Engagement with and outcomes of a Midwifery-led intervention group for pregnant women of high body mass index

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Abstract

Aims: To compare pregnancy care, maternal and neonatal outcomes of women with Body Mass Index (BMI) >30 enrolled in a Weight Intervention Group versus other models of antenatal care.

Methods: Retrospective, case-control study of mothers with BMI >30 managed with a specialised programme versus age-matched women enrolled in standard models of care.

Results: One thousand, one hundred and fifteen of 9954 pregnant women with singleton pregnancies, had a BMI >30, of whom 9.6% enrolled in the intervention group. Compared to controls, the intervention group had superior implementation of local high BMI guidelines, including; nutritional/weight gain advice (86% vs. 46%, $p < 0.001$), regular weighing (80% vs. 33%, $p < 0.001$), lactation consultant referrals (8% vs. 1%, $p = 0.02$), third trimester anaesthetic review and ultrasound (50% vs. 20.9%, $p = 0.04$ and 55% vs. 43%). Initiation of breastfeeding was higher in the intervention group (100% vs. 90%, $p = 0.001$). No significant difference was noted in Caesarean rate (30% vs 32%) and birthweight (3538 g vs 3560 g).

Conclusions: Women with high BMI enrolled in a specialised antenatal management programme received increased care, and had superior breastfeeding initiation rates. However, engagement was poor, and no significant differences were noted in antenatal or postnatal complications, mode of birth or neonatal outcome.

Keywords

Obesity, high-risk pregnancy, nutrition, endocrinology

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Background

The incidence of maternal obesity in Australia is continuing to increase and is becoming a common risk factor for adverse pregnancy outcome.¹ The prevalence of overweight (body mass index (BMI) 25.0–29.9) and obesity (BMI > 30) has increased in Australian adults, from 56.3% in 1995 to 63.4% in 2011–2012, with 35% of Australian women aged 25–35 being overweight or obese in 2011–2012.²

Increased maternal BMI in pregnancy has documented associations with increased morbidity and mortality in both mother and fetus.³ Maternal morbidities include increased rates of gestational hypertension, pre-eclampsia and gestational diabetes mellitus (GDM).^{4,5} Adverse neonatal outcomes include pre-term birth, stillbirth, congenital malformation and increased admission rates to special care nurseries.⁶ Epidemiological evidence also demonstrates significant long-term impacts on both maternal and child health, including increased childhood obesity, elevated risk of developing diabetes mellitus,⁷ and premature mortality from cardiovascular disease.⁸ The increased adverse outcomes in obese pregnant women and the neonate increase the burden of care and cost of health care delivery in Australia.⁹

A draft national guideline on antenatal care has been published in an attempt to standardise antenatal care across Australia.¹⁰ It highlights there is no supporting evidence for many areas of practice, including obstetric management of the obese patient and recommendations for weight gain throughout pregnancy. Furthermore, the 2009 Institute of Medicine's (IOM) recommendations for gestational weight gain for obese pregnant woman are not universally accepted.^{11,12} Despite strong epidemiological evidence demonstrating increased obstetric risk with increasing BMI, there is still very limited high level evidence available to support recommendations for management of obese women in pregnancy. A 2012 Cochrane meta-analysis found no high level evidence to support intensive lifestyle interventions for weight loss in pregnancy.¹² Since then randomised control trials (RCTs) including LIMIT and UPBEAT, conclude that despite

implementing lifestyle modifications in pregnancy, no significant benefit was found for either the fetus or mother compared with standard interventions.^{13,14} In light of new data, a Cochrane meta-analysis of the available evidence was published supporting exercise and diet interventions for reducing gestational weight gain in pregnancy.¹⁵ Although the review found trends in reduced cases of maternal hypertension, caesarean sections, fetal macrosomia and neonatal respiratory morbidity, these did not reach statistical significance.

Other interventions such as pre-pregnancy bariatric surgery to reduce obstetric and fetal complications have been evaluated. These studies found that although the number of macrosomic babies was reduced compared to matched controls, this was at the expense of a higher proportion of growth restricted babies and an increased incidence of preterm births was noted. Differences in other maternal and perinatal outcomes such as GDM, pre-eclampsia, caesarean section rate and admission to neonatal intensive care did not reach statistical significance.¹⁶

A midwifery-led specialised antenatal care group for women of high BMI was established in 2010 in an attempt to improve pregnancy care and outcomes. We wished to examine the efficacy of our current clinical practices, including an evaluation of the St George and Sutherland

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Weight Intervention Group (SSWInG) in its first 18 months, and whether the practiced interventions influenced maternal and perinatal outcomes. The aims of this study were to compare the pregnancy care, maternal and neonatal outcomes of women with BMI > 30 enrolled in the Weight Intervention Group versus other models of antenatal care.

