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Pregnancy Outcomes in Women With High Booking Body Mass Index in a Multi-ethnic Maternity Population: A Single-Centre Retrospective Study

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Abstract

Introduction: High maternal body mass index (BMI) is associated with increased obstetric, medical, anaesthetic, and neonatal risk. These risks may be further influenced by ethnicity, particularly in multi-ethnic maternity populations. This study evaluated maternal and neonatal outcomes among women with high booking BMI in a large multi-ethnic UK maternity unit.

Methods: This was a single-centre retrospective study of women who delivered at Luton and Dunstable Hospital between January 2025 and June 2026. A total of 124 women were included, with 31 women selected from each booking BMI category: normal BMI 18.5-29.9 kg/m², BMI 30-39.9 kg/m², BMI 40-49.9 kg/m² and BMI ⩾50 kg/m². BMI categories were adjusted using National Institute for Health and Care Excellence (NICE) ethnicity-specific thresholds where applicable. Maternal comorbidities, mode of delivery, blood loss, wound complications, neonatal outcomes, specialist referral and multidisciplinary input were reviewed. Caesarean section indications were analysed descriptively in the high BMI groups.

Results: Women with BMI ⩾50 kg/m² had the highest rates of gestational diabetes mellitus (10/31, 32.3%), pre-eclampsia (6/31, 19.3%), chronic hypertension (4/31, 12.9%), caesarean birth (21/31, 67.7%), postpartum haemorrhage >500 mL (19/31, 61.2%), wound infection (3/31, 9.7%), large-for-gestational-age (LGA) birthweight (5/31, 16.1%) and neonatal unit admission (6/31, 19.4%). Gestational diabetes was proportionally highest among South Asian/Asian/Middle Eastern women and Black/Black African-Caribbean women. Pre-eclampsia was highest among Black/Black African-Caribbean women. Caesarean birth was common across all BMI groups and appeared multifactorial, with elective caesarean section contributing substantially in the BMI 40-49.9 and BMI ⩾50 groups. No venous thromboembolism (VTE), blood transfusion, or shoulder dystocia events were recorded.

Conclusion: BMI ⩾50 kg/m² was associated with increased metabolic, hypertensive, operative, bleeding, wound, and neonatal morbidity, alongside substantial multidisciplinary service burden. Ethnicity appeared clinically relevant for gestational diabetes and pre-eclampsia risk. The absence of VTE was reassuring, but larger studies are needed to assess rare outcomes.

Categories: Obstetrics/Gynecology, Quality Improvement, Endocrinology/Diabetes/Metabolism
Keywords: gestational diabetes, high bmi pregnancy, maternal obesity, multi-ethnic population, neonatal outcomes, obstetric outcomes, pre-eclampsia, service evaluation

Introduction

Maternal obesity is a growing challenge in maternity care and is associated with increased risks of gestational diabetes mellitus, hypertensive disorders of pregnancy, caesarean birth, postpartum haemorrhage, wound infection, thromboembolism and adverse neonatal outcomes [1-4]. Women with very high body mass index (BMI), particularly BMI ⩾50 kg/m², represent a high-risk subgroup requiring complex antenatal, intrapartum, anaesthetic and postnatal planning [5-7].

Ethnicity is also clinically relevant, as obesity-related metabolic and pregnancy risks may vary between ethnic groups. National Institute for Health and Care Excellence (NICE) recommends lower BMI thresholds for some ethnic groups, including South Asian, Chinese, other Asian, Middle Eastern, Black African and African-Caribbean populations, because cardiometabolic risk may occur at lower BMI values [8]. This is particularly important in multi-ethnic maternity populations.

In addition, NICE recommends aspirin prophylaxis for women at increased risk of pre-eclampsia, specifically those with one high-risk factor or more than one moderate-risk factor. BMI ⩾35 kg/m² is one moderate-risk

factor and should therefore be considered alongside other risk factors rather than used in isolation [9].

National guidance also emphasises the importance of multidisciplinary planning for women with obesity in pregnancy, including assessment of anaesthetic, intrapartum, postpartum haemorrhage, wound and thromboembolism risks [2,10,11].

This study aimed to descriptively evaluate maternal and neonatal outcomes across four booking BMI categories in a multi-ethnic maternity population, with particular focus on women with BMI ⩾50 kg/m². A key objective was to explore ethnicity-related patterns in gestational diabetes and pre-eclampsia and describe how these outcomes varied across BMI groups. The study also assessed delivery outcomes, maternal and neonatal complications, and multidisciplinary care requirements to identify potential areas for local service improvement. The analysis was descriptive only and was not intended to establish causal associations or draw statistical inferences.

