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PRÉCIS: This paper describes the gestational weight change for a group of obese pregnant women enrolled in an innovative group-based antenatal program in NSW Australia.

ABSTRACT

Introduction: The prevalence of obesity in Australia among women of childbearing age has doubled over the past two decades. Obesity is associated with complications for women and their babies during pregnancy and birth. Limiting gestational weight gain can reduce perinatal complications and postnatal weight retention, but evidence supporting interventions designed to assist obese pregnant women to manage their weight gain in pregnancy is inconclusive. The aim of this paper is to describe the gestational weight change of a cohort of obese pregnant women enrolled in a group antenatal program, aimed at assisting them to limit their weight gain in pregnancy to levels recommended by the US Institute of Medicine.

Methods: The program was jointly developed by two metropolitan maternity services in New South Wales (NSW), Australia. This is a descriptive study that presents select data for women enrolled in the program. Body mass index (BMI), pre-pregnancy weight, last pregnancy weight and select clinical outcomes were recorded for 82 obese women enrolled in the program during the evaluation period of 14 months. Data were analysed using non-parametric tests; Chi Square and Mann-Whitney U.

Results: Parity was associated with pre-pregnancy BMI, with women of higher parity having higher BMIs. Women with higher BMIs had a significantly lower gestational weight gain than women with lower BMIs. Overall, 27% of women enrolled in the program gained the recommended 5-9kg, 27% gained less than this amount and 46% gained more.

Discussion: Evidence supporting interventions designed to assist obese pregnant women to manage their weight gain in pregnancy is lacking. This innovative, collaborative program shows promise as early results compare favourably with international comparisons.

KEYWORDS: obesity, weight gain, prenatal care, group antenatal care

QUICK POINTS

- There is a lack of evidence on the most effective way to support women to manage their weight gain during pregnancy
- This paper describes an innovative weight management program for obese pregnant women
- Of the women who attended the group antenatal care program, 27% gained less, 46% gained more, and 27% gained within the Institute of Medicine Guidelines
- Multiparous and heavier women (BMI >35kg/m²) were more likely to be successful in limiting their gestational weight gain than women who were primiparous and whose BMI was <35kg/m²
- The results of the study compare favourably with international comparisons.

INTRODUCTION

The increase in obesity worldwide is one of the greatest public health challenges of the 21st century. In Australia, 61% of adults were classified as overweight or obese, and almost 1 in 4 of the population were obese in 2008.¹ The World Health Organization² classifies overweight as people with a body mass index (BMI) of 25-29.9kg/m², and obese as people with a BMI equal to, or more than, 30kg/m². The rate of overweight and obesity amongst women booking for antenatal care in Australia has been found to be between 34-50%,³ and indications are that the rate is continuing to rise.⁴ It has been recently estimated, based on past trends, that 75% of women over 20 years old in Australia will be overweight or obese by 2025.⁵ This situation has important implications for the health of women and their families, and for the organisation and delivery of maternity services.

The incidence of complications during pregnancy and childbirth associated with overweight and obesity are well documented.⁶ Not only is pre-existing maternal obesity associated with

perinatal complications, but gaining excessive weight during pregnancy is also associated with adverse maternal and neonatal outcomes such as increased risk of gestational diabetes, hypertension, caesarean birth and weight retention.⁷⁻⁹ For the baby, excessive maternal weight gain has been associated with lower 5 minute Apgar scores, higher risks for hypoglycaemia and being large for gestational age.¹⁰ In addition, the children of women who gain excessive weight during pregnancy, compared to those who do not, are more likely to be overweight by the age of three years.¹¹

The Institute of Medicine (IOM) in the United States (US) has provided gestational weight gain (GWG) ranges for the past two decades based on the woman's pre-pregnancy BMI. The guidelines suggest that the higher the BMI at the beginning of pregnancy, the less weight a woman should gain. The guidelines were revised in 2009 to include a specific GWG recommendation for obese women of between 5-9kg (11-20lb).¹² These guidelines are the most commonly adopted in developed countries, such as in Australia, in the absence of country-specific guidelines.^{13,14}

Various resource-intensive interventions have attempted to limit weight gain in pregnancy with limited success, and the mechanisms by which lifestyle interventions lead to a reduction in GWG are not clear.¹⁵ In Australia, researchers suggest that a multi-faceted approach is needed,¹⁶ but few public maternity services currently exist that address the weight management needs of overweight and obese women during pregnancy.

