

## **Nutrition and Maternal Health: What women want and can we provide it?**

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## **ABSTRACT**

**AIM:** Maternal dietary behaviours are associated with some maternal and infant health outcomes during and after pregnancy. However, effective Maternal Health Dietetic models of care are limited. To inform service development and planning, Australian Maternal Health Dietetic services were benchmarked and nutritional aspects of women attending a large Australian women's hospital were investigated.

**METHOD:** During 2008, 15 Australian tertiary Maternal Health Dietetic services were surveyed collecting staffing and service delivery information. A maternity hospital's patients were also surveyed to assess nutrition knowledge, attitudes, behaviour, education preferences, and Dietetic service awareness.

**RESULTS:** The benchmarking survey response rate was 73%. There was considerable variation in staffing levels and services delivered. Individual antenatal inpatient and outpatient counselling dominated dietetic time. Few evidence-based models of care or guidelines were used by dietitians. Of the 309 antenatal (RR 24%) and 102 postnatal (RR 17.4%) patients surveyed, half were primiparous; over one-third had pre-pregnancy BMIs  $>25.9\text{kg/m}^2$  and average pregnancy weight gain was  $14.1 \pm 6.7\text{kg}$ . Few antenatal women knew their recommended pregnancy weight gain range. Excessive weight gain occurred in 33.3% to 100% of women (per BMI range). Women had poor diet quality, despite identifying healthy eating as a personal priority. Nutrition education delivery preferences were identified.

**CONCLUSION:** Considerable variations exist in Australian Maternal Health Dietetic services and referral guidelines. There is a role for Maternal Health Dietitian/Nutritionists to advocate for improved staffing levels and for the

implementation and evaluation of evidence-based services. Potential service delivery improvements are suggested, including a model of Dietetic care.

**Key words:** antenatal, postnatal, maternal health, health services

## **Introduction**

A new 150-bed Maternal Health Hospital (MHH) was opened in South East Queensland in June 2008 with over 4,000 births (per publicly- and privately-funded sections) in the past year. With the MHH expansion, the Department of Nutrition and Dietetics was allocated extra funding (to 1.0 full time equivalent, FTE) to expand the Maternal Health (MH) dietetic service. This study sought to ensure that the new service was underpinned by strong evidence-based care guidelines and incorporated evidence-based models of care.

An effective Dietetic service for maternity care is important for a number of reasons. A poor quality diet during pregnancy is associated with unhealthy maternal weight gain<sup>1,2</sup>, preeclampsia<sup>3</sup>, anaemia<sup>4</sup>, preterm birth or miscarriage<sup>5</sup>. It is also associated with poor infant outcomes, including inadequate development<sup>6</sup>, low birth weight<sup>7</sup>, preterm birth<sup>8</sup>, macrosomia<sup>9</sup>, and an increased risk of chronic diseases later in life<sup>10</sup>. Poor dietary choices postpartum and excess weight retention places women at an increased risk of maternal chronic disease later in life<sup>11,12</sup>. However, there are no effective MH Dietetic service delivery models of care reported in the literature, beyond specific weight management programs<sup>13, 14</sup> and diabetes management guidelines<sup>9,15</sup>.

## **The Maternal Health Hospital's Nutrition and Dietetics Service**

The MHH provides Nutrition and Dietetic services to antenatal (AN)(inpatients and outpatients), postnatal (PN)(inpatients and outpatients), and gynaecology patients (including preconception). AN inpatient care is generated through referrals from medical, midwifery, and allied health staff, with support from Nutrition Assistants (NAs). AN outpatient Dietetic services include a multidisciplinary (MD) gestational

diabetes mellitus (GDM) clinic; a diabetes and pregnancy MD clinic (following best-practice guidelines<sup>14,15</sup>); and a dietitian's clinic for AN women. PN inpatient and outpatient counselling is an ad hoc service, with limited referral or triaging guidelines.

Few women attending the MHH for AN and PN care receive comprehensive nutrition education material or referrals for nutrition intervention. No information is systematically provided on how a woman can access the dietetic service. Currently, some women attending the MHH antenatal clinic receive nutrition information from midwives, though content and delivery processes are not standardised.