Materials And Methods

Study design and setting

This was a single-centre retrospective observational study undertaken at Luton and Dunstable Hospital, Bedfordshire Hospitals NHS Foundation Trust. The project was conducted as a local audit/service evaluation of maternal and neonatal outcomes in women with high booking BMI.

Study population and sampling

The sample size was determined pragmatically for this local retrospective clinical audit, rather than through a formal sample size calculation. A total of 124 women who delivered between January 2025 and June 2026 were included, with 31 women selected from each of four booking BMI categories: normal BMI 18.5-29.9 kg/m², BMI 30-39.9 kg/m², BMI 40-49.9 kg/m² and BMI ⩾50 kg/m² to allow balanced descriptive comparisons. Booking BMI was defined as the maternal BMI recorded at the first antenatal booking appointment during pregnancy, rather than pre-pregnancy BMI. Eligible women were identified using hospital maternity records and categorised according to their booking BMI, with ethnicity-specific BMI thresholds applied where appropriate. As equal numbers were selected from each BMI category rather than proportionately from the entire maternity population, the sample may not reflect the actual BMI distribution of women delivering at the hospital. The sampling approach may therefore have introduced selection bias.

The cohort reflected a multi-ethnic maternity population, including British/White British, European, Pakistani, Bangladeshi, Black African/Caribbean, Indian, Middle Eastern and other Asian women. Ethnicity was collected as an important baseline characteristic.

BMI and ethnicity adjustment

Patients were initially identified according to booking BMI. BMI categories were then adjusted using NICE ethnicity-specific thresholds where applicable [8]. The final ethnicity groups used for analysis were British/White British, South Asian/Asian, European, Black/Black African-Caribbean and Middle Eastern.

Study procedure and data collection

Maternal records of women who delivered between January 2025 and June 2026 were reviewed retrospectively. Following selection into the four BMI categories, relevant demographic, antenatal, intrapartum, postnatal, and neonatal information was extracted from hospital clinical records. Data included maternal medical history, pregnancy complications, mode of delivery, caesarean section indications, maternal and neonatal outcomes, and multidisciplinary referrals. The collected data were anonymised and entered into a Microsoft Excel (Microsoft Corporation, Redmond, Washington, United States) spreadsheet for descriptive analysis.

Outcomes

The outcomes reviewed included maternal comorbidities, delivery outcomes, induction of labour, caesarean birth, elective and emergency/urgent caesarean section, estimated blood loss, postpartum haemorrhage (PPH) >500 mL, wound infection, blood transfusion, birthweight, large-for-gestational-age (LGA) birthweight, small-for-gestational-age birthweight, neonatal unit admission, specialist referral, anaesthetic referral and multidisciplinary input. Caesarean section indications were reviewed descriptively in the three high BMI groups.

Data analysis

Data were analysed descriptively using counts and percentages. Outcomes were compared across BMI groups. Ethnicity-related patterns in gestational diabetes mellitus (GDM) and pre-eclampsia were described. No formal inferential statistical testing was performed because of the small sample size and the service evaluation nature of the project.

Results

A total of 124 women were included, with 31 women in each BMI group. Baseline maternal characteristics are summarised in Table *1*. Mean maternal age ranged from 28.4 to 32.9 years across the groups. Women with BMI ⩾50 kg/m² had the highest proportion of current smokers (16.1%) and chronic hypertension (12.9%). Higher parity was more common in the BMI 40-49.9 and BMI ⩾50 groups. These baseline characteristics provide additional context for interpreting maternal and neonatal outcomes across BMI categories.

Characteristic	Normal BMI	BMI 30–39.9	BMI 40–49.9	BMI ≥50
Total women	31	31	31	31
Mean maternal age (years)	30.4	28.4	32.9	31.1
Age SD (years)	5.3	5.7	4.5	4.6
Mean booking BMI (kg/m²)	24.1	33.6	42.6	55.9
Booking BMI SD	2.5	2.6	2.7	6.2
Median recorded parity	2	1	2	2
Parity ≥2 (n)	17	14	24	22
Current smokers (n)	4	3	3	5
Current smokers (%)	12.9	9.7	9.7	16.1
Pre-existing diabetes (n)	0	1	1	1
Pre-existing diabetes (%)	0.0	3.2	3.2	3.2
Chronic hypertension (n)	0	0	2	4
Chronic hypertension (%)	0.0	0.0	6.5	12.9
Multiple pregnancy (n)	0	0	0	0
IVF pregnancy (n)	3	0	0	0

TABLE 1: Baseline maternal characteristics by BMI group

Cohort characteristics

A total of 124 women were included, with 31 women in each BMI group. The ethnicity distribution and rates of GDM and pre-eclampsia are presented in Table *2*. GDM was proportionally highest among South Asian/Asian/Middle Eastern women (28.6%) and Black/Black African-Caribbean women (26.7%). Pre-eclampsia was highest among Black/Black African-Caribbean women (20.0%). Of the 26 women with GDM, 23 belonged to the high BMI groups, while six of the 10 pre-eclampsia cases occurred in women with BMI ⩾50 kg/m².