We designed, implemented and evaluated an innovative, collaborative, antenatal intervention in NSW, Australia, which aimed to assist obese women to limit their weight gain during pregnancy according to the IOM guidelines.¹⁷ The purpose of this paper is to describe the model of care, the gestational weight change and other relevant characteristics of the first 82 women to complete the intervention program. Study data are presented to describe the results to date and to discuss the practice implications and recommendations that have arisen as a result.

THE INTERVENTION

The intervention program was developed by a steering committee with representation from midwifery, obstetrics, dietetics and physiotherapy, and was introduced simultaneously on two sites in Sydney, Australia, in March 2010. The intervention was based on the principles of group antenatal care, which combines antenatal assessment, lifestyle and parenting education in one visit, where women draw on the knowledge and support of others in the group. Group antenatal care in the US has been shown to achieve positive outcomes such as lower rates of preterm birth, greater satisfaction with care, higher rates of breastfeeding and lower rates of social isolation.^{18,19} The provision of antenatal care in groups has been introduced previously in Sydney, Australia, (without the emphasis on obesity and weight gain) demonstrating positive outcomes for women and midwives.²⁰ Our intervention was designed on the basis that the peer support available through group antenatal care would increase the effectiveness of an antenatal weight management intervention.

The intervention program consisted of eight sessions (seven antenatal and one postnatal) of two hours duration each, facilitated by two midwives, providing the women with continuity of care provider during their pregnancy. In line with each woman's assessed level of risk, care was shared between the midwives and an obstetrician. The groups were attended regularly by a dietician and a physiotherapist who facilitated discussions around healthy eating, cooking, eating out as a family and healthy activity, and who supported the women to set and achieve personal goals. Each group consisted of not more than 12 women of similar gestation, and was held in a community setting such as a Community Health Centre.

METHODS

While the program was considered a service development initiative, ethical approval for an evaluation of the intervention was sought and granted by the Harbour/Hawkesbury Northern Sydney Central Coast Health (NSCCH) HREC, Ref No HREC/10/HAWKE/61.

Women enrolling in the program were invited to participate in the evaluation, which was voluntary. Women agreeing to participate provided consent for the collection of additional data, and for the researchers to access obstetric data that is routinely collected. Data included maternal age, parity, pre pregnancy weight, height, weight at each antenatal visit, as well as select birth and neonatal outcomes. Pre-pregnancy BMI was calculated using self-reported pre-pregnancy weight and measured height. Gestational weight change was calculated by subtracting the self reported pre pregnancy weight from the last pregnancy weight (recorded at the last antenatal visit before birth).

In line with the World Health Organization categorisation of BMI², women were assigned to pre-pregnancy BMI obesity classes; class I was comprised of women with a BMI of 30-34.9 kg/m², class II, 35-39.9 kg/m² and class III women with a BMI greater than or equal to 40 kg/m². Gestational weight change was also categorised into three groups. The “under” category comprised of women whose gestational weight change was under that recommended by the IOM (<5kg), the “within” category comprised of women whose weight change was within that recommended by the IOM (5-9kg) and the “over” category by women who gained more than 9kg.

Analysis

Data were analysed using non-parametric tests; Chi Square for categorical data and Mann-Whitney U for comparing two categories with continuous data. Significance was set at 5%.

FINDINGS

At the time of evaluation 82 women had completed the antenatal program. Table 1 shows the characteristics of the women enrolled in the program. The mean self-reported pre-pregnancy weight of all women was just over 100kg and the mean BMI was in the obese class II range at 37.5 kg/m². There was a significant difference between BMI in multiparous (median BMI 37.3) and nulliparous women (median BMI 35), $P=.018$.

Gestational weight change, gestation, mode of birth and neonatal weight

Table 1 also shows the gestational weight change, mode of birth and gestation at birth for women enrolled in the program. The mean weight gain was 9.59 kg, although the range was large (-11.6 to 33.2kg). Mean gestation was 39.22 weeks. The mean neonatal birth weight was 3546g. The proportion of women experiencing a caesarean section overall was 32.9%.

