The prevalence and impact of overweight and obesity in an Australian obstetric population

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ABSTRACT

Objective: To assess the prevalence and impact of overweight and obesity in an Australian obstetric population.

Design, setting and participants: The Mater Mother's Hospital (MMH), South Brisbane, is an urban tertiary referral maternity hospital. We reviewed data for the 18 401 women who were booked for antenatal care at the MMH, delivered between January 1998 and December 2002, and had a singleton pregnancy. Of those women, 14 230 had an estimated pre-pregnancy body mass index (BMI) noted in their record; 2978 women with BMI ⩽ 20 kg/m^2 were excluded from further study; the remaining 11 252 women were divided into four categories: "normal" (BMI 20.01–25 kg/m^2), "overweight" (BMI 25.01–30 kg/m^2), "obese" (BMI 30.01–40 kg/m^2) and "morbidly obese" (BMI > 40 kg/m^2).

Main outcome measures: Prevalence of overweight and obesity in an obstetric population; maternal, peripartum and neonatal outcomes associated with raised BMI.

Results: Of the 14 230 women, 6443 (45%) were of normal weight, and 4809 (34%) were overweight, obese or morbidly obese. Overweight, obese and morbidly obese women were at increased risk of adverse outcomes (figures represent adjusted odds ratio [AOR] [95% CI]): hypertensive disorders of pregnancy (overweight 1.74 [1.45–2.15], obese 3.00 [2.40–3.74], morbidly obese 4.87 [3.27–7.24]); gestational diabetes (overweight 1.78 [1.25–2.52], obese 2.95 [2.05–4.25], morbidly obese 7.44 [4.42–12.54]); hospital admission longer than 5 days (overweight 1.36 [1.13–1.63], obese 1.49 [1.21–1.86], morbidly obese 3.18 [2.19–4.61]); and caesarean section (overweight 1.50 [1.36–1.66], obese 2.02 [1.79–2.29], morbidly obese 2.54 [1.94–3.32]). Neonates born to obese and morbidly obese women had an increased risk of birth defects (obese 1.58 [1.02–2.46], morbidly obese 3.41 [1.67–6.94]); and hypoglycaemia (obese 2.57 [1.39–4.78], morbidly obese 7.14 [3.04–16.74]). Neonates born to morbidly obese women were at increased risk of admission to intensive care (2.77 [1.81–4.25]); premature delivery (< 34 weeks' gestation) (2.13 [1.13–4.01]); and jaundice (1.44 [1.09–1.89]).

Conclusions: Overweight and obesity are common in pregnant women. Increasing BMI is associated with maternal and neonatal outcomes that may increase the costs of obstetric care. To assist in planning health service delivery, we believe that BMI should be routinely recorded on perinatal data collection sheets.

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Overweight and obesity have been recognised as an important public health problem in Australia. Thirty-five percent of Australian women aged 25–35 years are overweight or obese.[1] This has important implications for the delivery of obstetric care. It is well recognised that maternal obesity is associated with an increased risk of maternal, peripartum and neonatal complications.[2] Maternal complications include hypertensive disorders of pregnancy,[3-6] gestational diabetes, infections and thromboembolic disorders.[2] Obesity is associated with an increase in caesarean section rate.[7-9] Neonatal outcomes associated with maternal obesity include macrosomia, higher rates of intensive care nursery admission, birth defects, prematurity, stillbirth and perinatal death.[10-12]

The impact of overweight and obesity has not been documented in an Australian obstetric population for more than 20 years.[13] This previous study reported only the maternal, peripartum and neonatal outcomes for women weighing over 90 kg and did not document body mass index (BMI).

The aim of our study was to assess the prevalence of overweight and obesity in an Australian obstetric population, and to assess the maternal, peripartum and neonatal outcomes associated with maternal overweight and obesity.