Ethnicity group	Total women	GDM (n)	GDM (%)	PET (n)	PET (%)
British / White British	56	10	17.9	4	7.1
South Asian / Asian / Middle Eastern	35	10	28.6	2	5.7
Black / Black African-Caribbean	15	4	26.7	3	20.0
European	18	2	11.1	1	5.6
Total	124	26	21.0	10	8.1

TABLE 2: Maternal ethnicity and pregnancy complications

PET: pre-eclampsia; GDM: gestational diabetes mellitus

Maternal medical complexity by BMI group

Women with BMI ⩾50 kg/m² had the highest rates of GDM, pre-eclampsia, and chronic hypertension. Maternal medical comorbidities by BMI group are summarised in Table *3*.

Outcome	Normal BMI numerator	Normal BMI denominator	Normal BMI (%)	BMI 30–39.9 numerator	BMI 30–39.9 denominator	BMI 30–39.9 (%)	BMI 40–49.9 numerator	BMI 40–49.9 denominator	BMI 40–49.9 (%)	BMI ≥50 numerator	BMI ≥50 denominator	BMI ≥50 (%)
GDM	3	31	9.7	4	31	12.9	9	31	29.0	10	31	32.3
Pre-eclampsia	2	31	6.5	1	31	3.2	1	31	3.2	6	31	19.3
Chronic hypertension	0	31	0.0	0	31	0.0	2	31	6.5	4	31	12.9

TABLE 3: Maternal medical comorbidities by BMI group

These findings support the need for early risk assessment, consultant-led planning and multidisciplinary antenatal care for women with BMI ≥50 kg/m².

GDM: gestational diabetes mellitus

Delivery outcome

Caesarean birth was common across all BMI groups and was highest in women with BMI ⩾50 kg/m² (67.7%). Induction of labour was most frequent in the BMI 40-49.9 group (35.5%). Elective caesarean section contributed substantially to overall caesarean births in the BMI 40-49.9 and BMI ⩾50 groups, whereas emergency caesarean section was more frequent in the BMI 30-39.9 group (Table *4*). The high caesarean section rate appeared multifactorial. The main indications included previous caesarean section or uterine scar, failed induction of labour or failure to progress, cardiotocography (CTG) concerns, malpresentation, maternal request, and diabetes- or hypertension-related complications. These findings suggest that the high caesarean rate was not attributable to BMI alone.

BMI group	Total women	IOL (n)	IOL (%)	CS (n)	CS (%)	Elective CS (n)	Emergency CS (n)
Normal BMI	31	6	19.4	19	61.3	13	6
BMI 30–39.9	31	8	25.8	20	64.5	8	12
BMI 40–49.9	31	11	35.5	18	58.1	14	4
BMI ≥50	31	10	32.3	21	67.7	15	6

TABLE 4: Delivery outcomes and caesarean section characteristics

Data are presented as numbers and percentages. Percentages were calculated using the total number of women in each BMI group (n = 31). Elective and emergency caesarean sections are reported as absolute numbers.

BMI: body mass index; IOL: induction of labour; CS: caesarean section; n: number of women

Bleeding and wound morbidity

Bleeding and wound morbidity showed an increasing trend with higher BMI. Bleeding and wound outcomes by BMI group are shown in Table *5*. Women with BMI ⩾50 had the highest mean estimated blood loss, the highest rate of PPH >500 mL, and the highest wound infection rate. No women required blood transfusion.

