,007 (16.9)	9,041 (20.4)	814 (18.1)	
De facto	5,075 (11.2)	6,051 (13.6)	5,749 (16.0)	6,531 (18.4)	6,614 (14.9)	1,061 (23.5)	
Missing	36 (0.1)	72 (0.2)	69 (0.2)	92 (0.3)	176 (0.4)	26 (0.6)	

Table 67 *continued*

Variable	IRSD 1 (least deprived)	IRSD 2	IRSD 3	IRSD 4	IRSD 5 (Most deprived)	Missing IRSD	χ^2 p-value*
Parity							
Primiparous	20,074 (44.4)	19,485 (43.9)	16,156 (44.9)	14,593 (41.1)	18,564 (41.8)	1,913 (42.4)	P<0.001
Multiparous	25,093 (55.6)	24,939 (56.1)	19,792 (55.1)	20,929 (58.9)	25,807 (58.2)	2,596 (57.6)	
Co-existing medical condition							
No	41,868 (92.7)	40,421 (91.0)	32,742 (91.1)	31,784 (89.5)	40,196 (90.6)	3,711 (82.3)	P<0.001
Yes	3,299 (7.3)	4,003 (9.0)	3,206 (8.9)	3,738 (10.5)	4,175 (9.4)	798 (17.7)	
Ultrasound before 13 weeks							
Yes	36, 373 (80.5)	34,637 (78.0)	25,350 (70.5)	24,928 (70.2)	26,058 (58.7)	3,189 (70.7)	P<0.001
No	8,195 (18.1)	9,154 (20.6)	9,841 (27.4)	9,801 (27.6)	17,011 (38.3)	975 (21.6)	
Missing	599 (1.3)	633 (1.4)	757 (2.1)	793 (2.2)	1,302 (2.9)	345 (7.7)	
Multiple pregnancy							
No	44,271 (98.0)	43,603 (98.2)	35,336 (98.3)	34,905 (98.3)	43,683 (98.5)	4,437 (98.4)	P=0.06
Yes	896 (2.0)	821 (1.9)	612 (1.7)	617 (1.7)	688 (1.6)	72 (1.6)	
Past caesarean section							
0	37,673 (83.4)	37,311 (84.0)	30,489 (84.8)	30,075 (84.7)	37,929 (85.5)	3,864 (85.7)	P<0.001
≥1	7,494 (16.6)	7,113 (16.0)	5,459 (15.2)	5,447 (15.3)	6,442 (14.5)	645 (14.3)	
Past ectopic pregnancy							
0	44,478 (98.5)	43,849 (98.7)	35,432 (98.6)	35,001 (98.5)	43,793 (98.7)	4,454 (98.8)	P=0.01
≥1	689 (1.5)	575 (1.3)	516 (1.4)	521 (1.5)	578 (1.3)	55 (1.2)	
Past spontaneous abortion							
0	35,176 (77.9)	35,222 (79.3)	28,568 (79.5)	27,952 (78.7)	35,187 (79.3)	3,727 (82.7)	P<0.001
1-2	9,084 (20.1)	8,449 (19.0)	6,767 (18.8)	6,907 (19.4)	8,379 (18.9)	715 (15.9)	
≥3	907 (2.0)	753 (1.7)	613 (1.7)	663 (1.9)	805 (1.8)	67 (1.5)	

*χ^2 p-value reported for difference in proportions between IRSD quintile 1 and IRSD quintile 5

Missing data

The highest proportion of missing data, 2.2%, was for socioeconomic position (IRSD quintile) (Table 68). There was also 2.1% of data missing for ultrasound before 13 weeks, with less than 0.5% missing for all other variables with missing data. As outlined in the Methods section, there were no missing data for any of the clinical outcome variables.

Table 68. Missing data for each variable – cases and controls combined

Variable	Data missing n (%)
Socioeconomic position	4,545 (2.2)
Patient accommodation class	0
Age	8 (0.01)
Country of birth	906 (0.4)
ATSI	144 (0.1)
Marital status	472 (0.2)
Parity	0
Co-existing medical condition	0
US before 13 weeks	4,445 (2.1)
Multiple pregnancy	0
Past caesarean section	0
Past ectopic pregnancy	0
Past spontaneous abortion	0

MULTIVARIABLE ADJUSTED ANALYSIS

Table 69 shows the results of the model building to explore the odds being a case of maternal morbidity associated with socioeconomic position. The addition of the variables ATSI status and country of birth to the model produced minimal changes in the OR across quintiles but were shown to have a significant effect on the fit of the model and were retained. Following the addition of all subsequent variables the OR remained within a narrow range across all quintiles. Past ectopic pregnancy was the only variable that did not have a significant effect on the fit of the model and was not retained (Table 69).

Table 69. Odds of being a case of maternal morbidity by socioeconomic position (reference group IRSD quintile 1 omitted)

IRSD 2	IRSD 3	IRSD 4	IRSD 5	Missing IRSD	LRT p-value*
IRSD quintile only					
1.20 (1.00-1.44)	0.94 (0.76-1.15)	1.47 (1.22-1.77)	1.13 (0.93-1.36)	1.73 (1.21-2.46)	N/A
IRSD quintile, ATSI					
1.20 (0.99 – 1.44)	0.93 (0.76 – 1.15)	1.45 (1.20 – 1.75)	1.11 (0.92 – 1.33)	1.65 (1.15 – 2.36)	P=0.01
IRSD quintile, ATSI, Country of birth					
1.19 (0.99 – 1.44)	0.94 (0.76 – 1.16)	1.46 (1.21 – 1.76)	1.14 (0.94 – 1.38)	1.65 (1.15 – 2.35)	P=0.03
IRSD quintile, ATSI, Country of birth, Age					
1.24 (1.03 – 1.49)	0.98 (0.79 – 1.21)	1.55 (1.28 – 1.87)	1.21 (1.00 – 1.47)	1.75 (1.22 – 2.51)	P<0.001
IRSD quintile, ATSI, Country of birth, Age, Multiple pregnancy					
1.24 (1.03 – 1.49)	0.98 (0.80 – 1.21)	1.55 (1.28 – 1.87)	1.21 (1.00 – 1.47)	1.75 (1.22 – 2.51)	P<0.001
IRSD quintile, ATSI, Country of birth, Age, Multiple pregnancy, Medical condition					
1.23 (1.02 – 1.48)	0.98 (0.79 – 1.20)	1.53 (1.27 – 1.85)	1.20 (0.99 – 1.46)	1.70 (1.18 – 2.44)	P<0.001
IRSD quintile, ATSI, Country of birth, Age, Multiple pregnancy, Medical condition, Past caesarean section					
1.22 (1.01 – 1.47)	0.97 (0.79 – 1.20)	1.52 (1.25 – 1.83)	1.19 (0.98 – 1.44)	1.69 (1.18 – 2.42)	P<0.001
IRSD quintile, ATSI, Country of birth, Age, Multiple pregnancy, Medical condition, Past caesarean section, Parity					
1.23 (1.02 – 1.48)	0.98 (0.79 – 1.21)	1.55 (1.28 – 1.88)	1.22 (1.00 – 1.48)	1.73 (1.21 – 2.48)	P<0.001

Table 69 *continued*

IRSD 2	IRSD 3	IRSD 4	IRSD 5	Missing IRSD	LRT p-value*
IRSD quintile, ATSI, Country of birth, Age, Multiple pregnancy, Medical condition, Past caesarean section, Parity, Past ectopic pregnancy					
1.23 (1.02 – 1.48)	0.98 (0.79 – 1.21)	1.55 (1.28 – 1.88)	1.22 (1.00 – 1.48)	1.73 (1.21 – 2.49)	P=0.07
IRSD quintile, ATSI, Country of birth, Age, Multiple pregnancy, Medical condition, Past caesarean section, Parity, Past spontaneous abortion					
1.23 (1.03 – 1.49)	0.98 (0.79 – 1.21)	1.55 (1.28 – 1.87)	1.21 (1.00 – 1.47)	1.74 (1.21 – 2.50)	P<0.001

*p-value reported for likelihood ratio tests comparing model with and without the additional variable

Final model

After adjusting for all confounding variables in the dataset, the aOR for the 2nd IRSD quintile was 1.23 (95%CI 1.03 – 1.49), 0.98 (95%CI 0.79 – 1.21) for the 3rd quintile, 1.55 (95%CI 1.28 – 1.87) for the 4th and 1.21 (95%CI 1.00 – 1.47) for the lowest quintile (Table 70). The adjusted OR for women with missing socioeconomic data was 1.74 (95%CI 1.21 – 2.50). Indigenous status was associated with twice (aOR 2.02; 95%CI 1.32 – 3.09) the odds of being a case. The u-shaped relationship between age and maternal morbidity persisted in adjusted analysis with age <20 years (aOR 1.14; 95%CI 0.81 – 1.60) and ≥35 years (aOR 1.22; 95%CI 1.04 – 1.44) being associated with increased odds of being a case, compared to the baseline group of 25-29 years.

Multiple pregnancy was associated with a 2.30 times (aOR 2.30; 95%CI 1.71 – 3.10) increased odds of being a case. Compared to multiparous women, primiparous women were 36% (aOR 1.36; 95%CI 1.18 – 1.57) more likely to be a case and women with co-existing medical conditions were 39% (aOR 1.39; 95%CI 1.16 – 1.65) more likely to be a case. Women who had had one or more past caesarean sections were almost 80% (aOR 1.79; 95%CI 1.53 – 2.10) more likely to be a case. Those with 1-2 past spontaneous miscarriages were 25% more likely (aOR 1.25; 95%CI 1.08 – 1.44) and those with 3 or more past miscarriages were almost 60% more likely to be a case (aOR 1.57; 95%CI 1.10 – 2.24).

Table 70. Unadjusted and adjusted odds of being a case of maternal morbidity compared with controls (mutually adjusted for all other variables in the model)

Variable	Unadjusted OR (95%CI)	Adjusted OR (95%CI)
IRSD quintile		
1	1.0	1.0
2	1.20 (1.00 – 1.44)	1.23 (1.03 – 1.49)
3	0.94 (0.76 – 1.15)	0.98 (0.79 – 1.21)
4	1.47 (1.22 – 1.77)	1.55 (1.28 – 1.87)
5	1.13 (0.93 – 1.36)	1.21 (1.00 – 1.47)
Missing	1.73 (1.21 – 2.46)	1.74 (1.21 – 2.50)
ATSI		
Non-ATSI	1.0	1.0
ATSI	2.23 (1.47 – 3.38)	2.02 (1.32 – 3.09)
Missing	1.33 (0.19 – 9.50)	1.16 (0.16 – 8.44)
Country of birth (region)		
Australian	1.0	1.0
Oceania	0.75 (0.50 – 1.12)	0.78 (0.52 – 1.18)
UK & Ireland	0.97 (0.67 – 1.41)	0.98 (0.67 – 1.42)
Europe	0.68 (0.45 – 1.03)	0.73 (0.48 – 1.10)
Middle East	0.44 (0.24 – 0.80)	0.48 (0.26 – 0.87)
North America	0.84 (0.37 – 1.87)	0.87 (0.39 – 1.94)
South America	0.43 (0.14 – 1.33)	0.43 (0.14 – 1.35)
Africa	0.95 (0.65 – 1.39)	1.03 (0.71 – 1.51)
Asia	0.97 (0.81 – 1.17)	1.06 (0.88 – 1.27)
Missing	0.40 (0.10 – 1.60)	0.39 (0.10 – 1.59)
Age category		
< 20	1.29 (0.92 – 1.80)	1.14 (0.81 – 1.60)
20 – 24	0.80 (0.64 – 1.00)	0.78 (0.62 – 0.98)
25 – 29	1.0	1.0
30 – 34	0.86 (0.73 – 1.00)	0.87 (0.74 – 1.02)
≥ 35	1.23 (1.05 – 1.44)	1.22 (1.04 – 1.44)
Missing	Omitted (too few observations)	Omitted
Multiple pregnancy		
No	1.0	1.0
Yes	2.39 (1.77 – 3.21)	2.30 (1.71 – 3.10)
Co-existing medical condition		
No	1.0	1.0
Yes	1.48 (1.24 – 1.76)	1.39 (1.16 – 1.65)
Past caesarean section		
No	1.0	1.0
Yes	1.62 (1.41 – 1.87)	1.79 (1.53 – 2.10)
Parity		
Multiparous	1.0	1.0
Primiparous	1.03 (0.91 – 1.16)	1.36 (1.18 – 1.57)
Past spontaneous abortion		
0	1.0	1.0
1 – 2	1.29 (1.12-1.48)	1.25 (1.08 – 1.44)
≥3	1.74 (1.23-2.46)	1.57 (1.10 – 2.24)

5.5 DISCUSSION

Incidence estimates

This study was the first attempt to estimate the incidence of severe maternal morbidity in Victoria. Since all maternities in Victoria are recorded in the VPDC database, it would be reasonable to assume that the estimates of prevalence reflected the population prevalence of each individual condition and for the combined definition of maternal morbidity used. However, the overall prevalence of maternal morbidity of 503.2 per 100,000 maternities (0.53%) is lower than the estimate of 1.3% (12.5 per 1000) found by Roberts et al, the team that developed the MMOI (Roberts et al 2009). Roberts' study used linked hospital-birth record data for all women who gave birth in New South Wales Australia from 1999 to 2004. For each woman, codes from both hospital and birth record data sources were added together (as opposed to only including codes that were consistent between both sources), which would inevitably result in higher case ascertainment than the method used in the VPDC analysis. Additionally, several diagnoses, particularly those pertaining to procedural codes, were not available in the VPDC database and therefore could not be included in the analysis presented here. Both these factors are likely to have contributed to a lower estimate of incidence of morbidity in Victoria compared with New South Wales. Despite these differences in methods and findings, using the validated MMOI framework provided clear boundaries to the definition of severe morbidity used in this study.

Other studies in high-income countries around the world have also relied on ICD-10 coding frameworks but have included a much broader range of mild to severe conditions and have thus produced widely differing estimates of rates of morbidity. For example, a study conducted in Ireland between 2005 and 2008 using nationally representative hospital discharge data found that "17.2% of women had a maternal morbidity diagnosed during delivery in the hospital" (Lutomski et al 2011). In Canada, routine hospitalisation data was used to investigate rates of maternal morbidity during 2003 to 2007 based on a different, ICD-10 coding framework and this study estimated the rate of maternal morbidity to be 13.8 (95%CI 13.6 – 14.0) per 1000 deliveries (Joseph et al 2010).