There exists the potential to further develop the MHH Dietetic services so it is underpinned by models of care with demonstrated ability to improve health behaviours. This improvement process should be informed by evidence from the literature, peer expertise, and consumer opinions and needs. Limited literature exists regarding models of care for MH dietetic services. This study aimed to benchmark Australian publicly-funded tertiary MH Dietetic services to inform the development of the service. In addition, this study surveyed women attending the MHH for AN and PN care to investigate their nutritional behaviours, attitudes and knowledge. Further, women's awareness of the current Dietetic service and women's education preferences were assessed.

## **Methods**

### **Study 1: The service benchmarking survey**

#### **Study design and participants.**

In July 2008, 15 Australian publicly-funded tertiary maternity services were identified from State and Territory Department of Health websites. The survey and an

introductory cover letter with study purpose and return details was emailed to each of the hospital's MH Dietitians or Dietetic managers. Participants were recontacted after two weeks for unreturned surveys. Participation was voluntary and consent was assumed with survey return.

### **The service benchmarking survey**

The survey focused on the provision of services to MH patients from preconception to the postnatal period. The following information was collected; number of births each year, number of beds, staffing levels (as full time equivalents, FTEs), referral processes, service delivery methods, models of care in use, and gestation stage when women were seen, and reason for referral.

### **Analysis**

Responses were tabulated in Microsoft Excel and each hospital was given a unique identifier for reporting purposes. The FTE information was converted to hours, using 38 hours as a standard week. Due to a large variation in the tertiary hospital sizes and birthing numbers, results were collated in three groups: Hospitals birthing more than 5,000 babies each year; between 3,500 and 5,000 births; and fewer than 3,500 births each year.

## **Study 2: Women's pregnancy and postnatal nutrition behaviours, needs and preferences**

### **Study design and participants**

The study populations were convenience samples of eligible pregnant women over the age of 18 years receiving care at the MHH, through the antenatal clinic (ANC) or the publicly-funded PN ward. Separate AN and PN surveys were designed. Women

were ineligible for the study if they could not read English. Further, women were ineligible if they were attending their initial clinic appointment (AN) and this was determined when distributing the surveys.

The AN survey was distributed from 10<sup>th</sup> November to 24<sup>th</sup> December 2008. During each ANC, the MHH Dietitian approached women in the ANC waiting room and invited them to be involved in the study via a script. Ineligible women were identified at this point. Eligible women were provided with a copy of the survey, clipboard and pen. Women placed the completed survey in a sealed collection box. All women approached agreed to participate and returned a survey. Overall clinic attendance during the study period was used to determine survey participation rates.

The PN survey was distributed each Tuesday to women, via their breakfast meal tray, from 27<sup>th</sup> October to 15<sup>th</sup> December 2008. With an average length of stay of 2.2 days (median = 2.0 days), the weekly rate of distribution was chosen to prevent the likelihood of a woman receiving the survey twice. The surveys were distributed in an envelope labelled with the study purpose and instructions and were collected by the NAs with the menus. Numbers of new admissions to the ward during the study period were used to determine survey response rate.

Ethics approval for this study was not required as it was deemed a Quality Activity by the Hospital's Ethics Committee.

### **The antenatal and postnatal surveys**

Both surveys were self-report and collected information about women's demographics, anthropometric data (height, pre-pregnancy weight, current weight), pregnancy history, dietary quality, opinions and knowledge, as well as women's

awareness of, and use of MHH Dietetic services. Opinions about nutrition services they would find helpful were also sought. Dietary quality was assessed with a valid tool<sup>16</sup> and asked number of serves of fruit, vegetables, and dairy products consumed per day. Importance of healthy eating was rated on a Likert scale, with 1 being not important to 5 being very important. Women were asked to nominate their preferred style of education and their preferred timing (day: week, week end; time: morning, afternoon, evening; length: 30, 45, 60 minutes, and gestation stage) of nutrition information delivery. The AN survey also collected knowledge of *Listeria monocytogenes* and recommended weight gain guidelines. The PN survey also collected information about gestational weight gain, current breastfeeding behaviour, and days since delivery.