METHODS

Data source

The Mater Mothers' Hospital (MMH), South Brisbane, has a hospital-specific obstetric database from which we drew data for our study. Antenatal information is collected by the midwife at the initial visit, which generally occurs before 12 weeks' gestation. A computer-generated health record is produced for insertion into the patient's obstetric record. Since 1998, an estimated pre-pregnancy BMI has been recorded at this initial visit. Body height and weight are measured on routine clinical scales and stadiometers. Based on measured weight and estimated pregnancy-associated weight gain, an estimate of pre-pregnancy weight is recorded. This is used to calculate estimated pre-pregnancy BMI.

Sample

We reviewed the data for the 18 401 women who were booked for antenatal care at the MMH, delivered between January 1998 and December 2002, and had a singleton pregnancy. (Emergency and unbooked admissions were excluded from our analysis.)

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1 Comparison of maternal, peripartum and neonatal characteristics and outcomes according to body mass index (BMI) category ($n = 11\,252$)*

	BMI category (kg/m²)				
	Normal (20.01–25) (*n* = 6443)	Overweight (25.01–30) (*n* = 2882)	Obese (30.01–40) (*n* = 1679)	Morbidly obese (> 40) (*n* = 248)	*P*
Maternal characteristics and outcomes					
Mean age, in years (SD)	28.3 (5.6)	28.4 (5.6)	28.6 (5.3)	29.8 (5.2)	< 0.001
Mean parity (SD)	0.9 (1.1)	1.1 (1.2)	1.2 (1.3)	1.4 (1.7)	< 0.001
Ethnicity (%)†					
Caucasian	79.7	83.9	86.9	86.7	
Asian	12.2	6.1	1.2	1.2	
Aboriginal or Torres Strait Islander	2.0	2.6	2.5	2.5	
Other	6.1	7.4	9.4	9.4	< 0.001
Completed secondary school (%)	66.2	62.1	58.4	55.0	< 0.001
Smoker (%)	13.0	14.4	16.6	16.5	0.001
Drinks alcohol (%)‡	2.0	1.8	1.1	1.2	0.1
Hypertensive disorders of pregnancy (%)	2.4	5.6	9.1	14.5	< 0.001
Gestational diabetes (%)	1.2	2.0	3.3	8.9	< 0.001
Type 2 diabetes mellitus (%)	0	0.6	1.4	2.8	< 0.001
Chronic hypertension (%)	0.5	1.2	3.0	6.9	< 0.001
Mean length of stay, in days (SD)	2.9 (3.8)	3.1 (5.6)	3.1 (2.8)	3.9 (3.6)	< 0.001
Peripartum outcomes					
Spontaneous vaginal delivery (%)	68.6	63.7	59.0	53.2	< 0.001
Assisted vaginal delivery (%)	9.1	6.8	5.8	4.0	< 0.001
Caesarean section (%)	22.3	29.5	35.2	42.7	< 0.001
Neonatal characteristics and outcomes					
Male (%)	51.9	51.5	49.7	50.4	0.74
Gestational age at delivery, in weeks (SD)	39.1 (2.1)	39.0 (2.6)	39.0 (2.3)	38.6 (3.0)	0.002
Birthweight *z* score (SD)	0.0 (0.9)	0.2 (1.0)	0.3 (1.1)	0.4 (1.0)	< 0.001
Stillborn (%)	0.5	0.6	0.6	0.8	0.91
Birth defect (%)	1.2	1.4	1.9	4.0	< 0.001
Respiratory distress (%)	1.5	1.7	2.2	2.0	0.3
Mechanically ventilated (%)	0.4	0.3	0.7	1.2	0.03
Hypoglycaemia (%)	0.6	0.3	1.2	2.8	< 0.001
Jaundice (%)	28.2	27.9	26.5	33.9	0.1
Phototherapy (%)	3.8	3.6	3.9	5.6	0.46
Prematurity (%)					
< 34 weeks' gestation	3.0	3.7	3.5	6.0	
34–37 weeks' gestation	3.7	3.5	3.5	4.4	< 0.001
Admission to intensive care (%)	4.3	4.0	5.3	10.9	< 0.001