The rate of major obstetric haemorrhage, as defined by the need for transfusion of blood or clotting products (platelets), was 280 per 100,000 maternities in Victoria, which comprised 26.9% of total morbidity. Many other recent studies on maternal morbidity have found that haemorrhage accounts for the majority of total morbidity. A study conducted in Scotland in 2001-2002, found that major obstetric haemorrhage as defined by "transfusion of >5 units of blood during the acute episode of hypovolaemia", accounted for over 50% of cases of severe maternal morbidity (Brace et al 2004). A study in the UK by Waterstone et al in 2001 estimated that two thirds of severe morbidity was caused by massive haemorrhage and one third by severe pre-eclampsia, sepsis and uterine rupture (Waterstone et al 2001). These studies relied on more restricted definitions of morbidity, however, where haemorrhage was likely to comprise a greater proportion of the overall morbidity. The study by Roberts et al in New South Wales also found that 67% of women with an adverse outcome in their study had an obstetric haemorrhage, however unlike the VPDC dataset, this included antepartum haemorrhage, in addition to postpartum haemorrhage (Roberts et al 2009).

Overall, the rate of maternal morbidity in Victoria was estimated to be lower than the estimates found by studies in other settings. However, as it was based on a validated and comprehensive classification framework of morbidity, it was as precise as possible for the data available. The variability in incidence estimates across socioeconomic groups also emphasised the importance of conducting further analyses to look at risk of morbidity by socioeconomic group, adjusted for potential confounders.

Risk factors for maternal morbidity

Socioeconomic position as defined by IRSD quintile was associated with a statistically significant increase in odds of being 'a case of morbidity', however this association did not follow a linear gradient. After adjusting for confounders, the odds of morbidity was 23% higher amongst women from the 2nd quintile, 55% higher amongst the 4th quintile and 21% higher amongst the lowest socioeconomic group compared to the highest socioeconomic group. The odds estimated were equivocal (aOR 0.98) amongst women from the 3rd quintile. The finding amongst women from the lowest socioeconomic group reflects the results of the UKOSS analysis in Chapter Three where women from the lowest socioeconomic group were also 22% more likely to suffer from severe morbidity (although this finding was based on smaller numbers and was not statistically significant). The significantly elevated OR amongst women from the 4th quintile (OR 1.55) raises the question of whether these women were in fact more likely to be from rural regions of Victoria and the women from the 5th quintile from outer-metropolitan areas, since women living in parts of rural Victoria are likely to have more limited access to emergency obstetric care than women in outer metropolitan areas. No information was available however on the relationship between IRSD quintile and urban vs rural living locality.

"Australia has a universally funded public healthcare system (Medicare), which operates in tandem with an optional 'opt up' private health sector" (Moorin and Holman 2006). One of the "principal objectives of Medicare is to remove, or at least reduce financial barriers to access to healthcare for all Australian residents" (Moorin and Holman 2006, Duckett 2000) and 64% of maternity services are provided through the public system (Victorian Consultative Council on Obstetric and Paediatric Mortality and Morbidity 2006). Typically, women receiving care in the private system are from higher socioeconomic groups with the capacity to pay for private health insurance, and in the analysis presented here, patient accommodation class (Private vs Public) was clearly associated with socioeconomic position and thus a proxy for socioeconomic group and was therefore not included in the adjusted analysis.

Although there are no published studies looking at the causes of socioeconomic differences in maternal health outcomes in Australia, a study conducted in Western Australia in 2006 explored the "extent to which rates of hospital utilisation varied across socioeconomic status, locational accessibility to services and private patients status", adjusting for severity of illness and age, gender, race and co-morbidity (Moorin and Holman 2006). The background to the study was that healthcare services such as those in Australia, which are "designed so that services are accessible based on need regardless of social, location or financial status", should be equitable (Moorin and Holman 2006). However, many studies have shown that "variations in service provision are often poorly explained by variations in need" (MacLeod et al 1999) (the 'inverse care law' (Payne and Saul 1997, Moorin and Holman 2006)), and that distance to healthcare services is inversely associated with utilisation, especially in remote and rural areas of Australia (Jong et al 2004).

The authors of the Western Australian study concluded that equal need did not necessarily equate to equal utilisation and that "horizontal equity (equal utilisation for equal need) varied by disease", with the independent effects of socioeconomic position on hospital utilisation differing significantly by different causes of death (Moorin and Holman 2006). They also found that "private patient status did not globally affect utilisation across all causes of death" (Moorin and Holman 2006). Although the assessment of service utilisation was beyond the scope of this research thesis, it is likely that utilisation of and access to maternity care services, including rural and urban differences for which there was no measure in this dataset, contributed to the difference in maternal outcomes across the socioeconomic groups.

In keeping with existing research on social disadvantage and health outcomes in Australia, the results showed that independent of other factors, Indigenous (ATSI) Australians were at significantly increased risk of maternal morbidity (aOR 2.02) compared with non-Indigenous Australians. The UKOSS study conducted in 2010 to investigate ethnic differences in severe maternal morbidity in the UK found a significantly increased risk amongst non-white women (126 per 100,000 maternities) compared to white women (80 per 100,000 maternities) (Knight et al 2009b). The results relating to risk by country of birth are not statistically significant amongst the Australian cohort, however the finding that Indigenous women have twice the risk of morbidity suggests that social disadvantage in Australian society is mediated more through Indigenous status than through ethnic group related to country of birth.

Women 35 years of age and older had a 22% increased odds of morbidity and young women <20 years a 14% increased odds. These results are also comparable with the results of the UKOSS analysis in Chapter Three which showed that risk of morbidity increased at both extremes of age (women aged ≥35 years were 90% more likely to suffer from maternal morbidity and those <20 years were 20% more likely compared with women aged 25-29). The general pregnancy risks associated with older maternal age are well-researched and understood (Baskett and O'Connell 2005, Philibert et al 2008, Roberts et al 2009, Souza et al 2010b, Waterstone et al 2001). The association between the younger extreme of maternal age and maternal morbidity has not been thoroughly investigated but is no less surprising given the elevated risk of maternal mortality amongst younger women (Lewis 2011).

Co-existing medical condition (aOR 1.38), multiple pregnancy (aOR 2.30) and one or more previous caesarean sections (aOR 1.79) were all associated with moderate to high and statistically significant increases in risk of morbidity. There is strong evidence to suggest that women with multiple pregnancies have greater risk of adverse maternal outcomes (Philibert et al 2008, Waterstone et al 2001, Zwart et al 2008b) and that specific medical conditions such as cardiovascular disease, diabetes and hypertension also increase women's risk of morbidity in pregnancy and labour; this evidence has been discussed in previous chapters (van Roosmalen and Zwart 2009). More recently, the rise of caesarean section rates in high-income countries has led to extensive research into the risks associated with caesarean delivery, especially in the context of repeated caesareans. In particular, the UKOSS research team have shown that past caesarean section is associated with a significant increase in risk of peripartum hysterectomy and that this risk increases with each subsequent caesarean delivery (OR 2.14 with one previous delivery [95% CI 1.37-3.33], 18.6 with two or more [95% CI 7.67-45.4]) (Knight et al 2008a).

Although 'admission to ICU/HDU' was available as a variable in the VPDC dataset, there was concern as to whether it was most appropriate to classify this as an outcome variable or as a confounding exposure. There have been a number of studies conducted in recent years looking at maternal morbidity that have used 'need for admission to ICU or HDU' as the endpoint or outcome that defines morbidity (Baskett 2008). This approach has been extensively criticised in the literature however for its dependence upon the availability of ICU/HDU facilities in reporting hospitals and the fact that despite suffering from severe morbidity, few women are transferred to ICU/HDU for ongoing care in the pregnancy/labour setting as in tertiary centres many women are able to be managed appropriately in the hospital labour ward without the need for transfer (Baskett 2008). Furthermore, admission to ICU/HDU was not part of the MMOI classification and temporally, was inseparable from the hospital admission during which the maternal morbidity occurred. As a consequence, the decision was made to not include this variable in the analysis.

VPDC: strengths and limitations

One of the major advantages of the existing data infrastructure in Victoria, is that information on all births is routinely collected across the State, allowing for estimation of the population prevalence/incidence of various conditions and procedures and changes in health trends over time. This also means that the VPDC dataset is large and that studies using these data are well powered.

Once the information is recorded on the birth report by the midwives present at delivery, data coding, entry and checking is performed centrally at the VPDC unit. Additionally, the validation of data codes and birth numbers ensures that the information in the database is as reliable as possible. For the purpose of the analysis presented here, the coding of data into ICD-10 codes allowed for a simple approach to defining morbidity, based on the validated MMOI. This approach eliminated any uncertainty about how morbidity should be defined and which conditions or procedures to include or exclude. The birth report also contains relevant demographic information for each woman and so data linkage, which is often needed in studies using routine data, was not required although could have been beneficial as demonstrated by the study in NSW (Roberts et al 2009).

Despite the large amount of data available and the VPDC validation procedures, there were a number of limitations related to the type and quality of the data available. Issues related to the validation of coding of rare events applied in this instance, but this challenge is universal across datasets that deal with rare conditions (Roberts et al 2010, Knight et al 2012). The main limitations relate to the actual dataset. For example prior to 2009, BMI and smoking status were not routinely collected on the Victorian birth report and despite being potentially important factors in the analysis of socioeconomic position and maternal outcome, they were not able to be included. There is therefore the possibility that uncontrolled confounding remains in the associations observed.

With regards to the classification of socioeconomic position, data up until 2009 were only able to be mapped to postal areas for SEIFA coding which in Australia are relatively large, often highly diverse neighbourhood regions. As was discussed in Chapter Four with regards to the IMD in the UK, using an area-based measure of socioeconomic position mapped to a large and varied area diminishes the accuracy of the classification and the precision of the results. In Melbourne, many social housing apartment complexes are located within the most affluent suburb and postcode areas. Arguably, this leads to similar levels of access to healthcare services for all residents in the same area but with significantly different health opportunities for lower socioeconomic groups resulting from lower income, poorer housing, lower levels of education and more adverse health-related behaviours.

A paper prepared by the Australian Population Association in 2004, highlighted the issue of generalisability using SEIFA codes in the context of Indigenous health research. The authors refute the common assumption that using area-based measures at a small-area level ensures “the populations or households in each area are relatively homogenous in their socioeconomic characteristics” (Kennedy and Firman 2004). Instead they demonstrate that “stratifying SEIFA scores by Indigenous and non-Indigenous households in each area shows that Indigenous populations suffer a high level of social and economic disadvantage regardless of whether they live in high or low socioeconomic areas” (Kennedy and Firman 2004). This represents the concept of ‘ecological fallacy’, where “assumptions are made about individuals or small sub-groups of populations from the characteristics of the overall population they live among”, often leading to gross underestimation of the minority population’s level of disadvantage (Kennedy and Firman 2004). This is exaggerated by the common practice of averaging SEIFA scores to larger geographical areas, such as postal areas.

At present, the SEIFA coding framework is the only measure of socioeconomic position available nation-wide in Australia (Kennedy and Firman 2004). The absence of any individual measures of socioeconomic position in the VPDC dataset – occupation, income, education level – also meant that this was the only approach that could be taken. VPDC data from 2009 onwards will be mapped to a much smaller area level (using Geographic Information Systems (GIS) technology) however these data had not been validated or area-mapped at the time this analysis was conducted. A further analysis using these small area mappings may help to elucidate further the relationship between maternal morbidity and socioeconomic position.

As outlined in the methods, there were no missing data for any clinical variables as the birth report only allowed for 'yes' or 'no' answers and any incomplete fields defaulted to 'no' in the VPDC dataset. This is likely to have had an impact on the accuracy of the analysis however, due to the size of the dataset and the very small proportion of data missing for demographic variables it is unlikely to have significantly influenced the final results.

The final limitation relates to the use of ICD codes to define maternal morbidity. Without access to hospital medical records nor identifiers that could be linked to hospital records, the codes on the birth reports were not able to be linked and verified during this analysis and as a consequence, care had to be taken with how to define severe morbidity and which variables to include and exclude. One criticism of the ICD codes in published literature is their limited ability to distinguish the severity of conditions (Danel et al 2003). By using the MMOI definition, which is inherently based on conditions of *severe* morbidity, this limitation was avoided.

The coding of co-existing medical conditions using ICD codes is also a limitation raised in past studies as it is generally unclear if conditions are reported because they simply exist, or because of the development of complications during labour and delivery (Danel et al 2003). This is likely to have resulted in some inaccuracy of reporting in the VPDC dataset and consequently also in this analysis, yet this is a challenge for all studies relying on routinely collected/reported data and is not likely to be unique to the use of ICD codes specifically.

Conclusion

Overall, the incidence of maternal morbidity in Victoria based on the MMOI classification was found to be comparatively low. Despite this, the findings demonstrate that socially disadvantaged women in Australia – low socioeconomic position and ATSI background – suffer from significantly higher rates of maternal morbidity than women from higher socioeconomic groups and a non-Indigenous background, although the association between IRSD quintile and morbidity did not follow a linear gradient. The comparison of findings between the UKOSS analysis in Chapter Three and the results from Victoria suggest that an association between low socioeconomic position and maternal morbidity exists in both countries, despite universal healthcare, although the association observed in Victoria did not follow the same gradient as in the UK. Chapter Four provided a range of insights into why these differences might exist in the UK but the reasons for the impact of social disadvantage in Australia remain poorly understood. In addition to highlighting the need for further research into this issue, the Victorian findings strongly suggest that social disadvantage needs to be acknowledged as an independent risk factor for adverse maternal outcomes in Australia and incorporated into appropriate policy planning and healthcare programs.

CHAPTER SIX: Discussion

“Health is universal human aspiration and a basic human need. The development of society, rich or poor can be judged by the quality of its population’s health, how fairly health is distributed across the social spectrum, and the degree of protection provided from disadvantage due to ill-health. Health equity is central to this premise. Strengthening health equity – globally and within countries – means going beyond contemporary concentration on the immediate causes of disease to the ‘causes of the causes’ – the fundamental structures of social hierarchy and the socially determined conditions these create in which people grow, live, work and age. The time for action is now, not just because better health makes economic sense but because it is right and just”. Professor Sir Michael Marmot, Interim Statement of the Commission on Social Determinants of Health (WHO Commission on Social Determinants of Health 2008).

THE WHO COMMISSION ON SOCIAL DETERMINANTS OF HEALTH

When the WHO launched the Commission on Social Determinants of Health in 2008, it marked 30 years since the Alma Ata 'Health for All' Declaration (1978) and 60 years since the WHO was established (1948), both of which were considered "moments of great clarity about the needs and opportunities for health in the world" (Marmot et al 2012). Unfortunately, despite the inspiration that Alma Ata provided, many critics have pointed out that "the vision of comprehensive primary care was hardly implemented and the strong statement on social determinants of health (under another name) was almost completely ignored" (Marmot et al 2012).

In response to a scenario in which the gaps within and between countries in income levels, opportunities, health status, life expectancy and access to care are more pronounced than at any time in recent history, the WHO launched the Commission on Social Determinants of Health. Professor Sir Michael Marmot, the Chair of the Commission and one of the most prominent researchers in the field of social determinants of health worldwide, described the Commission as a "call for social justice as a route to a fairer distribution of health" (Marmot et al 2012).