Methods

This study was a retrospective case control study including all live born singleton pregnancies delivered at either St George or Sutherland hospitals between April 2010 and October 2012 with a documented maternal BMI > 30 at booking. St George is a level 5 metropolitan hospital, which has approximately 2500 babies born per year¹⁷ and Sutherland is a low risk, level 4, metropolitan hospital, delivering approximately 1300 babies per year.¹⁷

SSWInG was established as pregnant women with BMI > 35 were being transferred from low acuity care at Sutherland Hospital to St George Hospital as they were considered high risk, and there was no set policy guiding the safe and effective clinical care of these women. This model allowed women to access protocolised care with appropriate education of lifestyle choices and monitoring of weight under clinical guidelines. The hospital protocol (Appendix A; obm.sagepub.com/content/by/supplemental-data) for the management of obese women in pregnancy recommends that all women with a BMI > 30 should be commenced on high dose folate (5 mg daily) up until 12 weeks gestation, have a 75 g glucose tolerance test (GTT) at the booking visit and again at 26–28 weeks, be offered referral to a lactation consultant and be offered enrolment into the SSWInG program. Women with BMI > 35 are booked for care through the level 5 hospital only, have weight documented at each visit, offered dietician referral, undergo ultrasound for fetal growth 32–34 weeks gestation, are seen at least fortnightly in clinic from 28 weeks and weekly from 36 weeks, and referred to an anaesthetist at 32–34 weeks in the pre admission clinic.

Data were extracted and reviewed for all women with a singleton pregnancy and BMI > 30 enrolled in any model of antenatal care between April 2010 and October 2012 in the two hospitals. Data was obtained from the Obstetrix Databases (Obstetrix Consortium, NSW Department of Health). Obstetrix is a clinical database utilised at the level 4 and 5 hospitals, containing antenatal and intrapartum records for woman booked at the hospital. BMI is electronically calculated within the

database at the time of booking using the self-reported weight and height provided by the women. Women were excluded from the dataset if no BMI or an implausible BMI was documented at booking, or if BMI was documented to be < 30. Women enrolled in SSWInG were then identified using the records of SSWInG clinic.

A cohort of aged matched controls with a BMI > 30 (105) were selected from the dataset of 1115 women with BMI > 30 who did not participate in SSWInG. The data was matched according to age, and then a random number generator was used to match SSWInG to non-SSWInG participants.

Information extracted for all women of BMI > 30 included patient demographics, obstetric history, antenatal outcomes such as diagnosis with hypertensive or diabetic disorders, labour and birthing details, including mode of birth and maternal and neonatal outcome, such as breast feeding, birth weight and need for admission to special care nursery (Appendix B; obm.sagepub.com/content/by/supplemental-data). In addition, further information was extracted from patient medical records including timing of GTT, third trimester ultrasound, anaesthetic review, weight management advice and breastfeeding advice.

We hypothesised that (a) Women in SSWInG would be more likely to receive pregnancy care as per hospital protocol (b) Women in SSWInG would be less likely to have adverse maternal and neonatal outcomes, in particular giving birth by caesarean section and giving birth to a large for gestational age baby. Statistical analysis was performed using SPSS Version 21 (SPSS Statistics for Windows, IBM Corporation). Cases and controls were compared for all variables. For the demographic and outcome variables where Obstetrix data for the total high BMI cohort was available, comparison was also made between the total cohort, cases and controls. Comparisons for continuous variables were made using Student's *t*-test or ANOVA as appropriate, and for continuous variables chi-squared testing or Fisher's exact test as appropriate.

Ethics approval was granted for the study by the Human Research Ethics Committee of South Eastern Sydney Local Health District (SESLHD HREC 12/299).

Results

As shown in Figure 1, 9954 women had singleton births at the study hospitals in the study period (April 2010–October 2012). Of these,

Figure 1. Cohort inclusion and exclusion criteria.

Table 1. Population characteristics.