Outcome	Normal BMI value	Normal BMI numerator	Normal BMI denominator	Normal BMI (%)	BMI 30–39.9 value	BMI 30–39.9 numerator	BMI 30–39.9 denominator	BMI 30–39.9 (%)	BMI 40–49.9 value	BMI 40–49.9 numerator	BMI 40–49.9 denominator	BMI 40–49.9 (%)	BMI ≥50 value	BMI ≥50 numerator	BMI ≥50 denominator	BMI ≥50 (%)
Mean EBL, mL	473	NA	NA	NA	554	NA	NA	NA	624	NA	NA	NA	690	NA	NA	NA
PPH >500 mL	NA	11	31	35.4	NA	11	31	35.4	NA	16	31	51.6	NA	19	31	61.2
Wound infection	NA	0	31	0.0	NA	0	31	0.0	NA	1	31	3.2	NA	3	31	9.7
Blood transfusion	NA	0	31	0.0	NA	0	31	0.0	NA	0	31	0.0	NA	0	31	0.0

TABLE 5: Bleeding and wound outcomes by BMI group

PPH: postpartum haemorrhage; EBL: estimated blood loss

Neonatal outcomes

Mean birthweight was highest in the BMI ⩾50 group. LGA and neonatal unit (NNU) admission were also highest in this group. Neonatal outcomes are shown in Table *6*.

Outcome	Normal BMI value	Normal BMI numerator	Normal BMI denominator	Normal BMI (%)	BMI 30–39.9 value	BMI 30–39.9 numerator	BMI 30–39.9 denominator	BMI 30–39.9 (%)	BMI 40–49.9 value	BMI 40–49.9 numerator	BMI 40–49.9 denominator	BMI 40–49.9 (%)	BMI ≥50 value	BMI ≥50 numerator	BMI ≥50 denominator	BMI ≥50 (%)
Mean birthweight, g	3201	NA	NA	NA	3254	NA	NA	NA	3225	NA	NA	NA	3447	NA	NA	NA
LGA	NA	2	31	6.5	NA	0	31	0.0	NA	4	31	12.9	NA	5	31	16.1
SGA	NA	2	31	6.5	NA	4	31	12.9	NA	3	31	9.7	NA	4	31	12.9
NNU admission	NA	5	31	16.1	NA	3	31	9.7	NA	5	31	16.1	NA	6	31	19.4

TABLE 6: Neonatal outcomes by BMI group

LGA: large-for-gestational-age; NNU: neonatal unit; SGA: small-for-gestational-age

Process measures and service burden

Preventive care documentation and multidisciplinary referrals are summarised in Table 7. Aspirin and vitamin D documentation increased with higher BMI category. Specialist or joint-care referral was common across the high BMI groups. Among women with BMI ⩾50 kg/m², 74.2% had documented specialist/joint-care and anaesthetic referrals, reflecting substantial multidisciplinary service requirements. No venous thromboembolism (VTE) events were recorded in the cohort, although the sample size was insufficient to assess rare complications reliably.

Process measure	BMI 30–39.9 (n)	BMI 30–39.9 (%)	BMI 40–49.9 (n)	BMI 40–49.9 (%)	BMI ≥50 (n)	BMI ≥50 (%)
Aspirin documented	15	48.4	25	80.6	28	90.3
Vitamin D documented	8	25.8	15	48.4	16	51.6
Specialist/joint-care referral	30	96.8	22	71.0	23	74.2
Anaesthetic referral	NA	NA	22	71.0	23	74.2
Maternal medicine referral	NA	NA	0	0.0	1	3.2
Other referral	NA	NA	2	6.5	4	12.9

TABLE 7: Preventive care documentation and multidisciplinary referrals

Specialist referral and anaesthetic referral were common in women with BMI 40–49.9 and BMI ≥50, indicating a substantial multidisciplinary service burden.

Discussion

Our findings are consistent with previous literature showing that increasing maternal BMI is associated with higher obstetric and medical risk [1-4]. In the London population study of 287,213 pregnancies, maternal obesity was associated with increased odds of gestational diabetes, pre-eclampsia, caesarean birth, postpartum haemorrhage, wound infection, and LGA birthweight [4]. Similarly, the National Maternity and Perinatal Audit reported increasing rates of caesarean birth, heavy postpartum blood loss and adverse neonatal outcomes among women with BMI ⩾30 kg/m² [3].

Women with BMI ⩾50 kg/m² in our cohort had the highest burden of metabolic, hypertensive, operative, bleeding, wound and neonatal morbidity. This is in keeping with United Kingdom Obstetric Surveillance System (UKOSS) data and other studies of extreme or super obesity in pregnancy, which have demonstrated increased maternal and perinatal complications in women with BMI >50 kg/m² [5-7].

Ethnicity appeared clinically relevant in our cohort, with GDM proportionally highest among South Asian/Asian/Middle Eastern women and Black/Black African-Caribbean women, and pre-eclampsia highest

among Black/Black African-Caribbean women. This supports the importance of applying ethnicity-sensitive risk assessment in maternity care, including ethnicity-adjusted BMI thresholds where appropriate [8].