The work of the Commission has focused mainly on communities in developing countries around the world, but has simultaneously drawn attention to the dramatic social gradients in health within most countries, including wealthy, developed countries with plentiful resources (Marmot et al 2012). The Commission has emphasised that health inequalities arise from unequal distribution of the underlying determinants of health, including assets and income, literacy and knowledge and that in turn, these determinants influence risk factors for adverse health outcomes such as health services use, dietary and sanitary practices and behavioural factors (WHO Commission on Social

Determinants of Health 2008). Other key determinants of health acknowledged by the Commission are environment and infrastructure and access to health services (distance, cost, actual and perceived quality) (WHO Commission on Social Determinants of Health 2008).

The Commission uses two key concepts to frame the discussion around social determinants of health – health equality and health equity. Health equality refers to equal health outcomes across social groups and equal healthcare for all, compared with health equity which refers to "the absence of unfair and avoidable or remediable differences in health among social groups" (Solar and Irwin 2007) resulting from proportional healthcare based on need (greater services for those with greater need). Health inequalities, between social groups or populations, which are deemed avoidable by reasonable means are considered *health inequities* (Dahlgren and Whitehead 1991). The findings presented in this thesis reflect the persistence of inequalities in maternal health outcomes in the UK and Australia, where there are adequate resources and the opportunity to ameliorate the social gradient in health through improving equity in maternity care.

KEY STUDY FINDINGS

The analyses using UK and Australian data suggest that women from the lowest socioeconomic group in both these countries are approximately 20% more likely to suffer from severe maternal morbidity during pregnancy and labour than women from the highest socioeconomic group. The findings also suggest that other socially disadvantaged groups of women in these countries remain at higher risk of morbidity – specifically black African and Caribbean women in the UK and Aboriginal and Torres

Strait Islander women in Australia – and that this is independent of other risk factors such as maternal age and increased BMI.

The National Maternity Survey findings suggest several possible reasons for the social gradient in maternal morbidity in the UK, in particular the increased likelihood of women from lower socioeconomic groups to not receive antenatal care or access care late, to have complications in pregnancy as evidenced by requiring overnight hospital admission during pregnancy, to have an emergency unplanned caesarean (amongst women delivering by caesarean) and to not be seen for a routine 6-8 week postnatal check-up.

Additionally, although communication from health professionals was reported to be satisfactory overall, with decreasing socioeconomic position women were more likely to report that midwives and doctors did not speak in a way they could understand nor were they respectful most of the time during labour and birth.

The analysis of written feedback from women in the 5th IMD quintile about the care and support they received from health professionals also indicated that these women are subjected to sub-optimal maternity care from health professionals and there were several key themes and sub-themes that emerged and provide further insight into why the social gradient in maternal health might exist. These themes related to the quality of communication, lack of respect and empowerment, discontinuity of antenatal care, the need for greater support in early labour, the contrast between high-quality care in NICU/SCBU and the generally poor subsequent experience of care on the postnatal maternity ward, and staff shortages and the perceived effects of system pressures within the NHS. This qualitative analysis was restricted to the responses of women from the lowest quintile however and it is possible that similar themes may have been apparent across different quintiles if responses from those women had been analysed.

CHALLENGES OF DEFINING SOCIOECONOMIC POSITION

A universal challenge for studies that seek to explore the impact of social disadvantage in society is how to best capture the concept of 'disadvantage' and define socioeconomic position. There are multiple dimensions to social disadvantage and there are many different approaches to defining a person's position in the social structure of society.

Income, education and occupation are the most frequently used individual measures of socioeconomic position and in health research, especially in research that relies on routine data collection sources, occupation is often the most straightforward indicator to obtain. This was demonstrated by the UKOSS analysis in Chapter Three, however there were several important limitations that arose. First, when using hospital records for data collection, occupation is not always recorded in the patient's notes and can therefore result in a substantial amount of missing data. Second, using occupation proved to be a difficult approach in maternal health research where women are often on maternity leave or not working during late pregnancy and occupation therefore had to be obtained from their partner (where possible). Third, occupational codes can also be misleading and potentially provide a poor reflection of overall household disadvantage in situations where a woman who works in retail management for example is classified as 'management' level even though her education level and income might be low. Similarly, where the occupation of women working in low-paying non-professional jobs is used to represent their socioeconomic position but the occupation of their partner or husband who works in a well-paid professional position is not recorded, these women are incorrectly classified amongst a lower socioeconomic group.

Although individual measures can provide a simple and precise assessment of someone's socioeconomic position when data are complete, relying on any of these characteristics in isolation can fail to capture the complete picture of disadvantage.

Composite area-based measures have been constructed in many settings worldwide in an attempt to overcome these limitations and provide a more comprehensive measure of overall disadvantage. Generally, area-based measures rely on the premise that individuals' socioeconomic opportunities are mediated through their living locality and the characteristics of their near neighbours which are often derived from census data, and are easier to use in research than individual measures as the information needed is more widely available (residential address for example), especially in the context of routine data collection.

Area-based measures can also maintain greater anonymity of study participants but there are several limitations relating to their generalisability and accuracy. In particular, measures such as the IMD in the UK and the SEIFA in Australia have the potential for poor representation of social disadvantage in areas where the wealthy and poor live alongside each other – this is especially problematic in cities like London and Melbourne where social housing is often located within the most affluent suburbs.

In practice, area-level composite measures are likely to be more robust than individual measures but only if small-areas are used (such as census collection districts) as larger areas fail to represent individual socioeconomic constraints (Pattenden et al 1999). Ideally, studies on the impact of socioeconomic position on outcomes should take into account several measures of social disadvantage – for example area-based classifications in combination with individual factors such as level of education/income or occupation.

SOCIAL DISADVANTAGE AND HEALTH POLICY

Government commitment and existing public health policies

In England, following the Commission on Social Determinants of Health, the government commissioned the 'Fair Society, Healthy Lives' review as part of their plan to put the reduction of health inequalities at the centre of England's public health strategy (Marmot 2010, Department of Health 2010). The domains for recommendations laid out by the review include "to give every child the best start in life, education and lifelong learning, employment and working conditions, minimum income for healthy living, healthy and sustainable communities and social determinants approach to prevention" (Marmot 2010). The WHO, through the WHO European Review of Social Determinants of Health, has also pledged to "put social determinants at the centre of Europe's revitalised public health agenda" (WHO 2012a).

The 'Maternity Matters' programme emphasises the UK Government's commitment to providing choice guarantees for women regarding type of antenatal care and place of birth and also highlights the need for future maternity services to address disproportionately higher rates of maternal morbidity amongst disadvantaged women (Department of Health 2007). Whilst describing a comprehensive programme for improving choice, continuity of care and access, 'Maternity Matters' does not provide any specific recommendations for women from socially disadvantaged backgrounds in the UK. The recommendations for service provision relate fundamentally to Primary Care Trust-level (PCT) care provision and planning of maternity services, with the priorities of healthcare provision ultimately self-determined by each PCT.

In Australia in 2009, in addition to the release of the 'National Women's Health Policy', the Australian Government conducted a review of national Maternity Services. In parallel with the recommendations of 'Maternity Matters' in the UK, the report that was subsequently released details the Government's plan to provide Australian women with more choice regarding their maternity care and to continue to maintain safe and high-quality maternity services (Australian Government Department of Health and Ageing 2009).

The Australian review specifically highlights the difficulties faced by women living in remote and rural areas of Australia and the poor maternal outcomes amongst Indigenous mothers and babies, and focuses on the issue of access to maternity services amongst these groups of women. The report also acknowledged that inequalities in both outcomes and access to services may be the result for some individuals and population subgroups of other factors such as socioeconomic position, risk factors, and existing service delivery/provision (Australian Government Department of Health and Ageing 2009). Despite recognising the potential impact of low socioeconomic position, the review goes on to state that "the range of targeted initiatives and services, both within and outside the health sector, that currently exist or that could be considered by governments to address these inequalities are recognised by the Review, but have not been part of its detailed considerations", again leaving a gap in planned service provision for socially disadvantaged women.

Economic pressures and barriers to change

Health research in various settings worldwide has illuminated the ongoing existence of the 'inverse care law', first described in 1971 by Tudor Hart as the tendency for the "availability of good medical care to vary inversely with the need for it in the population served" (Hart 1971). A study conducted in Brazil in 2000 looking at inequities in child health reported that "new public health interventions and programmes reach those of higher socioeconomic status and only later affect the poor...inequities only improve later when the rich have achieved minimum achievable levels for morbidity and mortality and the poor gain greater access to interventions" (Victora et al 2000). Throughout history, disadvantaged populations have benefited less from healthcare spending, services and interventions than those from higher socioeconomic groups, even in countries where resources are widely available.

Following the 2008 global financial crisis, the WHO warned that the vulnerable and poor will be the first to suffer (WHO 2009). The Appleby report released in the UK in 2009 on funding prospects for the NHS ('How cold will it be?'), portrayed a very bleak picture, warning that "after years of unprecedented plenty, our publicly funded healthcare system is about to enter a period of uncertainty in which growth in its budget is certain to be constrained if not eliminated", resulting in difficult trade-offs between public spending and policy choices (Appleby et al 2009). Sir Michael Marmot argued however that "many of the responses to the global financial crisis [of 2008] have slowed progress towards health equity" and that the financial crisis has added a sense of urgency to consideration of the striking financial inequities, between and within countries, which preceded it (Marmot et al 2012).

Since 2008, the WHO has stressed that as the standards of living decrease in many countries, and government revenues and budgets are constrained, it is even more critical that the "distributional effects on all policies" are taken into account in policy decision-making (Marmot et al 2012). In a paper that argues that social welfare spending is as important as protecting health through safeguarding the healthcare budget, Stuckler et al proposed that "the current economic difficulties *could* be viewed as an opportunity to reorganise the provision of services to those in need, creating a broader set of services that reflect the increasingly complex needs of a society facing health challenges as varied as fast food and dementia" (Stuckler et al 2010).

In the UK, Sir Michael Marmot's review of health inequalities (Fair Society, Healthy Lives) concluded that "austerity need not lead to retrenchment in the welfare state", providing a timely reminder that the welfare state in England, the NHS itself, was "born in the most austere post-war conditions" (Marmot 2010). Gwatkin et al further encourage policy makers to recognise the economic benefits of looking after the poor: "even if poor people should prove more expensive to serve than those who are well-off, higher prevalence of treatable disease in the poor could result in an increased overall health benefit from programmes that serve them, thereby resulting in increased efficiency" (Gwatkin et al 2004). Lessons from the Commission on Social Determinants of Health and other reports around the world emphasise that despite the restraints and hardship of the current global economic climate, this is an important opportunity to think innovatively about the design and delivery of healthcare services, especially in maternity care, and the policies that govern them.

IMPLICATIONS OF THE STUDY FINDINGS: Recommendations for Policy and Practice

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As outlined by the WHO Commission, the main determinants of health lie outside the healthcare system – income, housing, education, behavior and sanitary practices. These determinants are mediated through the social structure of our society and the opportunities that are available to people at each position in that structure (Marmot 2010). The work of this thesis does not attempt to provide recommendations for changing the entrenched social structure of society that contributes to determinants of health. Rather, this research aimed to produce a set of relevant and achievable recommendations for improving maternity care and outcomes for socially disadvantaged women by tackling the modifiable determinants of health related to healthcare systems and the delivery of maternity care in the UK and Australia.

There are three important roles for the healthcare system to improve equity in healthcare and these roles are laid out by the Commission on Social Determinants of Health:

(a) to ensure universal access to high-quality healthcare, with increased focus on prevention and health promotion,

(b) people in the health sector – from the Minister of Health to primary care professionals and medical and health organisations – should be advocates for action on social determinants of health, and

(c) to ensure that routine monitoring systems are in place for health equity and the social determinants of health, in order to undertake evaluation of policies on these topics, and increase the knowledge base (Marmot et al 2012).

Following these principles, the findings of this thesis have produced three sets of recommendations for achieving equality in maternal health outcomes in the UK and Australia – recommendations for (a) health professionals, (b) the NHS and Australian Maternity Services and (c) for further research.

Recommendations for health professionals

In many respects, recommendations for health professionals arising from the findings reported here, are the least complex and least resource-intensive as they largely relate to interpersonal interactions with patients and the care provided within maternity services.

1) The first recommendation relates to the culture of care. All patients deserve to be treated with respect, kindness and compassion, but pregnancy and labour is arguably a time when women require even greater understanding and empathy from the health professionals caring for them as it can be a completely new and daunting experience. Added to this, is the need for particularly vulnerable women – those from lower socioeconomic groups, non-English speaking backgrounds, younger age for example –

to be treated with genuine understanding and empathy as there may be the added challenges of lower education level, less support at home and/or less preparation for the birth of their baby. In particular, staff should understand that women from different socioeconomic backgrounds may require explanations of care at different levels, and staff should check women's understanding of their consultation after every interaction.

2) Following closely on from the culture of care is the language and communication used by health professionals in dealing with vulnerable patients. The findings from the National Maternity Survey indicated that many women from the lowest socioeconomic group felt they had been spoken to in a patronising way, often at moments of high-stress or anxiety, which was not only unhelpful and not instructive but also led to them feeling disempowered and out of control. Health professionals should avoid speaking to any patient in a condescending tone, but instead use clear, plain language to communicate and repeat important health messages (the need for antenatal care or postnatal follow-up for example) in a timely manner.

3) Involving women's partners or husbands in discussions is extremely important in the provision of effective antenatal and labour care and can help to ensure that key messages are remembered and followed-up. The exclusion of partners/husbands was frequently and spontaneously mentioned by women in their NMS feedback as negatively impacting upon their pregnancy experiences.

4) Providing women with the opportunity to debrief and discuss their birth experiences can also help them to better understand why certain decisions were made or management instituted, and this is especially important in the context of obstetrics where clinical decisions sometimes have to be made very quickly. Involving partners/husbands in this process is also important to make sure they understand management decisions and the events surrounding the birth and can ask questions if needed.

5) The final recommendation for health professionals relates to maximising incidental opportunities for health education and promotion and by doing so, working to empower women. Education of women is widely recognised as a key determinant of health for women and for society more broadly due to the long-term generational benefits of education of women and girls; increased knowledge leads to greater protection of health and better health-seeking behaviour (WHO Commission on Social Determinants of Health 2008). Anticipating potential problem areas for individual patients and using incidental opportunities to provide health education and 'fill in the gaps' in women's understanding of pregnancy and childbirth should be part of routine antenatal care provision and can impact upon women's health-seeking behaviour and their sense of empowerment during pregnancy, labour and early motherhood.

   The development of tailored health education material for women from lower-education backgrounds related to health in pregnancy, labour and the postnatal period would encourage health professionals to maximise health education opportunities for these women, thereby assisting in the provision of effective antenatal care for these women.

Recommendations for the NHS and Australian maternity services

Both the UK and Australia have very high-quality, universal healthcare systems as well as national Governments' committed to providing equal care for all members of the community. The findings of this analysis have demonstrated however, that despite these resources, the most disadvantaged women in the UK and Australia do not have equal maternal health outcomes.