### **Analysis**

Data entry and statistical analyses were performed by the MHH Dietitians. Quantitative data were entered into and analysed in SPSS version 15. Means and standard deviations or frequencies were calculated for all variables. 1990 Institute of Medicine (IOM) weight gain guidelines<sup>17</sup> were current at the time of the study and were used in analyses. One participant had a multiple gestation (triplets) and was excluded from the weight gain comparison.

Qualitative verbatim responses were coded into groups. Pearson's correlations were used to analyse relationships between PN women's pre-pregnancy BMI and (i) women's rated importance of returning to their pre-pregnancy weight and (ii) women's rated importance of healthy eating. Pearson's correlations were also used to analyse the relationship between women's weight gain (correct, insufficient, excessive) and (iii) women's rated importance of returning to their pre-pregnancy weight and (iv)

women's rated importance of healthy eating. Statistical significance was set at  $p < 0.05$ .

## **Results**

### **STUDY 1: The service benchmarking survey**

#### **Response rate**

Seventy three percent (11/15) of hospitals returned surveys. Two surveys were incomplete and were excluded from the comparison. A summary of the results is in Table 1.

#### **Staffing levels**

Staffing levels ranged from 0.5-2.4 FTEs in hospitals with over 5,000 births per year, 0.2-0.5 FTEs in hospitals with between 3,500 to 5,000 births, and 0.1-0.3 FTEs exist in sites with fewer than 3,500 births per year (Table 1).

#### **Referral processes**

Most hospitals accept inpatient referrals from medical and nursing staff. All centres accept GDM outpatient referrals through various care pathways and models of care (Table 1).

#### **Service types**

Minimal preconception nutrition services are provided in Australian hospitals (Table 1). Eight to 53 hours/week are spent in individual consultations for AN inpatients and outpatients. Most centres provide GDM counselling. Minimal service is provided to PN women. No specific models of care were reported.

*Approximate placement of Table 1*

## **STUDY 2: Women's pregnancy and postnatal nutrition behaviours, needs and preferences**

### **Response rate and demographics**

A total of 309 AN surveys and 102 PN surveys were collected. Five AN surveys and one PN were excluded due to unrealistic improbable responses (i.e inappropriate and/or exaggerated), leaving 304 valid AN surveys and 101 valid PN surveys. Over the study period, 1314 eligible women attended the ANC, resulting in a response rate of 24% for the AN survey and 586 eligible women were postnatal inpatients at the MHH, resulting in a response rate of 17.4%. Over half of the respondents were between 20-30 years (AN) (or 19-30, PN)(Table 2) and was expecting or had just given birth to their first baby. Over a third of the women were overweight or obese BMI at the beginning of pregnancy (Table 2).

*Approximate placement of Table 2*

### **Nutrition behaviours, attitudes and knowledge**

Between 33-100% of women gained weight above the recommended range for their pre-pregnancy BMI<sup>17</sup>(Table 3). AN and PN women's rating of the importance of eating well and returning to their pre-pregnancy weight is shown in Table 4, along with their daily consumption of fruit, vegetables, and dairy serves. PN women's intake was assumed to reflect the late AN period. Over 84% of AN and 92% of PN women rated eating well at the moment as important (36.9% AN; 11.9% PN) or very important (47.2% AN; 80.2% PN). Less than half of the AN women (44.3%) reported knowing their expected weight gain for their pregnancy, with only one woman identifying this range correctly. Over two-thirds of women reported it to be important (18.8%) or very

important (48.5%) to return to their pre-pregnancy weight. Only 7.9% of women rated it as not important.

Amongst the PN women, the importance of returning to pre-pregnancy weight was significantly associated with pre-pregnancy BMI ( $r=0.2$ ,  $p=0.02$ ). The higher a woman's pre-pregnancy BMI, the more highly she rated the importance of returning to her pre-pregnancy weight. No statistically significant relationships existed between women's pre-pregnancy BMI, analysed by BMI group and her rated importance of healthy eating, except for women whose pre-pregnancy BMI was in the overweight range,  $r = -0.6$ ,  $p = 0.007$ . The higher a woman's pre-pregnancy BMI, the less importance she gave to healthy eating in the initial postpartum period.