	Total cohort (n = 1115)	Control (n = 105)	SSWInG (n = 108)	p-Value ^a
Mean BMI $\pm$ SD		35.0 $\pm$ 5.3	36.8 $\pm$ 4.1	0.007
Region of birth, n (%)				
Europe	140 (12.6)	3 (3)	7 (7)	NS
Australia	760 (68.0)	69 (66)	81 (75)	NS
Aboriginal and Torres Strait Islanders	28 (2.5)	10 (10)	7 (7)	NS
Asia	84 (7.5)	9 (9)	6 (6)	NS
Africa	13 (1.2)	6 (6)	1 (1)	NS
Middle East	64 (5.8)	6 (6)	4 (4)	NS
America	26 (2.4)	2 (2)	2 (2)	NS
Maternal age, n (%)				
Mean $\pm$ SD		30.0 $\pm$ 5.5	30.3 $\pm$ 5.2	NS
≤ 25 years	195 (17.5)	21 (20)	21 (19)	NS
26–30 years	346 (31.0)	40 (38)	41 (38)	NS
31–35 years	341 (30.6)	26 (25)	27 (25)	NS
36–40 years	190 (17.0)	13 (12)	14 (13)	NS
≥ 41 years	43 (3.9)	5 (5)	5 (5)	NS
Parity, n (%)				
Nulliparous	411 (36.9)	28 (27)	47 (44)	0.02
Parous	704 (63.1)	76 (73)	61 (56)	–
Smoker, n (%)	156 (13.9)	15 (14)	17 (16)	NS
Alcohol, n (%)	23 (2)	0 (0)	0 (0)	NS
Illicit drugs, n (%)	9 (0.8)	1 (1)	0 (0)	NS

Note: NS: not significant/no trend to significance ($p > 0.1$).

^aBetween control and SSWInG groups.

Table 2. Antenatal care outcomes.

	Control (n = 105)	SSWInG (n = 108)	p-Value ^a
Antenatal care BMI > 30 , n (%)			
Diet and weight information given	49 (47)	93 (86)	<0.001
Breast feeding information given	89 (85)	97 (90)	NS
Referral to lactation consultant	1 (1)	9 (8)	0.02
Weighed regularly	35 (33)	87 (80)	<0.001
Glucose tolerance test at booking			
Yes	41 (39)	47 (44)	NS
Not performed (pre-existing diabetes)	1 (1)	4 (4)	
Glucose tolerance test at 26–28 weeks			
Yes	84 (80)	87 (81)	NS
Not performed (pre-existing diabetes)	7 (7)	9 (8)	
Anaesthetic review antenatally	22 (21)	54 (50)	<0.001
3rd trimester ultrasound	45 (43)	60 (56)	0.06

Note: NS: not significant/no trend to significance ($p > 0.1$).

^aBetween control and SSWInG groups.

1115 (11.2%) had documented BMI > 30 and were included in the study.

Of the 1115 high BMI women, 108 (9.6%) were enrolled into the SSWInG program. They were age-matched with 105 (9.4%) high BMI control women. Baseline demographics are shown in Table 1, with SSWInG group women more likely to be nulliparous than control

Table 3. Pregnancy outcome.

	Total cohort, n (%) (Total, n = 1115)	Control, n (%) (Total, n = 108)	SSWInG, n (%) (Total, n = 105)	p-Value ^a
Hypertensive disorder of pregnancy	175 (15.6)	16 (15)	18 (17)	NS
Pre-existing diabetes mellitus	18 (1.6)	2 (2)	4 (4)	NS
Gestational diabetes	164 (14.8)	15 (14)	15 (14)	NS
Normal vaginal birth	657 (58.9)	67 (64)	62 (57)	NS
Instrumental delivery	94 (8.4)	4 (4)	14 (13)	0.016
Caesarean section	364 (32.6)	34 (32)	32 (30)	NS
Exclusively breastfeeding at discharge	706 (63.3)	74 (71)	83 (77)	NS
No attempt to initiate breastfeeding	78 (6.7)	10 (11)	0 (0)	0.001
Postnatal complications				
Post partum haemorrhage (> 500 ml)	206 (18.4)	20 (19)	19 (18)	NS
Blood transfusion	14 (1.25)	0 (0)	2 (2)	NS
Deep vein thrombosis	1 (0.89)	0 (0)	0 (0)	NS
Wound dehiscence	4 (0.35)	0 (0)	0 (0)	NS

Note: NS: not significant/no trend to significance ($p > 0.1$).

^aBetween control and SSWInG groups.