1) The first recommendation relates to directing the planning of maternity services towards the needs of disadvantaged women. There is a paucity of published studies looking specifically at equitable provision of maternity care in the UK or Australia, but other papers have explored the issue more broadly and have generally concluded that

directing the planning of healthcare services towards the needs of the disadvantaged can be effective in achieving more equitable outcomes. For example, Gwatkin et al make the case that health systems should be oriented towards the most deprived members of the population by establishing objectives which ensure the poor benefit fully from the services provided, and to monitor progress in terms of these goals (Gwatkin et al 2004). They emphasise that targets should be set in terms of progress, not in all people in the population, but in those people within the population who live in poverty (Gwatkin et al 2004).

The WHO references New Zealand as a commendable example of a country where a policy climate agenda oriented towards social justice allowed rapid large-scale changes in the way health services interacted with communities and collaborated between sectors, and where specific health interventions were supported by community level research evidence (WHO Commission on Social Determinants of Health 2008), which demonstrates that this goal can be achieved given the political will.

The national health policies within maternity services in Australia and the UK must be focused on improving outcomes amongst disadvantaged women specifically.

2) In order to ensure that the planning of maternity services provides maximum benefit for disadvantaged women, the second recommendation for health services relates to improving continuity of maternity care. In Australia, one of the greatest advantages of private maternity care is the ability for women to choose their obstetrician and therefore receive antenatal, labour and postnatal care from the same health professional. As previously discussed however, this option is available almost exclusively for women from higher socioeconomic groups who can afford private insurance and the additional 'out-of-pocket' fee. The Australian public healthcare system, like the NHS in the UK, relies upon teams of midwives and obstetricians and women can end up receiving care throughout

the continuum of pregnancy, labour, birth and postnatal care from multiple different practitioners. There are, however, several positive initiatives in both the UK and Australia that could be strengthened and made more widely available in order to overcome this challenge and improve continuity of care for women from lower socioeconomic groups.

The concepts of ‘team midwifery care’ and ‘case-load midwifery care’ in Australia for example (Department of Health and Ageing 2009), are becoming increasingly popular but are still only largely available to women living in more affluent areas. In team midwifery care, a small number of public hospital midwives are responsible for the antenatal, labour and postnatal care of a set group of women whom they see in the community for antenatal care, then follow through to labour in the hospital birth suite (of a designated hospital to which the programme is attached) and subsequently follow-up in the community post-discharge home. Similarly, case-load midwifery care involves ongoing care with the same public hospital midwife for the majority of antenatal, labour, birth and postnatal care. These models of care ensure that low-risk women only see one or two midwives throughout their entire pregnancy and are able to develop a trusting relationship with them. These women also see a registrar or consultant obstetrician during their antenatal care for a medical review, and have obstetric services close by if needed during their birth in hospital.

However, for women that are not low-risk based on antenatal risk factors (BMI, co-existing medical conditions, maternal age), there is a need for more integrated obstetric-midwifery group practices to be developed in the Australian public hospital system in order to provide an appropriate of level maternity care whilst ensuring continuity. There are currently ‘outreach midwifery care’ services for women with high social or obstetric risk which focus on support and education, but these services are sparsely available and continuity of care ceases at birth when women go on to be cared for by a different team of healthcare professionals in hospital through to the postnatal period.

An integrated care model for high-risk women (obstetric and social risk factors) could mean that particular patients are assigned to a small group of midwives and an obstetrician/obstetric trainee within their public hospital clinic whom they see for every antenatal appointment and for postnatal follow-up. This would be particularly effective in smaller, outer metropolitan hospitals in Australia where the demographic is often from lower socioeconomic groups and a smaller cohort of health professionals should mean easier co-ordination of an integrated medical-midwifery service.

In the UK, there are well-established free-standing midwifery units (FMU's) and alongside midwifery units (AMU's) which are able to provide greater continuity of care for low-risk women in the NHS, however this encompasses only 5% of deliveries in the UK (Redshaw et al 2011). Other models of care similar to Australia, such as case-load and team midwifery care have been implemented in some NHS trusts to ensure better continuity of care for women throughout pregnancy, labour and birth. In the UK, such programmes have been particularly successful amongst teenage mothers (Department for Education 2010a, Department for Education 2010b) and recent immigrants and/or asylum seekers. One of the most significant challenges in the UK relates to the variability of healthcare services across different trusts, and successful models of care in some locations have been well-documented but not funded across all NHS trusts.

As in Australia, the delivery of maternity care for high risk women in the UK could be vastly improved by increasing the integrated models of care with combined obstetric and midwifery teams and improving the availability of such a model across the UK, particularly in areas of high socioeconomic deprivation.

Several ways of improving continuity of care where integrated models of care are not yet available include:

- Ensuring that women have an emergency contact phone number for their antenatal midwife during pregnancy
- Arranging for women to meet a group of midwives in the hospital birthing unit prior to labour so that they are familiar with some of the health professionals that will be caring for them during their delivery
- Organising postnatal follow-up for women with the same midwife (or small teams of midwives) who was involved with their antenatal care

3) The third recommendation for health services relates to the provision of maternity services and policy guidelines. Although the policy documents on maternity services in both the UK and Australia make mention of the disproportionately higher rates of adverse outcomes amongst disadvantaged groups of women, neither have identified low socioeconomic position as an antenatal risk factor for adverse outcome, nor integrated any specific recommendations for mitigating this risk and improving care of these women in pregnancy.

It is important that women from low socioeconomic groups are not made to feel stigmatised by active 'targeting' during pregnancy and knowingly allocated to a high-risk group, however as the findings of this thesis demonstrate, these women need to be identified by the system in order to ensure they receive maximum continuity of care, tailored to their needs.

There is not currently sufficient evidence to suggest that more frequent antenatal visits would improve outcomes for these women and the published literature suggests that antenatal care cannot, for example, be expected to reduce the incidence of hypertension or pre-eclampsia (Hall 2001). However there may be some benefit in providing additional and more informal antenatal classes in disadvantaged areas, followed by postnatal education and support classes, particularly focusing on breastfeeding. Although not related to maternal morbidity, the NMS qualitative analysis highlighted that many women from the lowest quintile were very uncertain about basic baby care and breastfeeding and seemed to have received little antenatal education about caring for themselves and their baby postnatally. These issues have ramifications well beyond the period of pregnancy and labour, especially for women with limited social support, and could be addressed effectively in tailored antenatal and postnatal classes. Sure Start Children's Centre's in the UK and Maternal and Child Health Centre's in Australia would be the ideal location for tailored antenatal and postnatal care and classes for these women, especially since these centre's are already well-established and widespread throughout the community.

In both Australia and the UK, there seems to be a gap in public health education in the context of pregnancy. Issues such as the importance of antenatal care and postnatal follow-up and the availability of breastfeeding support services could all be addressed in community-wide public health programmes and campaigns.

Identifying low socioeconomic position as an antenatal risk factor for women and emphasising this in policy-level documents in the UK and Australia would help shift the focus of maternity care towards the needs of these women, including the need for greater public health education campaigns related to pregnancy.

4) Finally, continuity of care, additional antenatal classes and appointments, postnatal follow-up and improved hospital care are all reliant upon adequate staff numbers and in the UK, midwife shortages are a major problem facing the NHS. Recruitment and retention of midwives in the NHS is affected by a range of issues including pay, the changing nature of jobs, how valued the staff feel and other employment opportunities

(Finlayson et al 2002b) and these issues must be addressed at the level of Government in order to ensure equitable provision of health services, especially within maternity care.

Recommendations for further research

In order to offer recommendations for policy and practice that will effectively address the impact of social disadvantage on maternal outcomes, further research is required to better understand why these differences exist and test any proposed interventions to change outcomes for socially disadvantaged women. A comprehensive understanding of the incidence and changes in maternal morbidities over time on a national level is critical for health policy design, clinical recommendations and targeted interventions (Lutomski et al 2011).

1) The first recommendation therefore relates to further research into severe maternal morbidity and the provision of maternity care in the UK and Australia. The recommendations for health services outlined above for example have not been validated or indeed tested in any study and should be explored before any widespread implementation. One limitation of the analyses in this thesis was the reliance on existing datasets and the inability to therefore gather additional or different information. As a consequence, the analyses were limited to the data that were available and were not able to fully explore what could have been done differently for women at high risk of adverse outcomes. Further research is therefore required to answer the following questions:

a) Why is there a difference in risk of severe maternal morbidity between socioeconomic groups in Australia?
b) What aspects of the current maternity systems in the UK and Australia are *not* working to improve outcomes for disadvantaged women?

c) What interventions are effective in improving maternal outcomes for women from lower socioeconomic groups? For example, additional antenatal appointments, increased continuity of care, additional tailored antenatal and postnatal classes, tailored antenatal education material?

2) In order to monitor the progress of changes in health policies and care provision, particularly those directed at the improvement of outcomes amongst women from the lowest socioeconomic group, the second research recommendation relates to the need for ongoing evaluation of healthcare programmes and monitoring of maternal outcomes by socioeconomic group to explore any benefits and/or repercussions of new initiatives. In the UK, comprehensive monitoring and evaluation of maternal outcomes is predominantly carried out through research programmes at the National Perinatal Epidemiology Unit and other perinatal research units based at different Universities. In Victoria, despite there being a state-wide database of all maternities (VPDC) there are currently no evaluation programmes established to look at outcomes amongst disadvantaged women. There is the need for regular monitoring and evaluation of maternal outcomes and initiatives in all states in Australia.

3) The third research recommendation relates to the classification and measurement of social disadvantage. There are many inherent challenges to defining socioeconomic position and eliciting what constitutes disadvantage, but the absence of a universally-accepted definition of socioeconomic position makes the comparison of results across studies in different settings an ongoing issue. There appear to be greater challenges with missing data when individual measures of socioeconomic position are used (as demonstrated by the UKOSS analysis in Chapter Three) as this requires the collection of individual-specific data such as occupation in primary data collection. Data required for area measures are generally easier to collect (postcode, address etc) and are more widely available in medical records for example. However there then is a compromise

between precision (individual measures) and completeness of data (area measures). Based on the findings and experience garnered through this analysis, the following recommendations are made for future research on socioeconomic position and health outcomes:

a) Use of a composite measure of socioeconomic position such as the IMD seems to be the most robust and appropriate approach but only if measured at the small-area level.
b) For the purposes of health research, Australia needs to have SEIFA codes mapped to much smaller areas (Census Collection District) to provide a more meaningful representation of area-based disadvantage. In Victoria for example, future data (SEIFA codes) must be mapped to the Census Collection District level instead of Postal Areas for more accurate assessment of disadvantage.
c) Ideally, future population surveillance research should collect small area-level information (such as address) in addition to an individual measure of socioeconomic position such as level of education for comparison.

CONCLUSION

This thesis has confirmed that inequalities in maternal health exist in the UK and Australia. If countries such as the UK and Australia, with ample resources and established health infrastructure, are not able to provide equitable healthcare then there seems to be little hope for low-resource settings of achieving true equality in maternal health outcomes. Developed, wealthy nations have a responsibility to set the example of striving for equality in maternal health outcomes and ensuring that disadvantaged women do not continue to suffer from disproportionately higher rates of adverse outcomes.

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APPENDICES

Appendix One: A summary table of risk factors for severe maternal morbidity compiled from a selection of published studies

Appendix Two: The 2010 National Maternity Survey

Appendix Three: The Victorian Perinatal Data Collection Birth Report

Risk factor	Study setting & population*	Study design	Definition of outcome	Definition of risk factor	Findings	Comments on quality of study
Socio-economic position	• England • All 19 maternity units in South East Thames region 48,865 maternities (Waterstone et al 2001)	• Case-control study • 4 randomly selected controls per case	Severe pre-eclampsia, eclampsia, HELLP syndrome, severe haemorrhage, severe sepsis and uterine rupture	Social exclusion >1 of: concealed pregnancy, age<16 years, poor housing, low income, previous infant in state care, living alone, unbooked, unwanted pregnancy, in foster care, social work involvement or drug and alcohol dependency	Social exclusion independently associated with severe morbidity (aOR 2.64: 95%CI 1.69-4.11)	• Large case-control analysis controlling for important risk factors • Multi-dimensional approach to assessment of socioeconomic position
	• Belgium • Conducted in 14 of the 15 maternity hospitals in Brussels (Haelterman et al 2003)	• Case-control study • 99 cases over 1 years period and 200 randomly-selected controls	Severe pre-eclampsia, eclampsia or HELLP syndrome	Indicators of social deprivation included low education level, poverty and illegal residence or asylum request	Burden of pre-eclampsia was found to be concentrated in socially disadvantaged women	• Small study population • Outcomes were adjusted for major confounders
	• Brazil • A total of 5025 women with at least one live birth in the 5-year reference period preceding their interview in the demographic health survey (Souza et al 2010b)	• A demographic health survey focusing on reported maternal complications	Any woman reporting the occurrence of eclampsia, hysterectomy, blood transfusion or admission to the intensive care unit was considered as having experienced a near-miss event	No education/fundamental education (vs high school education)	aOR 2.18 (95%CI 1.15-4.10) for women with no education	• Secondary analysis of survey data based on self-reported morbidity – questionable accuracy of incidence and risk factors
Ethnicity	• All consultant-led maternity units in the United Kingdom • 686 women with severe morbidity of 775,186 maternities (Knight et al 2009b)	• National cohort study	Severe morbidity including acute fatty liver of pregnancy, AFE, eclampsia, antenatal PE or peripartum hysterectomy	Ethnic groups: White, Black African and Caribbean, Asian, Other	Risk of morbidity 80 per 100,000 maternities in white women vs 126 per 100,000 maternities in non-white RR 2.45 (1.81-3.31) for black Caribbean women	• Large nation-wide cohort study • Looking at specific clinical conditions of morbidity • Results adjusted for age, SES, smoking, BMI and parity

*A summary of risk factors for severe maternal morbidity complied from a selection of studies

Risk factor	Study setting & population	Study design	Definition of outcome	Definition of risk factor	Findings	Comments on quality of study
Ethnicity	• Netherlands • All 98 maternity units in the Netherlands – 371,000 pregnancies (Zwart et al 2008a)	• Prospective population-based cohort study	ICU admission, uterine rupture, eclampsia, HELLP syndrome, Massive obstetric haemorrhage (>4 units blood transfused), other severe morbidity cases	Non-Western immigrant women (based on country of birth)	• Non-Western immigrant women 1.3 fold increased risk of morbidity (95%CI 1.2-1.5) • Sub-standard care found in the majority of cases of morbidity	• Definition of morbidity included 'other cases' of morbidity identified by treating Obstetrician, the accuracy of which is difficult to predict • RR not adjusted for confounders
	• France (metropolitan) • 267 cases of maternal death and 13,186 randomly-selected controls (Philibert et al 2008)	• National case-control study	Maternal death between 1996-2001	Foreign nationality	aOR 5.5 (95%CI 3.3-9.0) for women from Sub-Saharan Africa and 3.3 (95%CI1.7-6.5) for women from Asia, North and South America Amongst women who died, care was more often considered sub-optimal for foreign women	• Large national study using maternal death as clear outcome • No exploration of conditions of morbidity preceding death
	• Belgium • Conducted in 14 of the 15 maternity hospitals in Brussels 99 cases over 1 years period and 200 randomly-selected controls (Haelterman et al 2003)	• Case-control study	Severe pre-eclampsia, eclampsia or HELLP syndrome	History of residence in another country	History of residence in another country strongly associated with risk of pre-eclampsia	• Small study population • Outcomes were adjusted for major confounders
Advanced maternal age	• United Kingdom (Knight et al 2008a)	• UKOSS population-based matched case-control study	Peripartum hysterectomy	Age ≥ 35 years	aOR 2.42 (95%CI 1.66-3.58) for women 35 years and older	• Large nation-wide study • Report of cases reliant upon reporting hospitals, exact case ascertainment unknown • Analysis limited to peripartum hysterectomy as outcome