Except for PN women who gained the correct amount of weight, there was no statistically significant relationships between women's weight gain (correct, insufficient, excessive) and (iii) women's rated importance of returning to their pre-pregnancy weight or (iv) women's rated importance of healthy eating. There was a strong positive correlation between women who gained the correct amount of weight and their desire to return to their pre-pregnancy weight,  $r = 0.5$ ,  $p = 0.02$ .

#### *Approximate placement of Tables 3 & 4*

### **Women's nutrition education preferences**

Over half (54.9%) AN women and 39.6% of PN women were interested in receiving AN nutrition education and 41.6% of PN would were interested in PN education. Two-thirds of the AN women surveyed (62.5%) recalled receiving basic nutrition information from the ANC, with 20.7% of those wanting further information. Of the 73.7% (244) of women who were not aware of any MHH nutrition services, half

indicated a preference for dietetic input during pregnancy. Topics of interest included: healthy eating for pregnancy, weight management during and after pregnancy, vegetarian/vegan information, breastfeeding information, morning sickness, Listeria, heart burn, practical food ideas, and a resource to help them monitor their progress in meeting lifestyle targets. Less than half of the PN women surveyed (43.6%) reported awareness of the MHH Dietetic service, and 40% of these women would have liked to have seen a dietitian during pregnancy. Only 9.9% of PN women had seen the MHH dietitian.

The preference for AN education delivery options of the AN women were individual consultations (35%), written information (31.7%), workshop (16.2%), and lectures (16.2%). Similarly, the PN women preferred individual consultations (72.5%), workshops (27.5%), and lectures (20%) for AN education. There was no clear preference given for session lengths, day of the week and time of the day. Half of all AN women indicated that they would have liked to have received nutrition information when they first found out they were pregnant, 29.9% when they first attended antenatal clinic, and 15.9% either of these times.

Preferences for PN education delivery options were individual consultations (78.6%), lectures (31%), discussion groups (14.2%), and workshops (14.2%), with 30 or 60 minutes more popular than 45 minutes. Most women wanted this information as an inpatient (73.8%), with fewer interested in returning to the hospital (38.1%) or a community location (50%). The main topic of interest was information on good nutrition for breastfeeding. A smaller percentage of women requested information on infant nutrition, weight loss, and quick, nutritious meals.

## **Discussion**

This study's purpose was to inform the MHH's Dietetic service development through benchmarking Australian MH Dietetic services and surveying MHH AN and PN patients to investigate their nutrition-related behaviours, attitudes, and knowledge and nutrition education preferences and service awareness.

### **Service benchmarking survey**

Current MH Dietetic practice is unlikely to provide the best nutrition support for women. For example, assuming the best resourced service (2.4FTEs) is in the busiest hospital (7,500 births), each FTE dietitian would be responsible for delivery of individual nutrition care to 3,125 women each year. Considering the high response rate for this survey, the results are likely to be representative of Australian MH Dietetic services. Therefore greater numbers of MH dietitians, in combination with new models of care in nutrition and MH, including referral guidelines, are required.

### **Nutrition behaviours, attitudes and knowledge**

Women's overall diet quality was relatively poor and the women surveyed consumed less than half of the recommended serves of fruit and vegetables for pregnancy<sup>18</sup>. Sufficient fruit and vegetable intake has been proposed as the most important public health message for the decrease of chronic disease<sup>19</sup>. Thus, the low prevalence of women meeting the guidelines warrants further attention. Future studies may also investigate total dietary intake during pregnancy to determine overall adequacy compared with dietary guidelines.

Over one third of women in this study were overweight or obese at the beginning of pregnancy. This is a similar proportion to a large retrospective study at

the MHH in 2006<sup>20</sup>, and more recently, from the MHH database from May 2007-2008.

There are strong links between awareness of weight gain guidelines and correct healthy weight gain for pregnancy<sup>21,22</sup>. Current ANC practice does not include routine weight monitoring during pregnancy or discussion of weight gain guidelines.