(44% vs. 26%, $p = 0.02$) and with slightly higher BMI (mean 36.8 ± 4.1 vs. 35.0 ± 5.3 , $p = 0.007$).

The majority of women in the overall BMI > 30 cohort were cared for in a hospital setting either by midwives alone (49%), or in combination with the medical team (23.2%). Midwifery Group Practice (13.4%), Birth centre (5%) and GP/Shared care (3.4%) were used by a minority. Of the SSWInG cases, only half the women had 100% attendance to all eight antenatal sessions, although 96% attended five or more sessions.

Antenatal care outcomes are shown in Table 2. Women enrolled in SSWInG were significantly more likely to receive breast feeding, nutritional and exercise advice than the control group and were more likely to be weighed at each antenatal visit. They were also significantly more likely to receive anaesthetic review than control women, although even in SSWInG only 50% of women had this recommended review. Performance of a third trimester growth ultrasound and 75 g GTT at 26–28 weeks was similar in both groups.

Pregnancy outcomes and postnatal complications are shown in Table 3. Across the total cohort of women with high BMI, there were high rates of pregnancy related hypertension (15.6%), pre-existing diabetic mellitus (1.6%) and GDM (14.8%). GDM rates were similar between groups.

Women who were in SSWInG had similar overall vaginal birth rates compared to control and total cohort (70% vs. 68% vs. 67%) and similar caesarean section rates (30% vs. 32% vs. 33%), however, significantly higher assisted vaginal birth rate (13% vs. 4% control, $p = 0.016$).

Women with a BMI > 30 were generally successful with initiating breastfeeding, however there were significantly higher rates of breastfeeding initiation in SSWInG cases (100%) versus control (89%) or the total cohort (93%) ($p = 0.001$). Postpartum complication rates were similar across all groups.

Neonatal outcomes are shown in Table 4. There was no significant difference found between the groups in regards to neonatal outcome including gestation at birth, birth weight and admission to special care nursery.

Table 4. Neonatal outcomes.

	Total cohort % (n = 1115)	Control % (n = 108)	SSWInG % (n = 105)	p-Value ^a
Neonatal outcomes				
Gestation at birth (weeks)		39.1 ± 2.3	39.3 ± 2.0	0.04
Birth weight (mean ± SD)		3560 ± 631 g	3538 ± 609 g	NS
Hypoglycaemia	13 (1.2)	1 (1)	1 (1)	NS
Birthweight (>4000 g)	232 (20.7)	17 (16)	21 (20)	NS
Hypothermia	15 (1.3)	1 (1)	0 (0)	NS
Other	28 (2.8)	1 (1)	2 (2)	NS
Respiratory distress	6.18 (6.2)	8 (8)	7 (7)	NS
Resuscitation intervention after birth	216 (19.3)	28 (27)	28 (26)	NS
Admission to special care nursery	187 (16.7)	19 (18)	20 (19)	NS

Note: NS: not significant/no trend to significance ($p > 0.1$).

^aBetween control and SSWInG groups.

Discussion

In this study of a specialised, protocolised model of care for pregnant woman with high BMI, there was evidence of improvement in aspects of pregnancy care, but little evidence of improved pregnancy or neonatal outcome compared to women who did not enrol. Engagement of our high BMI population with SSWInG was poor, with less than 10% of eligible women enrolling. Those who chose to enrol were of slightly higher BMI and more likely to be nulliparous than those who did not. As per our study hypothesis, SSWInG attendees were more likely to receive enhanced lifestyle and dietary advice in addition to greater antenatal screening tests and surveillance as recommended by our hospital protocol, and did have significantly improved breastfeeding initiation rates. However, there were no significant improvements in most maternal outcomes including mode of birth or neonatal outcomes including birth weight.

Regarding enhanced pregnancy care, various studies similarly conclude, that despite providing women with dietary advice, physical activity advice or combined physical and dietary advice, the interventions did not yield statistically significant improvements in outcome, particularly in relation to gestational weight gain.^{13,18,19} Of interventions previously trialled, there is conflicting evidence as to which is best for achieving gestational weight gain reductions,^{20–22} however, provision of lifestyle advice does appear to improve adherence to IOM recommendations,²² resulting in fewer macrosomic babies¹³ and a higher likelihood of return to pre-gestational weight 6 months post partum.²³ It remains unclear as to whether there is benefit in regularly weighing women at every visit, as gestational weight gain could not be compared in the two study groups due to incomplete control group reporting.