Gestational weight change and the IOM guidelines

The IOM guidelines recommend that obese women gain between 5 and 9kg over the course of their pregnancy. We compared the weight change of women enrolled in the antenatal program to the IOM guidelines and found that 27% gained within 5-9kg, 27% gained less than recommended and 46% gained more than recommended. Although the range of weight change was wide, a large proportion of the cohort achieved a weight gain that was close to the recommended range of 5-9kg. The distribution of the weight change is illustrated by the box plot in Figure 1.

In this group of women, those with higher booking BMIs and those of greater parity tended to have lower GWG than obese women with lower BMIs and women of lesser parity. The mean BMI of women who gained less than the IOM recommendations was higher (40.44 kg/m²) than those who gained the recommended weight (38.48 kg/m²) or those who gained over the IOM recommendations (35.2 kg/m²). In comparing BMI classes we found that a greater proportion of women in obesity class III gained less than the weight gain recommended by the IOM (47.6%) compared to those who gained within (36.4%) or over the recommended levels (10.5%).

Conversely, a lesser proportion of women in obesity class I gained under the weight gain recommended by the IOM (23.8%) compared to those who gained within (27.3%) or over the recommended levels (50%). There was a significant association ($P=.025$) between obesity classes I to III and weight change category (under, within, or over the IOM recommendations) and the direction of this association is illustrated by Figure 2.

Parity showed a similar pattern. The mean parity of women gaining less than the IOM recommended weight gain was 1.14 (0.99); for those gaining within the IOM weight gain recommendations mean parity was 0.95 (1.13), and for those gaining over the IOM recommendations it was 0.37 (0.59). There was a significant association ($P=.004$) between weight gain category (under, within, or over the IOM recommendations) and parity (primiparous versus multiparous).

DISCUSSION

This study adds to the literature concerning gestational weight gain by describing the results of an antenatal intervention utilising group care. While the descriptive nature of this study and the small sample size means that we cannot draw conclusions about the effectiveness of this antenatal program, the results provide clinicians with data about the patterns of gestational weight gain to support future service development.

The lack of baseline data on GWG in Australia means we are unable to draw local comparisons. Maternity care guidelines in Australia recommend a calculation of BMI at the first antenatal assessment (booking visit), with subsequent or routine weighing only for women whose clinical management is likely to be influenced.²¹ This practice is in contrast to other developed countries, such as the US, where routine weighing is part of antenatal care.¹² The prevalence of excessive GWG in Australia is therefore largely unknown,^{22,23} although one recent study suggests that Australian women are gaining excessive weight during pregnancy, similar to the experience of women in other developed countries.²² We have drawn on recent research in

other relevant settings to position our findings within the literature and to inform future research in this area.

Gestational weight change

The mean gestational weight gain for the obese women completing our program was 9.59 kg which is greater than the maximum weight gain recommended by the IOM of 9kg, but compares well to international studies. A large population based retrospective study in the United States ($n= 570,672$)²⁴ included over 100, 000 obese women and identified a mean gestational weight gain for this group of 11.4kg. In a population based study ($n= 60 892$) from Denmark²⁵ with a less comparable population (as only 7.9% were obese) the mean gestational weight gain for obese women was 10.5kg.

The prevalence of excess GWG in developed countries has been reported in population-based studies to be approximately 50%, varying between 40 and 70% dependent on pre-pregnancy BMI.^{10,24,26} Evidence shows that women who are overweight or obese before pregnancy are 2-6 times more likely to gain excessive weight during pregnancy than women of normal weight.^{27,28} In our study 46% of all obese women gained excess GWG (more than 9kg). This compares well to published data from large studies in the United States²⁷, Denmark²⁵ and Sweden,²⁹ which identified the proportion of obese women who had excessive GWG at 53.5%²⁷, 58%²⁵ and 49.2%²⁹ respectively.

Parity, BMI and gestational weight change

Our study showed a marked difference between median BMI of multiparous and primiparous women. We also found an association between gestational weight change and parity with multiparous women having a lower GWG than primiparous women. In Denmark, Nohr et al also found that primiparous women had a greater GWG than multiparous women³⁰; the mean GWG of obese primiparous women in this study was 11.3 kg versus obese multiparous women at 9.9kg. Similarly in a large population based sample in the United States ($n=52,998$) Chu et al found that GWG increased with decreasing parity and BMI.²⁶ In regression analysis obesity was

the strongest factor affecting GWG followed by parity. These findings are supported by a qualitative study in the UK.³¹ Multiparous women in the UK study reported being more careful about GWG as they were aware that pregnancy weight gain could be difficult to lose in the postpartum period.