Anecdotally, ANC health professionals report limited confidence in addressing weight management during pregnancy, thus training of these staff by dietitians has great potential to empower maternal health staff with which they work and disseminate important nutrition-related messages.

A large proportion of women from all pre-pregnancy BMI groups gained above their IOM recommended weight gain for pregnancy (both the guidelines current during the study and new 2009 guidelines)<sup>17,29</sup>. This excessive weight gain has major implications for maternal and infant health outcomes, and costs to the health service<sup>20</sup>. Furthermore, only half the women surveyed felt it was very important to return to their pre-pregnancy weight. Excessive weight gain during pregnancy can lead to postpartum weight retention and is associated with an increased risk of chronic disease<sup>11</sup>. Thus, it is important for health professionals to raise women's awareness of pregnancy weight gain guidelines and risks associated with excessive weight gain to encourage appropriate pregnancy weight gain.

The AN and PN surveys had lower than desirable response rates. However, no woman declined participation in the AN survey, and the PN survey distribution was limited by practical resources of the survey delivery method. Further, both study populations' sample ages and BMI categories reflect the larger MHH population during the study period. Whilst the lower response rate may have provided less information

with which to inform our service planning, the representative sample and interest in the survey suggests this study's findings can be generalised to the wider MHH population, but care must be taken when relating them to other services.

### **Women's needs and preferences**

Few AN women and approximately half of the PN women were aware of the MHH Dietetic service. Few had accessed a MHH dietitian during their pregnancy, suggesting a need for greater promotion of available nutrition services and guidelines for referral.

### **Informing service development**

The continuum of preconception, AN, PN, and internatal care is an ideal time to implement nutrition health behaviour changes, with the potential to influence the health of two generations<sup>9,10</sup>. For the greatest health benefits, women need specific information prior to and during the very early stages of pregnancy (e.g. folate consumption; Polycystic Ovary Syndrome and fertility, weight gain guidelines)<sup>6, 21,22,23,29</sup>, as well as information on a balanced diet. Current pregnancy care guidelines recommend that all pregnant women receive advice about the important factors which may influence pregnancy outcomes<sup>24,25,38</sup>. As the majority of women are in contact with the health service for AN care<sup>26</sup> and women are more receptive to health messages during pregnancy<sup>27,28</sup> this is an opportune time to reach women. However, greater resources and better models of nutrition care are required to facilitate these changes.

Not all services along this continuum can be provided by hospitals within current Nutrition and Dietetic FTEs or would be considered as a maternal hospital's

core business. However, this is a great opportunity for MH Dietitian/Nutritionists to reorientate the available resources and apply them to services that have demonstrated influence on maternal and infant health outcomes (e.g. delivery of and support for correct pregnancy weight gain (advice), healthy nutrition advice, and good diabetes control<sup>14,15,18,21,22,29</sup>). This, in addition to advocating for more resources and services, *and/or* collaborating with others who can assist Dietitian/Nutritionists in delivering nutrition messages (E.g. midwifery health promotion<sup>30,31</sup>; GDM teams<sup>15</sup>; engagement of community health care providers<sup>10</sup>; university researchers for more rigorous program evaluation) which may improve MH services.

#### **Nutrition-related services and nutrition education initiatives**

The importance of good nutrition during pregnancy has been well documented<sup>1-9,18,32-34,38</sup>. However, beyond diabetes management<sup>14,15</sup>, limited literature exists about effective methods of delivering important pregnancy-related healthy lifestyle information. The application of a patient self-management framework, such as the '5As' (in use by the state health service for other health behaviours<sup>35</sup>), can assist dietitians support patients in health behaviour change<sup>36</sup>. The framework provides structure for identifying those who are at most risk and in need of intervention (Assess); for directing information-sharing that is suitable for an individual's readiness for change (Advise); for guiding evidence based behaviour change (Agree); and eliciting behavioural changes through the organisation of ongoing support (Assist and Arrange). The 5As is an ideal, evidence-based structure to deliver MH nutrition education due to staff familiarity with this program format.