Regarding maternal outcomes, results were consistent with other studies who quote similar rates of caesarean section for women with BMI > 30; ranging from 21% to 49%.^{4,5} The reason for the higher assisted vaginal birth rate in the SSWInG women is uncertain, but possibly secondary to increased nulliparity and slightly higher BMI in SSWInG, as both of these characteristics are risk factors for obstetric intervention. This study concurs that women with high BMI had a high rate of hypertensive disorders compared to normal BMI.^{13,23} The rate of GDM (14%) was significantly higher than the 5.5%–8% as

reported by other studies.^{24–26} This may be attributable to the large proportion of high-risk ethnicities in this sub-population.

One important positive outcome was that initiation of breastfeeding in women who attended SSWInG was higher than the control group. We hypothesise this may reflect greater motivation and the impact of that referral to a lactation consultant by the women who attended SSWInG. Breastfeeding has many documented long-term benefits for mother and infant including reducing the long-term risk of hypertension and metabolic syndrome and decreasing post-partum weight retention.^{27,28} As lactogenesis is delayed in women of high BMI and lactation initiation rates often low,^{29,30} the benefit seen in this study, although modest, is potentially clinically important.

The main strength of this study is its observation of how a specialised high BMI antenatal care model operated in routine clinical practice, outside the randomised trial setting. Although clinical trials are of course central to determining which interventions work in improving outcomes for pregnant women of high BMI; selection bias, volunteer bias, and proportion of women screened versus recruited to randomised trials may all affect their external validity.³¹ If, as in our cohort, the underlying risk population does not engage with the intervention model, attempts to improve care in everyday practice are likely to fail.

Our study has the usual limitations of retrospective and database research, with relevant data such as gestational weight gain, missing or incomplete, and reliance on self-reported pre-pregnancy weight to determine booking BMI which is likely to lead to under-reporting. However, the use of an age-matched control group, and multi-source extraction of data (from both Obstetrix and patient files) was performed to improve data accuracy and validity. Other study limitations include its single centre nature, which may inaccurately reflect outcomes in a wider population, and difference between cases and controls being potentially secondary to underlying demographic differences. Given that the SSWInG women were higher-risk, it is unlikely the positive differences seen with lactation initiation and improved pregnancy care were secondary to SSWInG demographics.

Regarding the poor engagement with SSWInG, although no formal survey was performed, common reasons given by women for declining SSWInG included not believing they would benefit from the program, or inability to attend sessions. Of those who did enrol, attendance was fair although only half attended all eight sessions. Given that SSWInG enrollees were highly motivated and proactive in maintaining weight goals, if all 1115 eligible women had been enrolled it is likely that many less motivated women would be included, and that the few positive outcomes demonstrated would become less apparent.

Other studies have highlighted the reluctance of women with high BMI to participate in interventional programs, quoting similar issues with recruitment.^{13,31,32} The social stigmatization of attending a specialty high BMI clinic may partially account for low enrolment levels, meaning women with high BMI might be more responsive to having additional care but in the setting of a regular antenatal clinic. As high BMI intervention programs in other settings have met with some success, but were also costly and impractical in a public hospital setting with limited resources,¹³ potentially women should be assessed based on Prochaska and DiClemente's stages of willingness to change prior to recommending formal weight management interventions.³³ This would mean that resources would be funnelled into managing women with motivation to change, who would be more responsive to feedback and self-evaluation. By engaging only with women who are ready to change, they are more likely to maintain long-term changes and return to pre-pregnancy weight, resulting in positive implications for future pregnancies.

Conclusion

In this retrospective, case-control study of effects of specialised antenatal care for pregnant women of high BMI, engagement with specialised care was poor. Enhanced pregnancy care was provided by this

model, however, apart from improved breastfeeding initiation rates, this did not yield improvement in outcomes compared to standard models of care. Given the modest benefit of a specialised model of care approach to women of high BMI, alternatives to explore include enhanced care within standard models of care, greater targeting of programs towards primary health care pre-pregnancy, and stages of change assessment prior to delivering interventions.

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SRC and AH conceived and designed the study. Data acquisition by AR, BH and SRC. Analysis and interpretation of data by AH and SRC. Manuscript was drafted by SRC manuscript revision for critically important intellectual content by AH and AJO'S. Final approval of the manuscript for publication by SRC, AR, BH, AH and AJO'S.

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