* Our analysis excluded 2978 women with BMI ≤ 20 kg/m². † These are the ethnicity categories designated on the form, but their application is open to variable interpretation by staff entering the data. ‡ Refers to any alcohol drinking during pregnancy. ◆

Of the 18 401 women, 14 230 had BMI recorded in their antenatal record. Of the women with BMI recorded, 2978 (21%) had a BMI of ≤ 20 kg/m² and were excluded from further consideration in our study. The remaining 11 252 women were categorised as "normal" (BMI 20.01–25 kg/m²), "overweight" (BMI 25.01–30 kg/m²), "obese" (BMI 30.01–40 kg/m²) or "morbidly obese" (BMI > 40 kg/m²).

Maternal, peripartum and neonatal characteristics

Maternal, peripartum and neonatal characteristics were assessed for each BMI group. Gestational hypertension and pre-eclampsia (as defined by the Australian Society for the Study of Hypertension in Pregnancy[14]) were assessed together, and are referred to here as "hypertensive disorders of pregnancy" (this does not include women with pre-existing chronic hypertension). The MMH did not perform universal screening for gestational diabetes at the time of our study. Women were screened on the basis of clinical risk factors, which included overweight and obesity. Gestational diabetes is diagnosed according to the Australasian Diabetes in Pregnancy criteria.[15]

Birthweight results were expressed as standard deviation (z) scores, corrected for sex and gestation at delivery, using the formula:

$$z = \frac{\text{(birthweight} - \text{mean birthweight)}}{\text{SD (birthweight)}}$$

This allows for comparison of fetal size over a range of gestational ages. Normal birthweight data were derived from the cohort of 18 401 live singleton births at the MMH over the period of the study. All neonates are routinely examined by paediatric staff before discharge. Information on birth defects relates to this examination, as well as any defects noted on antenatal ultrasound screening.

Statistical analysis

Student's t test and χ^2 tests were used to compare characteristics of women who did or did not have their BMI recorded.

Analysis of variance was used to assess whether there was a difference in characteristics and outcomes between the four BMI categories.

Adjusted odds ratios were calculated after multiple logistic regression analysis. Hosmer–Lemeshow goodness-of-fit tests, residual and influence analyses were performed. The logistic regression models presented adequately fitted the data.

Significance was accepted at the 5% level on two-tailed tests for all measures.

Ethics approval

Our study was approved by the Mater Hospital's Human Research Ethics Committee.

RESULTS

Maternal charactistics and outcomes

Of the 4171 women with no BMI recorded in their antenatal record, 944 had weight, but not height, recorded. These 944 women had a mean weight of 63.1 kg (SD, 13.0 kg), compared with a mean weight of 63.6 kg (SD, 12.8 kg) for the 14 230 women with BMI recorded ($P = 0.17$).

Women with no BMI recorded were systematically different from those who did. They had poorer levels of education and were more likely to be of Aboriginal or Torres Strait Islander descent or belong to other ethnic minorities. These women also had significantly increased rates of hypertensive disorders of pregnancy, caesarean section, and neonatal complications. (Additional data comparing women who did and did not have a BMI recorded are available from the authors on request.)

Of the women who had their BMI recorded, 2882 (20.2%) were overweight, 1679 (11.8%) obese, and 248 (1.7%) morbidly obese. Baseline maternal characteristics according to BMI category are shown in Box 1. Increasing BMI was associated with increasing maternal age, parity, and cigarette smoking; a lower education level; and being of Aboriginal/Torres Strait Islander or minority ethnic group descent. Greater mean length of hospital stay and increased rates of gestational diabetes, type 2 diabetes, chronic hypertension and hypertensive disorders of pregnancy were also associated with increasing BMI. The overall prevalence of gestational diabetes recorded for the women in our study was 2%.