A new model of care evolving from synthesis of these audit findings, women's preferences, and the literature requires a balance between innovation, consumer needs and service practicalities. For example, it is important to acknowledge that low staffing levels prevents meeting women's preferences for individual consultations for antenatal education. Group education (which is more efficient and can be as effective as individual consultations in the delivery of health care<sup>37</sup>) still meets women's education needs. A service restructure in MH may include programs designed and delivered according to the 5As principles, including:

- improved marketing of the MH Dietetic services and referral guidelines to target women most in need of Dietetic services,
- improved nutrition resources to distribute to women at their first ANC visit,
- a workshop for all women to access during very early pregnancy,
- a postnatal program to support women's awareness of and ability to adopt healthy nutrition behaviours, and
- an integrated AN and PN weight management program.

## **Conclusion**

This paper described publicly-funded Australian tertiary MH Dietetic services and explored MHH patients' nutritional behaviours, attitudes, and knowledge. Women's nutrition education preferences and service awareness to inform MHH Dietetic service delivery, was also explored. Considerable staffing level and service variation was identified throughout Australia. The MHH's Nutrition and Dietetic service compares well with the current services across Australia. However, across all services there is an identified role for MH Dietitian/Nutritionists to advocate for better staffing

and for development, implementation and evaluation of services (and models of care) to influence preconception, antenatal and postnatal nutrition. Despite the perceived importance of nutrition during pregnancy, women's diets were of relatively poor quality and women's knowledge of the recommended pregnancy weight gain range was limited. In addition, a large proportion of women gained weight in excess of the recommended IOM guidelines. There was poor awareness of, and access to, the MHH Dietetic services and, therefore, areas for nutrition education improvement were identified. These results can be used to improve the profile and content of not only the MHH, but all MH Dietetic services, and to compare the effectiveness of new programs following their implementation.

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Table 1. Summary of Dietetic staffing levels, referral processes and service types in Australian maternal health hospitals.

Births/ year	Hospitals (n)	FTE/ hours	Referrals for inpatients from:	Referrals for outpatients from:	Details of services provided by type
>5000	3	0.5-2.4 (19-91 hours/ week)	n = 2 = medical, nursing, allied health (AH) n = 1 = other AH n = 1 = screens for higher nutritional needs n = 1 = sees on special diets	n = 2 = blanket referrals for young, drug and alcohol, and multiple foetus women n = 2 = GPs for "shared care" n = 3 = GDM patients using care pathways and guidelines	<b>Preconception</b> n = 1 = nil service n = 2 = individual outpatient; <b>minimal - 2 ½hours/week</b> , including <b>1 hr/week</b> in a 6 week MD group for women with diabetes using insulin <b>Antenatal (not including GDM)</b> n = 3 = <b>11-60 hours/week</b> , individual inpatients /outpatients <b>GDM</b> n = 3 = individual consultations (1 in MD clinic), <b>6-22hours/week</b> <b>Postnatal</b> n = 2 = nil service n = 1 = general inpatients/outpatients, <b>~2 hours/week</b>
3500- 5000	3	0.2-0.5 FTE (7.75-19 hours/ week)	n = 3 = medical and nursing staff n = 1 = menu monitors	n = 3= medical and nursing	<b>Preconception</b> n = 1, individual outpatients, <b>½ hour/week</b> <b>Antenatal (not including GDM)</b> n = 3 = inpatients/outpatients, <b>1-8 hours/week</b> <b>GDM</b> n = 2 = group education + individual (MD or own clinic), <b>½ -6hours/week</b> n = 1, individual consultation (inpatient or MD clinic), <b>10hours/week</b> <b>Postnatal</b> n = 3, inpatient/outpatients, <b>1 -1½ hours/week</b>
< 3500	3	0.1-0.3 FTE (3.4-10.2 hours/ week)	n = 3 = medical and nursing staff	n = 1 = blanket referrals for GDM n = 1 = from medical/nursing staff and GPs n = 1 = medical and nursing, with GDMs referred to Diabetes Australia	<b>Preconception</b> n = 3= nil service <b>Antenatal (not including GDM)</b> n = 2, <b>~1-2 hours/week</b> n = 1, 1 week in 6 week group <b>GDM</b> n = 3, MD clinic, individual, <b>2-4½ hours/week</b> , <b>Postnatal</b> n = 1, <b>1 hr/week</b> n = 2, nil

GDM: gestational diabetes mellitus; GP: general practice; FTE: full time equivalents; MD: multidisciplin

Table 2. Demographic, anthropometric and pregnancy profile of the study population.