Risk factor	Study setting & population	Study design	Definition of outcome	Definition of risk factor	Findings	Comments on quality of study
Advanced maternal age	• Netherlands • All 98 maternity units in the Netherlands – 371,000 pregnancies (Zwart et al 2008b)	• Prospective population-based cohort study	ICU admission, uterine rupture, eclampsia, HELLP syndrome, Massive obstetric haemorrhage (>4 units blood transfused), other severe morbidity cases	Age ≥ 35 years and age ≥ 40 years	Age ≥35: RR 1.2 (95%CI 1.1-1.3) Age ≥ 40: RR 1.4 (95%CI 1.21.7)	• Definition of morbidity included 'other cases' of morbidity identified by treating obstetrician, the accuracy of which is difficult to ascertain • RR not adjusted for confounders
	• Norway • All women giving birth (307 415) from 1 January 1999 to 30 April 2004 registered in the Medical Birth Registry of Norway (Al-Zirqi et al 2008)	• Population-based registry study	Severe obstetric haemorrhage (blood loss of > 1500 ml or blood transfusion)	Age ≥ 35 years	Age 35-39: aOR 1.14 (1.03–1.21) Age >40: 1.41 (1.16–1.74)	• Definition of blood loss based on visual estimation – known to be highly variable and subjective
	• United States (Duckitt and Harrington 2005)	• Systematic review of controlled studies published 1966-2002	Pre-eclampsia	Age ≥ 40 years	Age ≥ 40 years: aOR 1.96 (95%CI 1.34-2.87)	• Studies in any language were included in search • Most studies were case-control and cohort studies and all included reference group and controlling for confounders • 52 studies included in review – limited to those looking at pre-eclampsia
	• Brazil • A total of 5025 women with at least one live birth in the 5-year reference period preceding their interview (Souza et al 2010b)	• A demographic health survey focusing on reported maternal complications	Any woman reporting the occurrence of eclampsia, hysterectomy, blood transfusion or admission to the intensive care unit was considered as having experienced a near-miss event	Age 40-49 years	Age >40 years: aOR 9.60 (95%CI 1.26-72.87)	• Secondary analysis of survey data based on self-reported morbidity – questionable accuracy of incidence and risk factors • High level of uncertainty around aOR estimates (wide confidence interval)

Risk factor	Study setting & population	Study design	Definition of outcome	Definition of risk factor	Findings	Comments on quality of study
Raised BMI	• United Kingdom (Heslehurst et al 2008)	• Meta-analysis of cohort studies, all with one obese and at least one comparison group 49 studies included	Primary outcomes included instrumental delivery, caesarean delivery, duration of hospital stay, neonatal intensive care, neonatal trauma, haemorrhage, infection, and 3rd/4th degree tears	Maternal BMI recorded prior to 16 weeks pregnancy	Maternal obesity significantly contributes towards a poorer prognosis for mother and baby during delivery and immediately post-partum	• Specific outcome risk estimates not able to be obtained for multiple outcomes due to too few studies looking at each particular morbidity
	• United Kingdom • 143 cases of pulmonary embolism and 59 matched control women (Knight 2008)	• UKOSS national case-control study	Antenatal pulmonary embolism	BMI ≥ 30 kg/m^2	aOR 2.65 (95%CI 1.09-6.45) for women with BMI ≥ 30 kg/m^2	• Large nation-wide study • Unclear exact case ascertainment through UKOSS programme • Analysis limited to cases of pulmonary embolism
	• Netherlands • All 98 maternity units in the Netherlands – 371,000 pregnancies (Zwart et al 2008b)	• Prospective population-based cohort study	ICU admission, uterine rupture, eclampsia, HELLP syndrome, Massive obstetric haemorrhage (>4 units blood transfused), other severe morbidity cases	BMI ≥ 30 kg/m^2	RR 1.5 (95%CI 1.3-1.7) for women with BMI ≥ 30 kg/m^2	• Definition of morbidity included 'other cases' of morbidity identified by treating Obstetrician, the accuracy of which is difficult to predict • RR not adjusted for confounders
	• United States 15,262 women who gave birth between 1991 and 1995 (ThadhanI et al 1999)	• Cohort study	Gestational hypertension or preeclampsia was confirmed by medical record review according to standard criteria	Prenatal BMI based on self-report	RR of women with prenatal BMI over 30 kg/ m^2 was 2.1 (95% CI 1.0-4.6)	• BMI based on self-report and outcome limited to pre-eclampsia
Smoking	• England • All 19 maternity units in South East Thames region 48,865 maternities (Waterstone et al 2001)	• Case-control study • 4 randomly selected controls per case	Severe pre-eclampsia	Pre-existing essential hypertension	Pre-existing hypertension: aOR of 1.92 (95%CI 1.04-3.56) for development of severe pre-eclampsia	• OR adjusted for confounders • Large case-control study of a specific region of England

Risk factor	Study setting & population	Study design	Definition of outcome	Definition of risk factor	Findings	Comments on quality of study
Smoking	• Norway • All women giving birth (307 415) from 1 January 1999 to 30 April 2004 registered in the Medical Birth Registry of Norway (Al-Zirqi et al 2008)	• Population-based registry study	Severe obstetric haemorrhage (blood loss of > 1500 ml or blood transfusion)	Smoking during pregnancy	aOR for smoking 1.01 (0.91–1.12)	• Definition of blood loss based on visual estimation – known to be highly variable and subjective
Co-existing medical condition	• Sweden • Data from the the Swedish Medical Birth Register and include all nulliparas aged 34 years or less who gave birth at the University Hospital of Uppsala, Sweden, during 1987–1993 (Ros et al 1998)	• Cohort study	Pre-eclampsia	Pre-existing Type 1 diabetes	Type 1 diabetes: aOR 5.58 (95% CI 2.72–11.43)	• Large prospective dataset • All data based on information recorded in patient notes by midwife at booking visit • Attempt made to obtain accurate risk estimates by limiting analysis to younger, nulliparous women (at lower risk of pre-eclampsia)
	• Canada • 2,548,824 deliveries between 1991-2001 (Wen et al 2005)	• Retrospective cohort study	"Near miss" conditions with potential to cause maternal death that could be reliably identified from the hospital-discharge database (including Venous thromboembolism, eclampsia, uterine rupture, myocardial infarction, severe postpartum hemorrhage requiring hysterectomy or transfusion)	Systemic lupus erythematosus, cystic fibrosis, chronic renal disease, essential hypertension, diabetes mellitus with and without (renal and other) complications, primary and secondary pulmonary hypertension, and congenital, chronic rheumatic and ischemic heart disease	Risk of severe maternal morbidity among women with pre-existing chronic diseases was increased to 5.8-fold the risk among those without pre-existing conditions (RR not provided)	• No adjusted estimates of risk given (all based on incidence estimates) • Wide variety of maternal morbidities included, providing no direct comparison with other studies on severe maternal morbidity

Risk factor	Study setting & population	Study design	Definition of outcome	Definition of risk factor	Findings	Comments on quality of study
Co-existing medical conditions	• United States (Duckitt and Harrington 2005)	• Systematic review of controlled studies published 1966-2002	Pre-eclampsia	Pre-existing diabetes and raised blood pressure at booking	Pre-existing diabetes: RR 3.56 (95%CI 2.54-4.99) Raised BP (diastolic ≥ 80 mm Hg) at booking: RR 1.38 (95%CI 1.01-1.87)	• Studies in any language were included in search • Most studies were case-control and cohort studies and all included reference group and controlling for confounders • 52 studies included in review – limited to those looking at pre-eclampsia
	• United Kingdom (Knight et al 2008a)	• Population-based matched case-control study	Peripartum hysterectomy	Parity ≥ 3	Parity ≥ 3: aOR 2.30 (95% CI 1.26-4.18)	• Assessment limited to peripartum hysterectomy
Parity	• United States (Duckitt and Harrington)	• Systematic review of controlled studies published 1966-2002	Pre-eclampsia	Nulliparity vs parity ≥ 1	Nulliparity: RR 2.91 (95%CI 1.28-6.61)	• Studies in any language were included in search • Most studies were case-control and cohort studies and all included reference group and controlling for confounders • 52 studies included in review – limited to those looking at pre-eclampsia
	• United States • All twin pregnancies (3407) and approximately twice as many singletons (8287) were assembled using Washington state birth certificates from the period 1984-1988 (Coonrod et al 2005)	• Population-based cohort study	Pre-eclampsia	Nulliparity vs parity ≥ 1	Adjusted RR 4.0 (95%CI 3.3-4.8) for nulliparous women	• Risk estimates adjusted for important confounders • Outcome limited to pre-eclampsia

Risk factor	Study setting & population	Study design	Definition of outcome	Definition of risk factor	Findings	Comments on quality of study
Parity	• United Kingdom • 57 women in the UK diagnosed with AFLP between February 2005 and August 2006 in an estimated cohort of 1 132 964 maternities (women delivering) (Knight et al 2008b)	• Population-based cohort study	Acute fatty liver of pregnancy (AFLP)	Singleton vs multiple pregnancy	Women with a twin pregnancy have a 14-fold increase in the risk of AFLP (OR 14.3: 95% CI 6.4-28.6)	• Largest population-based cohort of cases of AFLP
Multiple pregnancy	• France (Bouvier-Colle et al 1997)	• Case-control survey of pregnant women or those delivered within past 42 days admitted to ICU	ICU admission	Singleton vs multiple pregnancy	aOR 2.3 for women with multiple pregnancies (95%CI 1.2–4.5)	• Survey based on self-report of ICU admission and risk factors, therefore uncertain accuracy • OR adjusted for major confounders • Outcome limited to ICU admission
	• Netherlands • All 98 maternity units in the Netherlands – 371,000 pregnancies (Zwart et al 2008b)	• Prospective population-based cohort study	ICU admission, uterine rupture, eclampsia, HELLP syndrome, Massive obstetric haemorrhage (>4 units blood transfused), other severe morbidity cases	Singleton vs multiple pregnancy	RR 4.9 (95%CI 4.3-5.7) for women with multiple pregnancy	• Definition of morbidity included 'other cases' of morbidity identified by treating obstetrician, the accuracy of which is difficult to predict • RR not adjusted for confounders
	• United States • All twin pregnancies (3407) and twice as many singletons (8287) were assembled using Washington state birth certificates from the period 1984-1988 (Coonrod et al 1995)	• Population-based cohort study	Pre-eclampsia	Twin vs singleton pregnancies	Twin pregnancy: RR 3.5 (95% CI 3.0-4.2) adjusted for parity, age, smoking and race	• Risk estimates adjusted for important confounders • Outcome limited to pre-eclampsia

Risk factor	Study setting & population	Study design	Definition of outcome	Definition of risk factor	Findings	Comments on quality of study
Past pregnancy condition	• England • All 19 maternity units in South East Thames region • 48,865 maternities (Waterstone et al 2001)	• Case-control study • 4 randomly selected controls per case	Severe pre-eclampsia, eclampsia, HELLP syndrome, severe haemorrhage, severe sepsis and uterine rupture	Past postpartum haemorrhage	Past postpartum haemorrhage: aOR 2.41 (95%CI 1.53-3.77)	• OR adjusted for confounders • Large case-control study
	• United States (Duckitt and Harrington 2005)	Systematic review of controlled studies published 1966-2002	Pre-eclampsia	History of pre-eclampsia in previous pregnancy	Previous history of pre-eclampsia RR 7.19 (95% CI 5.85-8.83)	• Studies in any language were included in search • Most studies were case-control and cohort studies and all included reference group and controlling for confounders • 52 studies included in review – limited to those looking at pre-eclampsia
	• United Kingdom (Knight et al 2008a)	• Population-based matched case-control study	Peripartum hysterectomy	Past caesarean section	Past caesarean section: aOR 3.52 (95% CI 2.35-5.26)	• Assessment limited to peripartum hysterectomy

National Survey of Women's Experience of Maternity Care

This is an independent survey about your recent experience of pregnancy and childbirth. We would like to be able to feed back the views of women who have recently given birth to the Department of Health who have funded the survey. In this way you can help to improve the way that maternity services are provided.

We asked the Office for National Statistics (ONS) to send out this survey on our behalf. They have not told us your name and we do not have access to any of your details.

If you would prefer not to fill in this questionnaire, please just return it in the pre-paid envelope. This will ensure that we don't contact you again.

If the survey raises issues or questions of concern, you may wish to contact your family doctor (GP) or Health Visitor.

You can complete this survey on-line if you prefer, using the link from the NPEU website:
www.npeu.ox.ac.uk/maternitysurveys
and the details in your letter or those in the small box at the bottom of this page.

If you would like to complete the questionnaire over the telephone or with the help of a Language Line interpreter, please telephone this Freephone number 0800 1385451

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National Perinatal Epidemiology Unit

How to complete this questionnaire

- If you have been pregnant before, please only think about the maternity care you received in your **most recent pregnancy** and birth when answering these questions.
- For most questions, just tick clearly inside one box ☑ or write clearly on the line or in the box provided. For some questions you may tick more than one box.
- Not all sections will apply to you. We estimate that the questionnaire will take around 30 minutes to complete.

Section A: Dates and Your Baby

A1 Did you give birth to a single baby, twins or more in your most recent pregnancy?

☐ A single baby ☐ Twins ☐ Triplets, quads or more

A2 If you had a single baby, is your baby…? *Please tick one box*

☐ A boy **OR** ☐ A girl

If you had a multiple birth, did you have…?

☐ All boys **OR** ☐ All girls **OR** ☐ boy and girl twins, triplets or more

A3 When was your baby born? ***If you had more than one baby in your most recent pregnancy, please fill in the rest of the questionnaire about the baby who was born first as a result of this pregnancy.***

D D / M M / Y Y (date/month/year)

A4 Roughly how many weeks pregnant were you when your baby was born?

☐☐ weeks

A5 How much did your baby weigh at birth? ***Please remember if you had more than one baby, to fill in this questionnaire about the baby who was born first.***

Either What your baby weighed in grams ☐☐☐☐

Or What your baby weighed in pounds ☐☐ and ounces ☐☐

Section B: Antenatal Care

Your early care in pregnancy

B1 How many weeks pregnant were you when you first realised you might be pregnant?