Peripartum outcomes

Increasing BMI was associated with reduced rates of spontaneous and assisted vaginal delivery and increased rates of caesarean section (Box 1).

Neonatal characteristics and outcomes

Neonatal characteristics according to maternal BMI are shown in Box 1. Increasing maternal BMI was associated with increasing birthweight *z* scores, rates of admission to the intensive care nursery, birth defects, respiratory distress syndrome, hypoglycaemia and prematurity. Gestational age at delivery was slightly less for the morbidly obese group than for other groups.

2 Adjusted odds ratios (95% CIs) for maternal, peripartum and neonatal outcomes, according to body mass index (BMI) category (*n* = 11 252)*†

	BMI category (kg/m²)			
	Normal (20.01–25) (*n* = 6443)	Overweight (25.01–30) (*n* = 2882)	Obese (30.01–40) (*n* = 1679)	Morbidly obese (> 40) (*n* = 248)
Maternal outcomes				
Hypertensive disorders of pregnancy	1.00	***1.74 (1.45–2.15)***	***3.00 (2.40–3.74)***	***4.87 (3.27–7.24)***
Gestational diabetes	1.00	***1.78 (1.25–2.52)***	***2.95 (2.05–4.25)***	***7.44 (4.42–12.54)***
Length of stay > 5 days	1.00	***1.36 (1.13–1.63)***	***1.49 (1.21–1.86)***	***3.18 (2.19–4.61)***
Peripartum outcomes				
Caesarean section	1.00	***1.50 (1.36–1.66)***	***2.02 (1.79–2.28)***	***2.54 (1.94–3.32)***
Neonatal outcomes				
Stillborn	1.00	1.16 (0.62–2.17)	1.19 (0.56–2.55)	0.89 (0.12–6.60)
Birth defect	1.00	1.26 (0.85, 1.87)	***1.58 (1.02–2.46)***	***3.41 (1.67–6.94)***
Hypoglycaemia	1.00	0.78 (0.36–1.66)	***2.57 (1.39–4.78)***	***7.14 (3.04–16.74)***
Jaundice	1.00	1.02 (0.92–1.12)	0.98 (0.88–1.13)	***1.44 (1.09–1.89)***
Prematurity (< 34 weeks' gestation)	1.00	1.22 (0.90–1.64)	1.16 (0.81–1.67)	***2.13 (1.13–4.01)***
Prematurity (< 37 weeks' gestation)	1.00	1.07 (0.89–1.28)	0.95 (0.76–1.19)	1.54 (1.00–2.39)
Admission to intensive care	1.00	0.92 (0.73–1.16)	1.25 (0.97–1.62)	***2.77 (1.81–4.25)***

* Statistically significant results are in ***bold italics***. Results are corrected for maternal age, parity, educational status, smoking status and ethnicity. † Our analysis excluded 2978 women with BMI ≤ 20 kg/m². ◆

Multiple logistic regression analysis

Adjusted odds ratios for maternal, peripartum and neonatal outcomes after multiple logistic regression analysis are shown in Box 2. The risks of hypertensive disorders of pregnancy, gestational diabetes, maternal hospital admission in excess of 5 days and caesarean delivery increased with increasing BMI.

Our study was not large enough to be adequately powered to examine the relationship between increasing BMI and rates of stillbirth. Neonatal intensive care admission was more frequent for babies born to morbidly obese mothers. Rates of hypoglycaemia and birth defects were higher in babies whose mothers were obese or morbidly obese. The risk of delivery before 34 weeks' gestation was higher in the morbidly obese group. There was a significant association between neonatal jaundice and morbid obesity.

The multiple logistic regression analysis for neonatal outcomes was also repeated to adjust for the differing rates of maternal type 2 diabetes and gestational diabetes across the BMI categories. On repeat analysis, the odds ratios were slightly attenuated, but the overall conclusions were not altered.