	Antenatal study sample Percentage (n)	Postnatal study sample Percentage (n)	Maternal Health Hospital population
<b>Age group</b>			
<20 years	5.2% (16)	2.0% (2) <sup>†</sup>	7.2% (54) [3.9% (29)] <sup>†</sup>
20-30	58.6% (181)	56.4% (57) <sup>†</sup>	57.1% (430) [60.4% (455)] <sup>†</sup>
31-40	33.3% (103)	36.6% (37)	34.4% (259)
>41 years	1.3% (4)	5.0% (5)	1.3% (10)
<b>BMI (kg/m<sup>2</sup>)</b>			
Average (range)	25.1 ± 2.9 (15.9-47.8)	25.2 ± 5.5 (16.4-42.6)	
<19.7	15.2% (47)	11.9% (12)	23.4% (176)
19.8-25.9	44.0% (136)	42.6% (43)	45.6% (343)
26-29.9	15.9% (49)	20.8% (21)	13.4% (101)
30-34.9	11.6% (36)	8% (8)	8.4% (63)
35-39.9	4.8% (15)	4%(4)	3.7% (28)
>40	1.6% (5)	2%(2)	3.6% (27)
<b>Pre-pregnancy weight (kg) (range)</b>	n/a	68.0 ± 15.5 (42-123)	
<b>Pregnancy weight gain (kg) (range)</b>	n/a	14.1 ± 6.7 (-9 to 28)	
<b>Week of gestation</b>			
0-12	0		-
13-24	25.9% (80)	n/a	-
25-36+	72.2% (223)		-
<b>Multiple pregnancy</b>	n = 1 (triplets)	n = 0	
<b>Median days since delivery</b>	n/a	2.0 (IQR 2-3)	2.2
<b>Breastfeeding</b>	n/a	92% = yes	
<b>Number of children</b>			
0	50.8% (157)	0%	-
1	26.9% (82)	50.5% (51)	-
2	12.9% (40)	31.7% (32)	-
>2	5.2% (16)	14.9% (15)	-

<sup>†</sup> age ranges for PN were <19years and 19-30years, instead of < 20year and 20-30 years

Table 3. Weight gain patterns according to pre-pregnancy BMI ranges [1].

Pre-pregnancy BMI range (kg/m <sup>2</sup> )	Insufficient weight gain (n)	Correct weight gain (n)	Excessive weight gain (n)
<19.7	8.3% (1)	<b>58.3% (7)</b>	33.3% (4)
19.8-25.9	32.6% (14)	23.3% (10)	<b>35.7%‡ (15)</b>
26-29.9	19.0% (4)	33.3% (7)	<b>47.6% (10)</b>
>30-34.9	25.0% (2)	0%(0)	<b>75.0% (6)</b>
35-39.9	0% (0)	0%(0)	<b>100% (4)</b>
>40	0% (0)	0%(0)	<b>100% (2)</b>

‡NB One 'multiple pregnancy' participant has been excluded from the comparison. However, her weight gain was at the upper limit of normal, compared with recommended guidelines.<sup>38</sup>

Table 4. Antenatal and postnatal women's dietary and nutrition-related behaviours.

		Antenatal study sample	Postnatal study sample
Diet quality <sup>16</sup>	Fruit serves	2.1 ± 1.2	1.9 ± 1.1
	Vegetable serves	2.2 ± 1.3	2.2 ± 1.2
	Dairy serves	2.2 ± 1.2	2.0 ± 1.0
Are you aware of Listeria?		Yes = 75.4%	n/a
Importance of eating well		4.3 ± 0.9	4.7 ± 0.6
Importance of returning to pre-pregnancy weight		n/a	4.0 ± 1.3