☐☐ weeks

B2 How was your pregnancy confirmed? *Please tick all that apply*

☐ By home pregnancy test ☐ By a doctor ☐ By a midwife

B3 Did you plan to become pregnant with this baby? ☐ Yes ☐ No

B4 How would you describe your reaction when you realised you were pregnant with this baby? *Please tick one box only*

☐ Overjoyed
☐ Pleased
☐ Mixed feelings
☐ A bit unhappy
☐ Very unhappy
☐ No particular feelings

B5 Which health professional did you go to first about your pregnancy care?
Please tick one box only

☐ GP / Family doctor ☐ Midwife ☐ Other

B6 Roughly how many weeks pregnant were you when you first saw this health professional about your pregnancy care?

☐☐ weeks

B7 Were you able to see this person as soon as you wanted about your care in pregnancy?

☐ Yes ☐ No

B8 Did you know you could go straight to a midwife, rather than a GP/family doctor as your first contact about your pregnancy care?

☐ Yes ☐ No

B9 Roughly how many weeks pregnant were you when you had your 'booking' appointment? (the appointment where you were given your hand held pregnancy records/notes)

☐☐ weeks

B10 How many times did you see a health professional about your pregnancy care before your 'booking appointment'? *(the appointment where you were given your hand held pregnancy records/notes)*

☐☐ times

B11 Where did you have your 'booking' appointment? *Please tick one box only*

☐ Local clinic
☐ Children's centre
☐ GP surgery
☐ Hospital clinic
☐ At home
☐ Other place *Please give details* ______

B12 During your pregnancy were you…

Given a copy of 'The NHS Pregnancy Book'?	☐ Yes	☐ No	☐ Not sure / Don't know
If Yes, was this useful?	☐ Yes	☐ No	☐ Not sure / Don't know
Given information about the NHS Choices website	☐ Yes	☐ No	☐ Not sure / Don't know
If Yes, was this useful?	☐ Yes	☐ No	☐ Not sure / Don't know

Antenatal check-ups

A 'check-up' is any contact with a midwife or a doctor to check the progress of your pregnancy. This usually includes having your blood pressure and urine checked. *Please ignore other appointments that did not include these things, such as a visit for a scan or a blood test only.*

B13 During your pregnancy… *Please tick one box for each line*

	Yes	No	Not sure / Don't know	Does not apply
Did you have any antenatal check-ups?	☐	☐	☐	☐
Were you given a choice about **where** your check-ups would take place?	☐	☐	☐	☐
Did you have a choice about **who** would carry out your check-ups?	☐	☐	☐	☐

B14 Roughly how many check-ups did you have at each of these places? *Please write in the number for each*

- Local clinic ☐☐
- Children's centre ☐☐
- GP surgery ☐☐
- Hospital clinic ☐☐
- At home ☐☐
- Other place ☐☐ *Please give details* ____________

B15 Who did you see for your antenatal check-ups? *Please tick all that apply*

- ☐ Midwife
- ☐ GP (family doctor)
- ☐ Obstetrician (hospital doctor)
- ☐ Other give details ____________

Tests and scans

In this section we are asking about some of the tests that you may have had during your pregnancy. We are interested in whether tests were explained to you, and whether you felt you had any say in having the tests.

B16 Did you have any screening tests (blood test or nuchal scan) to check whether your baby might have Down's syndrome? *Please tick one box only*

- ☐ Yes, a blood test only
- ☐ Yes, a nuchal scan only
- ☐ Yes, a nuchal scan and a blood test
- ☐ No, I didn't want a screening test for Down's syndrome
- ☐ No, I wasn't offered any screening tests for Downs' syndrome
- ☐ Don't know / Can't remember

B17 Do you feel that you had a choice about whether to have a screening test for Down's syndrome?

☐ Yes ☐ No

B18 Were the reasons for having a screening test for Down's syndrome clearly explained to you?

☐ Yes ☐ No

B19 During your pregnancy did you ever have an ultrasound scan, showing your baby on a screen?

☐ Yes ☐ No **If No, *please go to B24***

B20 Roughly how many scans did you have in total during your pregnancy?

☐☐ scans

B21 Roughly how many weeks pregnant were you at your first scan?

☐☐ weeks

B22 Did you have a dating scan (at between 8-14 weeks of pregnancy)?

☐ Yes ☐ No

Was the reason for this scan clearly explained to you? ☐ Yes ☐ No

Do you feel you had a choice about having this scan? ☐ Yes ☐ No

B23 Did you have a scan at around 20 weeks of pregnancy? This may have been called a '20 week scan', an 'anomaly' scan or a 'mid-trimester' scan.

☐ Yes ☐ No

Was the reason for this scan clearly explained to you? ☐ Yes ☐ No

Do you feel you had a choice about having this scan? ☐ Yes ☐ No

Staying in hospital during your pregnancy

B24 While you were pregnant, but *before* you went into labour (or before your labour was induced), did you stay in hospital overnight?

☐ Yes ☐ No

If Yes, how many nights in total? ☐☐ nights

If No *please go to B26*

B25 How many times altogether did you stay overnight in hospital, *before* you were in labour (or before you were admitted for induction)? *If you are not sure, please estimate*

☐☐ times

Please tell us the reason(s) for your stay(s) in hospital during your pregnancy?

During your pregnancy

B26 During your pregnancy did you have the name and contact details, (for example, phone number), of a midwife you could get in touch with if you were worried?

☐ Yes ☐ No ☐ Not sure / Can't remember

B27 Thinking about the care you received from staff during your pregnancy, do you agree or disagree with the following statements? *Please tick one box for each line*

Midwives…	Agree	Disagree	Not sure
Talked to me in a way I could understand	☐	☐	☐
One or more did not talk to me in a way I could understand	☐	☐	☐
Treated me with respect most of the time	☐	☐	☐
One or more did not treat me with respect	☐	☐	☐
Treated me with kindness	☐	☐	☐
One or more did not treat me with kindness	☐	☐	☐

Doctors…	Agree	Disagree	Not sure
Talked to me in a way I could understand	☐	☐	☐
One or more did not talk to me in a way I could understand	☐	☐	☐
Treated me with respect most of the time	☐	☐	☐
One or more did not treat me with respect	☐	☐	☐
Treated me with kindness	☐	☐	☐
One or more did not treat me with kindness	☐	☐	☐

B28 Some women experience health problems in pregnancy. Did you experience or seek help from a midwife or doctor for any of the following? *Please tick all that apply*

	Yes, I experienced this	Yes, I saw a midwife or doctor about this
Repeated vomiting (hyperemesis)	☐	☐
Pubic bone pain (symphysis pubis dysfunction)	☐	☐
Heartburn (indigestion)	☐	☐
Varicose veins	☐	☐
Haemorrhoids (piles)	☐	☐
Constipation	☐	☐
Backache	☐	☐
Problems with your wrist/hand (carpel tunnel syndrome)	☐	☐
Stress incontinence (losing urine when you don't mean to)	☐	☐
Anxiety	☐	☐
Depression	☐	☐

B29 Did you have long term health problems which made this pregnancy difficult or complicated (e.g. epilepsy or diabetes)?

☐ Yes ☐ No

Please give details

If Yes, did you receive additional or specialist care during your pregnancy for this reason?

☐ Yes ☐ No

If you received specialist care, how well was this co-ordinated? *Please tick one box only*

☐ Very well ☐ Quite well ☐ Not very well

B30 Did you have specific pregnancy related problems which affected you or your baby? (e.g. high blood pressure, threatened preterm labour, low-lying placenta?

☐ Yes ☐ No

Please give details

If Yes, did you receive additional or specialist care during your pregnancy for this reason?

☐ Yes ☐ No

If you received specialist care, how well was this co-ordinated? *Please tick one box only*

☐ Very well ☐ Quite well ☐ Not very well

B31 During your pregnancy were you offered any NHS antenatal classes or workshops?

☐ Yes ☐ No

If Yes, were these offered at? *Please tick all that apply*

☐ Local clinic
☐ Children's centre
☐ GP surgery
☐ Hospital clinic

B32 Did you attend the antenatal classes or workshops? *Please tick one box only*

☐ Yes
☐ No, they were all booked up
☐ No, I did not wish to attend classes
☐ No, I did not attend for other reasons

B33 *Whether or not* you attended antenatal classes provided by the NHS…
Please tick one box for each line

	Yes	No	Don't know / not sure
Were the NHS classes were at the right stage of pregnancy?	☐	☐	☐
Were the NHS classes were at a convenient time of day?	☐	☐	☐
Was your partner welcome to attend with you?	☐	☐	☐
Were there separate classes for partners to attend?	☐	☐	☐
Were the NHS classes held at a convenient place?	☐	☐	☐
Were there enough NHS classes in the course?	☐	☐	☐
Did the classes cover the topics you wanted?	☐	☐	☐

B34 If you attended antenatal classes how many weeks pregnant were you at the start of the classes?

☐☐

B35 Did you attend any private antenatal classes for which you paid?

☐ Yes ☐ No

B36 Did you use the NHS Choices website?

☐ Yes ☐ No

B37 Did you use any other websites?

☐ Yes ☐ No

If Yes, which did you use?

Section C: Your Labour and the Birth of Your Baby

Worries about labour and birth

C1 Before you went into labour or had your baby did you have any particular worries about the labour and birth? *Please tick one box for each line*

	Very worried	Quite worried	Not very worried	Not at all worried
Not knowing when I would go into labour	☐	☐	☐	☐
Not knowing who to contact	☐	☐	☐	☐
Getting to the hospital in time	☐	☐	☐	☐
Having to be induced	☐	☐	☐	☐
Having a long labour	☐	☐	☐	☐
Pain and discomfort of labour	☐	☐	☐	☐
Getting effective pain relief	☐	☐	☐	☐
Not knowing how long labour would take	☐	☐	☐	☐
Having a forceps or 'ventouse' delivery	☐	☐	☐	☐
Embarrassment	☐	☐	☐	☐
Needing a caesarean	☐	☐	☐	☐
Other *Please give details* ____	☐	☐	☐	☐

Where you gave birth to your baby

C2 What options were you aware of for *where* you could have your baby?
Please tick all that apply

☐ To give birth at home
☐ In a midwife-led unit or birth centre separate from hospital
☐ In hospital in a midwife-led unit
☐ In hospital, in a consultant-led unit

C3 When did you make your choice? *Please tick one box only*

☐ Early pregnancy
☐ Mid pregnancy
☐ Late pregnancy
☐ At the start of labour
☐ I did not have a choice

C4 Did you have an opportunity to change your mind?

☐ Yes ☐ No ☐ Does not apply

C5 Where was your baby born? *Please tick one box only*

☐ In hospital, in a midwife-led unit
☐ In hospital, in a consultant-led unit
☐ In a midwife-led unit or birth centre separate from hospital
☐ At home
☐ Other

Please write the name of hospital and/or unit where you gave birth ____

C6 Was the hospital and/or unit where you gave birth… *Please tick one box for each line*

In the area or NHS trust where you had your antenatal care?	☐ Yes	☐ No
Ideally where you wanted your baby to be born?	☐ Yes	☐ No
Where you planned at the start of labour?	☐ Yes	☐ No
A place with the specialist facilities you or your baby needed?	☐ Yes	☐ No

Your Labour

C7 Did you have a labour? ☐ Yes ☐ No

If No and you had a caesarean section *before* labour had started ***please go to question C19***

C8 Roughly how long did your labour last?

☐☐ hours **AND/OR** ☐☐ minutes

C9 How did your labour start? *Please tick all that apply*

☐ It started naturally
☐ I was given a vaginal gel or pessary to induce my labour
☐ I had one or more membrane sweeps
☐ My waters were broken by a doctor or a midwife (amniotomy)
☐ I was given a drip (in my hand or arm) to induce my labour

C10 If your labour was induced (started off), what was the reason for this? *Please tick all that apply*

- ☐ My baby was overdue
- ☐ Regular contractions were starting and stopping (my labour did not establish)
- ☐ Staff were worried about the baby's health
- ☐ Staff were worried about my health
- ☐ Other reasons *Please give details* __________
- ☐ I don't know why I was induced
- ☐ Does not apply, my labour started naturally

C11 Do you feel you had any choice about whether your labour would be induced (started off)?

- ☐ Yes
- ☐ No
- ☐ Not sure / Can't remember
- ☐ Does not apply, my labour started naturally

C12 During your labour, did you use any of the following to relieve the pain and how helpful were they?
Please tick one box for each line

	Very helpful	Quite helpful	Not helpful	Did not use this
Natural methods (e.g. breathing, massage)	☐	☐	☐	☐
Water or a birthing pool	☐	☐	☐	☐
TENS machine (with pads on your back)	☐	☐	☐	☐
Gas and air (breathing through a mask)	☐	☐	☐	☐
Injection of pethidine or a similar painkiller	☐	☐	☐	☐
Epidural (injection in your back)	☐	☐	☐	☐
Other *Please give details* __________	☐	☐	☐	☐

C13 During your labour, how was your baby monitored (checked)? ***If you had more than one baby, please answer about the baby who was born first.*** *Please tick all that apply*

- ☐ Staff listened with a stethoscope (or ear trumpet) now and then
- ☐ Sonicaid (a hand held monitor) was used now and then
- ☐ A monitor was used now and then, with a belt around my abdomen
- ☐ A monitor was used constantly with a belt around my abdomen
- ☐ A monitor was used constantly with a clip attached to the baby's head
- ☐ Other
- ☐ I had no monitoring
- ☐ Not sure/Can't remember

C14 During your labour, were you able to move around and choose the position that made you most comfortable? *Please tick one box only*

☐ Yes, most of the time ☐ Yes, some of the time ☐ No, not at all

C15 Some women plan to give birth in one location, (for example, at home or in a midwifery-led unit), but are transferred during labour to hospital for medical reasons or epidural anaesthesia.
Did this happen to you?

☐ Yes ☐ No

If No, ***please go to C19***

C16 If you were transferred, was this from

- ☐ A midwife-led unit (birth centre) **in hospital**, to a consultant-led unit **in the same hospital**?
- ☐ A separate midwife-led unit (birth centre) **outside the hospital** to a consultant-led unit?
- ☐ Home to hospital?
- ☐ One hospital to another?
- ☐ Other? *Please give details* __________

C17 If you were transferred, how far did you have to travel? *Please use '0" if same hospital*

☐☐☐ miles

C18 If you were transferred, why was this? *Please tick all that apply*

- ☐ Staff were concerned about the baby
- ☐ Slow progress in labour
- ☐ I was ill or needed the type of care provided elsewhere
- ☐ Epidural for pain relief
- ☐ Other *Please give details* __________

The birth of your baby

C19 ***Before*** **the birth of this baby had you ever given birth by caesarean section?**

☐ Yes ☐ No

C20 Thinking about the birth of your baby this time, what kind of delivery did you have? ***If you had more than one baby in this pregnancy, please complete this question about the baby that was born first.*** *Please tick one box only*

- ☐ Normal (vaginal) birth
- ☐ A caesarean (through a cut in the abdomen)
- ☐ Delivery using forceps
- ☐ Delivery using vacuum cap on the baby's head (ventouse)

Caesarean Birth

Note: If you did **not** have a caesarean, ***please go to Question C25***

C21 If your baby was born by caesarean was this… *Please tick one box only*

- ☐ Planned and carried out before you went into labour?
- ☐ Planned, but carried out after you had gone into labour?
- ☐ The result of an unforeseen problem during your labour?