VTE risk assessment and thromboprophylaxis are important components of care for women with high BMI. In our unit, women undergo antenatal VTE risk assessment and reassessment following delivery, with low molecular weight heparin (LMWH) prophylaxis prescribed according to their individual risk scores and local protocol. No VTE events were recorded in this cohort. This is reassuring because thrombosis and thromboembolism remained the leading cause of maternal death in the UK during pregnancy or up to six weeks after pregnancy in the 2022-2024 MBRRACE-UK data [12]. However, individual LMWH administration was not systematically analysed, and the small sample size limits interpretation of this finding. Therefore, the absence of VTE cannot be attributed directly to prophylactic measures. Ongoing VTE risk assessment and thromboprophylaxis remain important in women with obesity in pregnancy and the puerperium, as recommended in national guidance [10].

Women with BMI ⩾30 and GDM in our cohort also demonstrated high operative birth rates. This is relevant because recent data suggest that the combination of raised BMI and GDM is associated with increased adverse pregnancy outcomes, including hypertensive disease, caesarean birth, preterm birth and LGA birthweight [13].

The high caesarean section rate in this study appeared multifactorial rather than attributable to BMI alone. Elective caesarean section contributed substantially in the BMI 40-49.9 and BMI ⩾50 groups, while emergency caesarean section was mainly related to failed induction or failure to progress and CTG concerns. This supports the need for structured antenatal counselling, anaesthetic planning, individualised delivery planning and intrapartum risk assessment for women with high BMI [2,11].

This study highlights the need for a structured local pathway for women with high BMI in pregnancy. The pathway should include early identification, ethnicity-adjusted BMI risk assessment, consultant-led antenatal planning, anaesthetic referral, diabetes and blood pressure surveillance, VTE risk assessment, delivery planning, PPH risk planning, wound care advice and postnatal follow-up. These recommendations are consistent with national guidance on obesity in pregnancy, VTE prevention and intrapartum care for women with medical or obstetric risk factors [2,10,11].

Although the association between maternal obesity and adverse pregnancy outcomes is well established, this study provides additional descriptive information from a multi-ethnic UK maternity population. GDM was proportionally highest among South Asian/Asian/Middle Eastern women (28.6%) and Black/Black African-Caribbean women (26.7%), while pre-eclampsia was highest among Black/Black African-Caribbean women (20.0%). These findings highlight the potential importance of ethnicity-sensitive risk assessment alongside BMI-based maternity care. However, the small ethnicity subgroups and lack of adjustment for confounding factors mean that these differences should be interpreted cautiously and cannot establish independent ethnicity-related risks.

Strengths and limitations

The main strengths of this study include its focus on women with very high booking BMI (⩾50 kg/m²), the inclusion of a multi-ethnic maternity population, and the comparison of maternal and neonatal outcomes across four BMI categories. The study also evaluated multidisciplinary care requirements and caesarean section indications, providing useful information for improving local maternity services.

However, this study has several limitations. It was a single-centre retrospective study with a small sample size, limiting generalisability and the assessment of rare outcomes such as venous thromboembolism and shoulder dystocia. Equal numbers of women were selected from each BMI group, which may not reflect the actual BMI distribution of the local maternity population. The normal BMI comparator group also had a relatively high caesarean section rate. Data collection depended on the accuracy and completeness of clinical records. Furthermore, the analysis was descriptive without adjustment for potential confounding factors such as maternal age, parity, previous caesarean section and ethnicity.

Conclusions

In this single-centre retrospective study, women with BMI ⩾50 kg/m² had higher observed rates of several maternal and neonatal complications, including gestational diabetes, pre-eclampsia, postpartum haemorrhage, and wound infection. Differences in gestational diabetes and pre-eclampsia were also observed across ethnic groups. However, these findings should be interpreted cautiously because of the small sample size and descriptive analysis without adjustment for potential confounding factors.

The findings highlight the potential value of preconception counselling, weight optimisation, early antenatal risk assessment and individualised multidisciplinary care for women with high BMI. Larger studies with appropriate statistical analysis are needed to confirm these observations and assess their wider applicability.

The high caesarean section rate appeared multifactorial rather than attributable to BMI alone, with elective caesarean section contributing substantially in the BMI 40-49.9 and BMI ⩾50 groups. No VTE, blood transfusion, or shoulder dystocia events were recorded, which is reassuring but limited by sample size.

These findings support the development of a local high BMI pregnancy pathway, with emphasis on early multidisciplinary planning, diabetes and blood pressure optimisation, appropriate VTE prevention, PPH and wound risk planning, improved documentation of preventive care, and future re-audit.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Clinical Governance Team, Luton and Dunstable University Hospital issued approval on 28th September 2026. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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