These findings suggest that women who are primiparous and those in the lower category of obesity (Obesity Class I) are at particular risk for excessive gestational weight gain and of becoming progressively heavier during their childbearing years.^{25,30} Interventional strategies should therefore focus on attracting these 'at risk' groups in order to achieve the greatest preventative health benefits.

Optimal gestational weight change

The IOM Guidelines suggest a narrow range of optimal GWG for obese women (5-9kg), irrespective of obesity class. The weight change during pregnancy for the women in our study varied considerably from -11.6 to +33.2kg. The 27% that gained less than recommended by the IOM were women with higher BMIs. While the IOM recommends that obese women gain between 5-9kg in pregnancy there are suggestions³² that these guidelines may be unnecessarily liberal for those in obesity class II and III. A recent observational study by Blomberg²⁹ of 46,595 obese women demonstrated 'reasonable safety' for women in obesity classes II and III to lose weight during pregnancy, although the amount of weight loss is not specified in the paper. The study demonstrated a decreased risk for these women for caesarean birth and babies who were large for gestational age, and risk remained unaffected for pre-eclampsia, excessive post partum bleeding, low APGAR score and fetal distress, compared to those who gained the recommended 5-9Kg.

Kiel et al³³ and Cedergren³⁴ have also made a case for lowering the optimal weight gain ranges according to pre-pregnancy BMI. In a large population-based study of over 120,000 women in the US, Kiel et al calculated a range of weight gains associated with minimal risk in terms (collectively) of preeclampsia, caesarean birth, large- and small-for-gestational-age for women

in each obesity class: 4.5-11kg for class I, 0-4kg for class II and a loss of 0-4kg for women in class III. Cedergren studied over 298,000 singleton pregnancies in Sweden and established optimal weight gain ranges across all BMI classes, based on the relationship between maternal weight gain and adverse perinatal outcomes. For women with a BMI >30kg/m² the study recommendation was a weight gain of less than 6kg, irrespective of obesity class.

The group antenatal care intervention

There is insufficient evidence to recommend specific interventions that assist obese women to limit their weight gain to recommended levels during pregnancy, and the mechanisms by which interventions lead to a reduction in GWG are also not clear.¹⁵ There are however, suggestions that simple measures such as those incorporated into our group antenatal care intervention may be helpful to overweight and obese women in terms of limiting weight gain during pregnancy; accurate information on target GWG,³⁵ regular weight measurement,³⁶ and peer support³⁷ for example.

In terms of interventions that are acceptable to obese women, several studies have considered preferences for care.³⁷⁻⁴⁰ These preferences include continuity of care (allowing sensitive issues to be addressed gradually over time)^{38,39}, a community location (with an emphasis on health rather than illness),³⁷ clear and consistent advice and information,³⁷⁻³⁹ access to a variety of health professionals,³⁹ social support from group sessions^{37,39} and motivational strategies.³⁷

Considering these factors, our specifically designed group antenatal care program may offer an acceptable form of intervention for many obese women in terms of limiting GWG. The integrated nature of the community-based program enabled continuity of care from the same midwives throughout pregnancy, and immediate access to a multidisciplinary team. The involvement of a dietician and physiotherapist at the group antenatal sessions may have had a major role to play in motivating women to meet their personal weight management goals, as much emphasis was placed on motivational strategies during the sessions. The spontaneous and lively group discussions often focused on a whole of family approach to weight

management and a healthier lifestyle, supporting a focus on health rather than illness. Further research is required in relation to the group antenatal care program to explore potential causal relationships in terms of limiting GWG.