C22 For your caesarean did you have?

☐ An epidural or spinal anaesthesia **OR** ☐ A general anaesthetic (making you go to sleep)

C23 Were you involved in the decision-making about your caesarean birth?

☐ Yes ☐ Yes to some extent ☐ Not at all

C24 Why did you have a caesarean? *Please tick all that apply*

☐ My baby was 'distressed'
☐ Labour had 'failed to progress'
☐ I wanted my baby to be born in this way
☐ My baby wouldn't fit through my pelvis
☐ Breech presentation (feet first)
☐ I had twins or triplets
☐ Because of worries about my health
☐ Because I had a caesarean before
☐ Because I was in premature labour
☐ Other reason *Please give details* ______
☐ Don't know / Can't remember

Note: Now, ***please go to C30***

Vaginal Birth

C25 Where did you give birth? *Please tick one box only*

☐ On a bed
☐ On the floor (on a mattress/mat)
☐ In water or in a birthing pool
☐ Other *Please give details* ______

C26 What position were you in when your baby was actually born? *Please tick one box only*

☐ Sitting / sitting supported by pillows
☐ On my side
☐ Standing, squatting or kneeling
☐ Sitting/Lying with my legs supported in stirrups (for the birth)
☐ Lying flat
☐ Other

C27 If you had a vaginal birth, while your baby was being born did you have an episiotomy (cut) to assist with the delivery of the baby?

☐ Yes ☐ No ☐ Don't know / Can't remember

C28 If you had a vaginal birth, while your baby was being born did you have a tear (not a deliberate cut)? *Please tick one box only*

☐ No
☐ Yes, a tear that did not need stitches
☐ Yes, a tear that needed stitches
☐ Yes, a serious tear which involved my back passage (third or fourth degree tear)
☐ Don't know / Can't remember

C29 Did you have stitches (perineal repair) after your vaginal birth?

☐ Yes ☐ No

If Yes, what kind of pain relief did you have? *Please tick one box only*

☐ Local anaesthetic ☐ Epidural ☐ General anaesthetic ☐ None

The staff caring for you

Please answer the following section if you had a vaginal birth **or** a caesarean.

C30 Altogether, how many different midwives looked after you during your labour and the birth of your baby? *Please tick one box only*

☐ One ☐ Two ☐ Three ☐ Four ☐ Five or more

C31 Had you met any of these midwives before you went into labour? *Please tick one box only*

☐ All of them ☐ Some of them ☐ None of them

C32 Who delivered your baby? *Please tick all that apply*

☐ Midwife
☐ Doctor (obstetrician)
☐ Other *Please give details* ______

C33 Soon after your baby was born, were you able to…
Please tick one box for each line

	Yes	No, I was not offered this	No, I was not well enough	No, I did not want this
Hold your baby?	☐	☐	☐	☐
Have skin to skin contact with your baby?	☐	☐	☐	☐
Breastfeed your baby?	☐	☐	☐	☐

C34 How well do you feel staff communicated with you about your care in labour and delivery?
Please tick one box only

☐ Very well ☐ Fairly well ☐ Not very well ☐ Not at all well

C35 Did you have confidence and trust in the staff caring for you during your labour and birth?
Please tick one box only

☐ Always ☐ Sometimes ☐ Rarely ☐ Never

C36 Were you (and/or your husband, partner or companion) left alone by staff at a time when it worried you? *Please tick all that apply*

☐ No, not at all
☐ Yes, during labour
☐ Yes, shortly after the birth
☐ Yes, during labour and shortly after the birth

C37 If you gave birth in a maternity unit or hospital, were you shown the call button to use when staff were not with you?

☐ Yes ☐ No ☐ Does not apply

C38 Thinking about the care you received from midwives and doctors during your labour and birth, do you agree or disagree with the following statements?
Please tick one box for each line

Midwives…	Agree	Disagree	Not sure
Talked to me in a way I could understand	☐	☐	☐
One or more did not talk to me in a way I could understand	☐	☐	☐
Treated me with respect most of the time	☐	☐	☐
One or more did not treat me with respect	☐	☐	☐
Treated me with kindness	☐	☐	☐
One or more did not treat me with kindness	☐	☐	☐

Doctors…	Agree	Disagree	Not sure
Talked to me in a way I could understand	☐	☐	☐
One or more did not talk to me in a way I could understand	☐	☐	☐
Treated me with respect most of the time	☐	☐	☐
One or more did not treat me with respect	☐	☐	☐
Treated me with kindness	☐	☐	☐
One or more did not treat me with kindness	☐	☐	☐

C39 We would like to know how you feel you were looked after during your labour and birth. Please circle any of the words below which describe the staff you saw during labour.
Circle as many as you wish

rushed	humorous	insensitive	kind
considerate	unhelpful	supportive	offhand
rude	warm	inconsiderate	polite
sensitive	bossy	informative	condescending

Are there any other words you would like to add? ______________________

C40 Is there anything else you would like to say about your care during labour and the birth of your baby? *Please give details*

Note: **Please complete the following section if you had your baby at home**. If you did **not** have your baby at home, ***please go on to Section E***.

Section D: Babies Born at Home

D1 Before your baby was born, did you plan to have your baby at home?

☐ Yes ☐ No **If No**, ***please go to D3***

If Yes, was it?

☐ Planned before labour ☐ Planned after labour started

D2 Were you given information about the following? *Please tick one box for each line*

	Yes	No	Don't know / Can't remember
The type of pain relief that would be available at home	☐	☐	☐
The monitoring of the baby that would be available at home	☐	☐	☐
The distance and location of the nearest maternity service	☐	☐	☐
The sorts of emergency back-up that would be available for transfer (e.g. ambulance facilities if you needed them)	☐	☐	☐

D3 After the birth did you or your baby go to hospital? *Please tick one box only*

☐ No, my baby and I stayed at home
☐ Yes , my baby and I both went to hospital
☐ Yes, I went to hospital, but my baby stayed at home
☐ Yes, My baby went to hospital

Section E: Care of You and Your Baby in a Maternity Unit After the Birth

Note: This section is about your postnatal maternity unit or hospital stay. If you had a home birth and did not go to a maternity unit or hospital at all, ***please go to Section F***

Your maternity unit stay

E1 How long did you stay in the maternity unit after your baby was born?

☐☐ hours and/or ☐☐ days

E2 Looking back, do you feel that the length of your stay was…

☐ Too long? ☐ About right? ☐ Too short? ☐ Not sure/Don't know

E3 Thinking about the care you received in the maternity unit (or hospital) after the birth of your baby, do you agree or disagree with the following statements? *Please tick one box for each line*

	Agree	Disagree	Not sure
Staff talked to me in a way I could understand	☐	☐	☐
One or more staff did not talk to me in a way I could understand	☐	☐	☐
Staff treated me with respect most of the time	☐	☐	☐
One or more staff did not treat me with respect	☐	☐	☐
Staff treated me with kindness	☐	☐	☐
One or more staff did not treat me with kindness	☐	☐	☐

E4 Generally, during your postnatal stay in the maternity unit did you feel that the staff treated you as an individual? *Please tick one box only*

☐ Always ☐ Sometimes ☐ Rarely ☐ Never

E5 Is there anything else you would like to say about you or your baby's postnatal care in the maternity unit (or hospital)? *Please give details*

Section F: Feeding Your Baby

F1 During your pregnancy, how had you planned to feed your baby? *Please tick one box only*

☐ Breast milk (or expressed breast milk) only
☐ Both breast and formula (bottle) milk
☐ Formula (bottle) milk only
☐ Not sure

F2 During your pregnancy did your midwife discuss infant feeding with you?

☐ Yes ☐ No ☐ Don't know / Can't remember

F3 Did you ever try to breastfeed your baby, even if it was only once?

☐ Yes ☐ No

F4 In the first few days after the birth how was your baby fed? *Please tick one box only*

☐ Breast milk (or expressed breast milk) only
☐ Both breast and formula (bottle) milk
☐ Formula (bottle) milk only
☐ Not sure

F5 Thinking about feeding your baby, did you feel that midwives and other carers gave you… *Please tick one box for each line*

	Yes, always	Yes, generally	No	Don't know	Didn't want this
Consistent advice?	☐	☐	☐	☐	☐
Practical help?	☐	☐	☐	☐	☐
Active support and encouragement?	☐	☐	☐	☐	☐

F6 Who helped or advised you with feeding your baby? *Please tick all that apply*

☐ Health professionals
☐ Partner/friend/relative
☐ Parent support or peer group
☐ Voluntary organisation
☐ Breastfeeding clinic
☐ I was not given any help or advice
☐ I did not need help or advice

F7 How is your baby fed now? *Please tick one box only*

☐ Formula (bottle) milk only
☐ Breast milk (or expressed breast milk) only
☐ Both breast and formula (bottle) milk
☐ Other *Please give details* ______

F8 If your baby no longer has breast milk how old was your baby when he/she was last given breast milk?

☐ days **OR** ☐☐ weeks *Please use '0' if not fed breast milk at all*

Section G: Babies Needing Specialist Care

After birth some babies need specialist care, e.g. help with breathing, and are admitted to a neonatal unit, sometimes called a Special Care Baby Unit (SCBU) or Neonatal Intensive Care Unit (NICU).

G1 Was your baby cared for in a neonatal unit (NNU, NICU, SCBU) at all?

☐ Yes ☐ No

Note If your baby was *not* cared for in a neonatal unit, ***please go to Section H***

G2 Why was your baby admitted to a neonatal unit? *Please tick all that apply*

☐ My baby was premature
☐ My baby had breathing problems
☐ My baby had feeding difficulties
☐ For observation
☐ Other reason *Please give details* ______

G3 **How much were the equipment and procedures in neonatal care explained to you?** *Please tick one box only*

☐ Always ☐ Sometimes ☐ Rarely ☐ Never

G4 **Were your baby's problems discussed with you?** *Please tick one box only*

☐ Always ☐ Sometimes ☐ Rarely ☐ Never

G5 **When did you first?** *Please tick one box for each line*

	At the birth	First day	First week	More than a week	Not able/Didn't want this
See your baby?	☐	☐	☐	☐	☐
Hold your baby?	☐	☐	☐	☐	☐
Touch your baby?	☐	☐	☐	☐	☐

G6 **During your baby's stay in neonatal care did your baby receive skin-to-skin (kangaroo) care?** *Please tick one box only*

☐ Quite a lot ☐ Sometimes ☐ Rarely ☐ Not at all

G7 **Were you encouraged to express breast milk for your baby?**

☐ Yes ☐ No

G8 **Is your baby in a neonatal unit now?**

☐ Yes ☐ No

G9 **If your baby was discharged from a neonatal unit, how long was your baby in neonatal care *in total*?**

☐☐ hours **OR** ☐☐ days **OR** ☐☐ weeks **OR** ☐☐ months

G10 **During your baby's stay in the neonatal unit did you stay overnight in the hospital at any time after you had been discharged home?**

☐ Yes ☐ No

If Yes, for how many nights in total ? ☐☐

Section H: Care at Home After the Birth

H1 **Were you given a copy of the 'Birth to Five' book?**

☐ Yes ☐ No ☐ Don't know / Can't remember

H2 **When you were at home after the birth of your baby did you have the name and telephone number of a midwife or health visitor you could contact ?**

☐ Yes ☐ No ☐ Not sure / Don't know

H3 **After your baby's birth were you visited at home by a midwife?** *Please tick one box only*

☐ Yes
☐ No, I visited the midwife or saw a midwife in a clinic
☐ No, I was not offered a visit
☐ No, I was visiting or staying near my baby in a neonatal unit (NNU or SCBU)
☐ No, I moved home
☐ No, I did not want a midwife to visit
☐ No, for another reason

Note: If you did not see a midwife or maternity support worker at all for your postnatal care, ***please go to H9***

H4 **After the birth of your baby how many times in total did you…**

See a midwife at home? ☐☐ times
See a maternity support worker at home? ☐☐ times
Contact a midwife or maternity support worker by phone? ☐☐ times

H5 **How old was your baby when you had the last visit or contact with the midwife or maternity support worker?**

Age in days ☐☐

H6 **How many different midwives in total visited you at home after your baby was born?** *Please tick one box only*

☐ One ☐ Two ☐ Three or more ☐ Don't know / Can't remember

H7 **Had you met any of these midwives before you had your baby?** *Please tick one box only*

☐ All of them ☐ Some of them ☐ None of them

H8 **Did you have confidence and trust in the midwives you saw after going home?** *Please tick one box only*

☐ Always ☐ Sometimes ☐ Rarely ☐ Never

H9 **For postnatal care at home, would you have liked to have seen a midwife…?** *Please tick one box only*

☐ More often ☐ Less often ☐ I saw them as much as I wanted

H10 **Do you feel that you and your partner had a choice about when and where you could access postnatal care?**

☐ Yes ☐ No

H11 **Where would you have liked to see or contact a midwife or maternity support worker for postnatal care of you and your baby?** *Please tick all that apply*

☐ My home
☐ Regular clinic based at my GP's surgery
☐ Children's centre
☐ Open drop-in baby clinic
☐ By phone

H12 In the six weeks after the birth of your baby did you receive help and advice from health professionals about each of the things listed below? *Please tick one box for each line*

	Enough	Some, but not enough	None	Did not need any
Handling your baby	☐	☐	☐	☐
Bathing your baby	☐	☐	☐	☐
Settling your baby to sleep	☐	☐	☐	☐
Your baby's crying	☐	☐	☐	☐
Your baby's sleeping position	☐	☐	☐	☐
Your baby's feeding	☐	☐	☐	☐
Your baby's skin care (e.g. nappy rash)	☐	☐	☐	☐
Your baby's colic	☐	☐	☐	☐
Your baby's health and progress	☐	☐	☐	☐

H13 Since your baby was born have the following been available or used by you?

	Was available	Have attended or used
Regular baby clinic based in GP surgery	☐	☐
An open drop-in baby clinic	☐	☐
Children's Centre	☐	☐
A parent-to-parent group	☐	☐
One or more postnatal classes	☐	☐
A 'baby café'	☐	☐

H14 Since your baby was born have you used a parenting website?

☐ Yes ☐ No

If Yes, please give details ______

Your Health and Wellbeing

H15 Overall, how did you feel physically during the first few days after the baby was born?
Please tick one box only

☐ Very well
☐ Quite well
☐ Tired and uncomfortable
☐ Exhausted all the time
☐ Very ill

H16 Did you have a postnatal check-up of your own health with your GP (family doctor) between 4-8 weeks after the birth?