DISCUSSION

Our study, which provides information on 8% of all deliveries in Queensland over the study period,[16] confirms that overweight and obesity are common in our obstetric population. Our results are consistent with other studies in finding that increasing BMI is associated with increased rates of hypertensive disorders of pregnancy, gestational diabetes and caesarean section, as well as longer maternal stay in hospital, higher birthweight *z* scores, increased rates of neonatal admission to intensive care, birth defects and prematurity.[2-12] Our study was not adequately powered to detect significant differences in outcomes such as perinatal mortality in babies of overweight and obese women, as reported in other populations.[11]

The fact that increasing BMI was associated with increasing mean maternal age may reflect the tendency for our population to gain weight with age.[1] The increased parity of women in higher BMI categories may be related to the tendency to gain weight with each pregnancy.[17] The higher incidence of daily cigarette smoking and lower level of education in obese pregnant women have been documented in other studies.[11]

The recorded prevalence of gestational diabetes in our study was lower than the 5.5%–8.8% quoted in other Australian studies.[18] The fact that the MMH did not carry out universal screening for gestational diabetes at the time of our study may partly explain this discrepancy. In addition, the accuracy of routinely collected data on gestational diabetes has been questioned in Australia recently.[19,20] At the MMH, women with diet-controlled gestational diabetes who cease to be monitored at 36 weeks may not have this diagnosis documented by the clinical staff at the time of delivery. Anecdotally, we have noted uncertainty among staff entering data regarding the difference between type 1, type 2 and gestational diabetes. This highlights one of the weaknesses of using routinely collected data for research purposes.

It could be argued that overweight and obese women have higher rates of maternal complications, caesarean delivery and neonatal complications because they suffer higher rates of type 2 diabetes and gestational diabetes. We found that the associations between increasing BMI and poor outcomes were attenuated but not abolished after adjustment for the presence of pre-gestational and gestational diabetes. In the absence of universal screening for gestational diabetes at the MMH, we were not able to precisely separate the relative contributions of obesity and gestational diabetes to maternal and neonatal morbidity. However, other studies indicate that overweight and obesity, which are much more prevalent than pre-gestational and gestational diabetes, are likely to have a greater influence on maternal and neonatal outcomes.[9,21]

In our study, there were significant baseline differences between women who did and did not have BMI recorded in their antenatal record. The likely reasons for women not having BMI recorded were that they failed to attend an early pregnancy visit with the midwife, they refused to be weighed, or staff failed to record their weight and height on the computerised record. Our results suggest that women with no BMI recorded fall into a high-risk category. It is possible that women identified as high-risk in other institutions were referred selectively to access tertiary level care. These women may have missed the standard "booking in" procedures, including measurement of weight and height, given that they may have been reviewed at other institutions in early pregnancy.

It could be argued that the MMH's method of calculating pre-pregnancy BMI (which relies on estimated pregnancy-associated weight gain at about 12 weeks' gestation) is somewhat inaccurate. However, another study at the MMH showed that there is a very good correlation ($r = 0.95$) between weight recorded at the first antenatal visit and independently reported pre-pregnancy weight.[22]

Although our data relate to an urban tertiary referral centre, we believe that similar trends are likely to exist in other maternity health care settings.

Our findings highlight overweight and obesity as an important public health issue. As BMI increases, caesarean section rates, maternal morbidity, neonatal morbidity, neonatal intensive care utilisation and length of hospital stay all increase, which has important implications for the cost of health care delivery. There are also a number of practical, everyday problems encountered in caring for an increasingly obese obstetric population, including difficulty with lifting patients, gaining venous access and finding appropriate beds and operating tables. Thus, routine collection of data on maternal BMI can provide valuable information for resource planning for obstetric and neonatal care.

Currently, many state-based perinatal data collections do not include maternal BMI. We believe that pre-pregnancy or early pregnancy maternal BMI should be recorded on perinatal data collection sheets at the time of delivery for every baby.

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COMPETING INTERESTS

None identified.

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