Implications for practice

Health professionals have reported lacking understanding in relation to nutrition, physical activity and weight gain requirements in pregnancy.^{40,41} In turn, research has shown that women report inconsistent advice, and interpret a general lack of attention on weight gain as a sign that weight change in pregnancy is unimportant.³¹ The recently published Australian clinical practice guidelines for antenatal care recommend giving all women advice about appropriate weight gain during pregnancy in relation to their BMI (such as that recommended by the IOM), and providing them with accurate and consistent information about healthy eating and physical activity.²¹ These measures now need to be incorporated into routine antenatal care in Australia, accompanied by educational strategies and communication skills training for health professionals. Interventions such as ours that utilise groups may assist this process. Group sessions enable health professionals to gain relevant practical skills and knowledge directly from visiting 'experts' at the group, such as dietitians, physiotherapists and maternal and child health nurses, whilst simultaneously providing women with consistent and accurate information.

LIMITATIONS

Self-reported pre-pregnancy weight was used to calculate BMI and subsequent weight gain for this study. Although measured weight at a preconception visit is the most accurate and ideal measure, it is usually not practical due to the unplanned nature of many pregnancies. Self reported pre-pregnancy weight is widely used in population studies^{35,42} and has been shown to be a reasonable estimate of weight at conception.⁴³

This paper presents the findings of a descriptive study and caution should be exercised in the interpretation of the results. It is likely that only those women motivated to manage their weight in pregnancy would have enrolled in the program. Due to the small sample size we have not undertaken an in-depth analysis and this is required to more fully appreciate the interaction between variables such as parity, BMI, weight change and mode of birth. This study does however, make a contribution to the field especially given that there is very little published Australian data on weight change in pregnancy and the outcomes of interventions aimed at assisting obese women to manage their weight change in pregnancy.

CONCLUSION

The early results of our intervention, utilising the principles of group antenatal care to support women to limit GWG, shows promise in terms of weight change, comparing favourably with international comparisons. This study contributes to the international evidence concerning antenatal interventions designed to change lifestyle behaviour and minimise gestational weight gain in obese women. The optimal recommended weight gain for overweight and obese pregnant women remains controversial, and there is some evidence that a small reduction in weight for these groups of women may be less of a risk than previously thought. Further research in this area is warranted and given the rapidly increasing average BMI of women entering pregnancy in the developed world, such research is urgently needed.

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Table 1. Characteristics of the 82 women who completed the antenatal program

Characteristics/outcomes	Result
Maternal age , mean (SD), y	29.1 (4.25)
Maternal age , median (range)	29 (21-39)
Parity , mean (SD)	0.73 (0.93)
Parity , median (range)	1 (0-5)
Pre pregnancy weight , mean (SD), kg	100.93, (16.65)
Pre-pregnancy weight , median (range), kg	98.5 (60 to 152)
Pre pregnancy weight , mean (SD), lb	222.51 (36.71)
Pre-pregnancy weight , median (range), lb	217.15 (132.28 to 335.10)
BMI^a , mean (SD)	37.49 (5.41)
BMI , median (range)	36.05 (30.1-61)
Total pregnancy weight gain , mean (SD), kg	9.59 (8.36)
Total pregnancy weight gain , median (range), kg	4.95 (-11.6 to 33.2)
Total pregnancy weight gain , mean (SD), lb	21.14 (18.43)
Total pregnancy weight gain , median (range), lb	10.91 (-25.57 to 73.19)
Gestation at birth , mean (SD), wks	39.22 (2.30)
Gestation at birth , median (range). wks	39.5 (26.1 – 42)

Birth weight , mean (SD), gm	3545.96 (653.10)
Birth weight , median (range), gm	3525 (915-4795)
Birth weight , mean (SD), lb	7.82 (1.44)
Birth weight , median (range), lb	7.77 (2.02-10.57)
Caesarean Section , n (%)	26 (32.9)

Abbreviations: BMI (body mass index)

^a Body mass index was calculated as kg/m²

Figures

Figure 1. The distribution of gestational weight change

Figure 1 shows the distribution of gestational weight change across the sample of 82 women. The box plot shows the range of gestational weight gain (30.5kg to -4kg with several outliers) (67.2 to -8.8 pounds), the median weight change (8.7kg)(19.2 pounds), and quartiles. Focusing on the 2nd and 3rd quartiles (the boxed in area) we see that 50% of participants gained between 4.6kg and 14.8kg (10.1 and 32.6 pounds).

Figure 2. Percentage of women in each obesity class by IOM GWG category

Figure 2 shows the percentage of women in each obesity class (Obesity class I in the dark grey shading, obesity class II in light grey shading and obesity class III in black) by their gestational weight change category.

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