☐ Yes ☐ No

If you did ***not*** have a postnatal check-up, why was this? *Please tick one box only*

☐ It was not offered
☐ I did not want to have this check-up
☐ Other reasons *Please give details* ______

H17 Since your baby was born, have you talked to any health professionals about what happened during your labour or the birth of your baby?

☐ Yes ☐ No

If Yes, who have you talked to? *Please tick all that apply*

☐ A doctor/midwife who was present during labour/birth
☐ Another doctor/midwife not present during labour/birth
☐ GP (family doctor)
☐ Health visitor
☐ Other *Please give details* ______

If No, would you have liked to talk to somebody? ☐ Yes ☐ No

H18 Did you experience any of the following 10 days, 1 month, and 3 months after the birth of your baby? *Please tick all that apply*

	10 days after the baby's birth	1 month after the baby's birth	3 months after the baby's birth
'The blues'	☐	☐	☐
Painful stitches	☐	☐	☐
Breastfeeding problems	☐	☐	☐
Depression	☐	☐	☐
Wound infection	☐	☐	☐
Leaking urine when you don't mean to (stress incontinence)	☐	☐	☐
Fatigue/severe tiredness	☐	☐	☐
Backache	☐	☐	☐
Anxiety	☐	☐	☐
Difficulties/pain during intercourse	☐	☐	☐
Sleep problems (not related to the baby)	☐	☐	☐
'Flash-backs' to the labour or birth	☐	☐	☐
Difficulties in concentrating	☐	☐	☐
Other *Please give details* ______	☐	☐	☐
None of these	☐	☐	☐

H19 Overall, how have you felt physically during the last few days? *Please tick one box only*

- ☐ Very well
- ☐ Quite well
- ☐ Tired and uncomfortable
- ☐ Exhausted all the time
- ☐ Very ill

H20 Overall, how satisfied or dissatisfied were you with the maternity care you received during… *Please tick one box for each line*

	Very satisfied	Satisfied	Neither satisfied nor dissatisfied	Dissatisfied	Very dissatisfied
Your pregnancy?	☐	☐	☐	☐	☐
Your labour and birth?	☐	☐	☐	☐	☐
Your care after the birth?	☐	☐	☐	☐	☐

H21 Overall were you…

	Yes	To some extent	No
Given information about your choices for maternity care	☐	☐	☐
Able to participate in decision-making about your care?	☐	☐	☐
Given enough information to help to you decide about your care?	☐	☐	☐
Given information at the right time to help you decide about your care?	☐	☐	☐

Section J: Father and Partner Involvement

Note: This section is about the involvement of your husband or partner. If you are a parent without a partner at this time, please answer these questions if your ex-partner or the father of the baby was with you during pregnancy, otherwise ***please go to section K***.

J1 How would you describe your husband or partner's reaction when you found you were pregnant with this baby? *Please tick one box only*

- ☐ Overjoyed
- ☐ Pleased
- ☐ Mixed feelings
- ☐ A bit unhappy
- ☐ Very unhappy
- ☐ No particular feelings
- ☐ Does not know about the baby

J2 Was your husband or partner present for? *Please tick as many as apply*

- ☐ Your pregnancy test or when your pregnancy was confirmed
- ☐ One or more of your antenatal checks
- ☐ One or more of your ultrasound scans
- ☐ One or more antenatal education classes
- ☐ Your labour
- ☐ Not present at all

J3 Was your husband or partner involved in? *Please tick as many as apply*

- ☐ Finding information about pregnancy
- ☐ Decision-making about antenatal screening
- ☐ Making a birth plan
- ☐ Finding information about labour and birth
- ☐ Decision-making in labour
- ☐ Not involved at all

J4 In general how did your husband or partner feel midwives and doctors communicated with them? *Please tick one box for each line*

	Very well	Quite well	Not very well	Not at all
During pregnancy	☐	☐	☐	☐
During labour and birth	☐	☐	☐	☐
In the postnatal period	☐	☐	☐	☐

J5 Since your baby was born has your husband or partner been involved in?
Please tick one box for each line

	A great deal	A bit	Rarely	Not at all
Changing the baby's nappy	☐	☐	☐	☐
Helping or supporting you with feeding	☐	☐	☐	☐
Helping when the baby cries	☐	☐	☐	☐
Bathing the baby	☐	☐	☐	☐
Playing with the baby	☐	☐	☐	☐
Looking after the baby when you are out or at work	☐	☐	☐	☐
Postnatal activities, such as classes	☐	☐	☐	☐

J6 Was your partner able to take paternity or parental leave when your baby was born?

☐ Yes ☐ No ☐ Does not apply

If Yes, how long was this for? ☐☐ days **OR** ☐☐ weeks

Section K: Previous Pregnancies and Childbirth

We would like to know a little about your experiences in relation to **previous** pregnancies.

K1 Have you had a previous pregnancy?

☐ Yes ☐ No

Note: If you have not had any previous pregnancies, ***please go to Section L***

K2 Have you given birth before?

☐ Yes ☐ No

If Yes, how many babies have you had *before* this pregnancy?

☐☐ babies

K3 Before this baby, did you have problems with your health which made *previous pregnancies* difficult or complicated (e.g. epilepsy or diabetes)?

☐ Yes ☐ No

Please give details

K4 Was this pregnancy a result of treatment for infertility?

☐ Yes ☐ No

Please give details

K5 Before this baby, did you have problems with *previous pregnancies* (e.g. high blood pressure, premature birth, low-lying placenta)?

☐ Yes ☐ No

Please give details

Section L: You and Your Household

Please answer as many of these questions as you can. This will help us to describe the women taking part in this survey and show whether the care offered to women is the same regardless of their background or circumstances.

L1 How old are you now?

☐☐ years

L2 How old were you when left full-time education?

☐ 16 years or less
☐ 17 or 18 years
☐ 19 years or over
☐ Still in full-time education

L3 Which of the following people live with you?

☐ Your baby / children
☐ Husband or baby's father
☐ Same sex partner
☐ Other family members
☐ Other people in your household

L4 To which of these ethnic groups would you say you belong? *Please tick one box only*

WHITE

☐ British
☐ Irish
☐ Any other White background

If other, please write in box

MIXED

☐ White and Black Caribbean
☐ White and Black African
☐ White and Asian
☐ Any other Mixed background

If other, please write in box

ASIAN OR ASIAN BRITISH

☐ Indian
☐ Pakistani
☐ Bangladeshi
☐ Any other Asian background

If other, please write in box

BLACK OR BLACK BRITISH

☐ Caribbean
☐ African
☐ Any other Black background

If other, please write in box

CHINESE OR OTHER ETHNIC GROUP

☐ Chinese
☐ Any other ethnic group

If other, please write in box

L5 In which country were you born? ____________

If you were born outside the United Kingdom, what year did you come to the UK? ☐☐☐☐

L6 Do you need any help in understanding English?

☐ Yes ☐ No

L7 Which of these best describes your current situation?

- ☐ In paid work (full-time or part-time)
- ☐ On maternity leave
- ☐ Looking after my family, home or dependants
- ☐ In education (including government training programmes)
- ☐ Unemployed
- ☐ Unable to work because of disability or ill health
- ☐ Other *Please give details* ______

L8 Do you have a long-standing physical problem or disability?

☐ Yes ☐ No ☐ Don't know / Not sure

L9 Do you have a longstanding mental health problem or learning disability?

☐ Yes ☐ No

L10 Do any of these problems or disabilities affect your day to day activities?

☐ Yes, definitely ☐ Yes, to some extent ☐ No ☐ Not applicable

Would you mind telling us what your health problem or disability is?

Please give details ______

If there is anything else you would like to tell us about your care while you were pregnant or since you have had your baby, please add your comments here, or use the back page:

Was there anything else you meant to go back and complete later? Please check you haven't missed any pages.

Thank you very much for your help

If the survey has raised issues or questions of concern you may wish to contact your family doctor (GP) or health visitor.

Please return the questionnaire in the envelope provided. If you have any queries about the questionnaire or you would like to know more about the research please contact the address below:

Maggie Redshaw
National Perinatal Epidemiology Unit
University of Oxford
Old Road Campus
Headington
Oxford OX3 7LF
Tel. 01865 289700

UNIVERSITY OF OXFORD

MOTHER

Mother UR number:

Admission date: 2 0

Suburb: .... **Postcode**

Public/Private Patient: Public ☒ Private ☒

Country of Birth: *(Mother)* ....

Indigenous Status *(Mother)*: *(circle one or more)* Aboriginal ☒ TSI ☒ No ☒
(Baby): *(circle one or more)* Aboriginal ☒ TSI ☒ No ☒

Marital Status *(Mother)*: Married ☒
Single ☒ Widowed ☒ Defacto ☒
Divorced ☒ Separated ☒ Unknown ☒

Birthdate *(Mother)*: **Height:** *(cm)* **Weight:** *(kg)*

Hospital:

Intended Place of Birth:
Hospital *(specify)*.................... ☒
Birth Centre ☒ Home ☒
Other *(specify)*.................... ☒

Actual Place of Birth:
Hospital *(specify)*.................... ☒
Birth Centre ☒ Home ☒
Other *(specify)*.................... ☒

If place of birth changes, specify if change occurred:
Before onset of labour ☒ During labour ☒

Reason for change:
Recognition of higher risk ☒ Unintended/unplanned ☒
Complication of pregnancy ☒ Not stated ☒
Social or geographic ☒ Other *(specify)*.................... ☒

Smoking <20 weeks:
Non-smoker ☒
Quit ☒
Smoked ☒

Smoking ≥ 20 weeks:
Non-smoker ☒
Smoked *(n/day)*
Occasional *(<1/day)* ☒

REPRODUCTIVE HISTORY

G: **P:**

Total number: *(Excluding this pregnancy)*
Livebirth – (lived ≥ 28 days) ....
– (died < 28 days) ....
Stillbirth ....
Abortion – spontaneous ....
– induced ....
Ectopic ....
Unknown ....

Date of completion of last pregnancy: *(mth/yr)*

Outcome of last pregnancy:
Livebirth
- lived ≥28 days ☒
- died <28 days ☒
Stillbirth ☒
Unknown ☒
Abortion
- spontaneous ☒
- induced ☒
Ectopic ☒

Was last birth a caesarean section?: Y N
Total no. of previous caesarean sections:
Plan for VBAC: (if prev CS) Y N

THIS PREGNANCY

Agreed due date:

Estimated gest. age at 1st A/N visit:

Maternal medical conditions:

Pre-existing
Diabetes Type 1 ☒ Diabetes Type 2 ☒
Circulatory ☒ Hypertension ☒
Renal *(specify)* ☒ Psychosocial *(specify)* ☒
Other *(specify)*....................
....

Obstetric complications:
Gestational diabetes Diet ☒ Insulin ☒
Pre-eclampsia ☒ IUGR ☒ GBS+ ☒
Placenta praevia - with haemorrhage ☒
- without haemorrhage ☒
Placental abruption ☒ Other APH ☒
Other *(specify)*....................
....

A/N care provider:
Obstetrician ☒ Midwife ☒ GP ☒ None ☒

Procedures and operations:
Ultrasound 10 - 14 weeks *(specify no.)*
Ultrasound 15 - 26 weeks *(specify no.)*
Ultrasound ≥ 27 weeks *(specify no.)*
Cervical suture ☒
IM Steroids *(2 doses)*.................... ☒
ART *(specify)*.................... Y N
Other *(specify)*....................

Occasional data:
- ....
- ....
- ....

LABOUR, BIRTH & POSTNATAL

Onset labour: Date 2 0 Time
Onset 2nd stage: Date 2 0 Time
Rupture of membranes: Date 2 0 Time

Labour:
Spontaneous ☒ Augmented ☒
Induced – medical ☒ No labour ☒
surgical ☒

If labour induced or augmented: *(circle one or more)*
Oxytocin ☒ ARM ☒
Prostaglandins ☒ Other *(specify)* ☒
....

Specify indication for induction:
....

Fetal monitoring in labour: *(circle one or more)*
Intermittent Ausc ☒ Internal CTG ☒
Admission CTG ☒ Fetal blood sampling ☒
Intermittent CTG ☒ None ☒
Cont. external CTG ☒

Presentation:
Vertex ☒ Brow ☒ Shoulder ☒
Breech ☒ Compound ☒ Unknown ☒
Face ☒ Cord ☒ Other *(specify)* ☒
....

Method of birth:
Unassisted vaginal ☒ Forceps ☒ Vacuum ☒
Planned C/S - No labour ☒ Labour ☒
Unplanned C/S - No labour ☒ Labour ☒

Indications for operative birth:
....
....

Analgesia for labour: Y N
Specify....................

Anaesthesia for operative delivery: Y N
Specify....................

Complications/events of labour and birth:
Antibiotics ☒ Shoulder dystocia ☒ Water birth ☒
Specify....................
....
....
....

Lead intrapartum care provider:
Obstetrician ☒ Midwife ☒ GP ☒ None ☒

Prophylactic oxytocin 3rd stage: Y N
Manual removal of placenta: *(excl c/s)* Y N
Perineal status: Episiotomy Y N
Laceration: Y N
Degree/type: *(specify)*....................
Repaired: Y N
Blood loss: *(mls)*
Transfusion: Y N

Postpartum complications:
Specify....................
....

Admitted to HDU/ICU: *(Mother)* Y N

BABY UR:

(Complete a separate form in full for each baby of a multiple birth)

Birthdate: Date 2 0 Time

Estimated gestation at birth: *(weeks)*
Sex: Male ☒ Female ☒ Indeterminate ☒
Plurality: (eg. Single 1, Twins 2)
(this record refers to ☐ born)
Condition: Liveborn ☒
Stillborn *(before labour)* ☒ *(during labour)* ☒
Birthweight: *(grams)*
Apgar: 1 minute 5 minutes
Time to established respiration: *(mins.)*

Resuscitation – mechanical:
None ☒ ETT with air ☒
Suction ☒ ETT with O_2 ☒
O_2 therapy ☒ CPAP with air ☒
IPPR with air ☒ CPAP with O_2 ☒
IPPR with O_2 ☒ Cardiac massage ☒
Other *(specify)*.................... ☒

Resuscitation - drugs: *(specify)*....................
....

Congenital anomalies: Y N
CVS / CNS / MS / GI / UG / Resp / Skin / Other
Circle & Specify....................
....
....
....
Paediatrician:

Neonatal morbidity: Y N
Specify....................
....
....
....

Admitted: SCN ☒ NICU ☒

Hepatitis B vaccine received:
≤ 7 days ☒ > 7 days ☒ Not given ☒

Breastfeeding attempted: Y N
Formula given in hospital: Y N
Last feed taken exclusively from breast: Y N

DISCHARGE

Date of discharge from place of birth:
Mother date 2 0
Baby date 2 0

Discharge status: Mother Baby
Discharged ☒ ☒
Died ☒ ☒
Transferred to *(specify)* ☒ ☒
Mother....................
Baby....................

Date 2 0

PERINATAL DATA COLLECTION

HOSPITAL/MEDICAL PRACTITIONER/ MIDWIFE COPY

APR 2009