12-1-2005

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Published in final edited form as:
Clin Excell Nurse Pract. 2005 December 1; 9(4): 195–201.

Weight Gain in High-Risk Pregnant Women: Comparison by Primary Diagnosis and Type of Care

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Abstract

Reasonable weight gain in pregnancy is essential for the health of the woman and fetus. The purpose of this secondary analysis was to examine patterns of prenatal weight gain in women with diabetes and hypertension using data from a randomized controlled trial examining physician-only (n = 29) versus APN and physician-delivered (n = 38) prenatal care. Data collection included gestational age at enrollment, delivery, diagnosis (diabetes, hypertension), prepregnancy body mass index (BMI), weight every 4 weeks during pregnancy, and total weight gain during pregnancy. Based on prepregnancy BMI, 21% of the sample was normal weight, 16% overweight, and 63% obese. There were no significant differences between physician versus APN and physician prenatal care and weight gained during pregnancy; the trend in favor of APN and physician care was evident. For women entering pregnancy with a chronic health condition, compounded by obesity, education on nutrition, diet, and behavioral modification is essential.

Keywords

high-risk pregnancy; obesity; weight gain

Reasonable weight gain in pregnancy is important for the health of the woman and the growing fetus. This is especially true for women at high risk for pregnancy complications such as those with hypertension and diabetes mellitus. Excessive weight gain for pregnant women with these health conditions or diabetes and hypertension can result in increased fluid load, polyhydramnios, and increased stress on the cardiovascular system for the

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woman, and macrosomia and intrauterine growth restriction for the fetus (Ray, Vermeulen, Shapiro, & Kenshole, 2001). While these risks have been documented, the literature on the actual patterns of weight gain in women with these risk factors is limited.

Review of the Literature

Weight Gain in Pregnancy

Adequate nutrition and weight gain during pregnancy have long been important components of prenatal care, especially for women with preexisting health problems. The recommended amount of weight gain during pregnancy has changed over time. In 1990, the Institute of Medicine of the National Academy of Sciences recommended weight-gain parameters for pregnant women based on prepregnancy body mass index (BMI). BMI is calculated by dividing weight (kg) by height (m) squared. Recommended weight-gain parameters for pregnant women are as follows: for underweight women, (BMI < 19.8 kg/m^2), 28 to 40 pounds; for normal weight women (BMI of 19.8 to 26 kg/m^2), 25 to 35 pounds; for overweight women (BMI > 26 kg/m^2), 15 to 25 pounds (Institute of Medicine, 1990).

Strychar and colleagues (2000) compared maternal weight gain patterns with recommendations to determine factors associated with gaining recommended, insufficient, or excessive amounts of weight during pregnancy. Results indicated that women who had excessive weight gains had a higher prepregnancy BMI, had not spoken with a physician about weight gain at the time of first interview, and were less knowledgeable about the importance of not gaining excessive weight during pregnancy.

In their sample of 1,661 pregnant women, Cogswell and colleagues (1999) found that 27% of the women received no advice on weight gain, 14% were advised to gain less than the recommended weight, and 22% were advised to gain more than the recommended weight, including women who were already overweight.

Pregnancy Weight Gain and Diabetes Mellitus

Diabetes mellitus (pregestational and gestational) is one of the most common health disorders in pregnancy, occurring in between 3% and 10% of all pregnancies (Gilbert & Harmon, 2003). Weight gain, diet, and blood sugar levels need to be closely monitored for the health and well-being of both mother and fetus. Research by Ray and colleagues (2001) demonstrated that increased weight gain in pregnancy was associated with increased incidence of cesarean birth (increasing progressively with higher prepregnancy BMI), hypertension in pregnancy, preeclampsia, increased preterm birth, and fetal death. Limiting weight gain to recommended parameters in gestational diabetes was effective in reducing adverse events within the obese group of women studied. In addition, in women with pregestational or gestational diabetes, prepregnancy obesity was found to be strongly associated with macrosomia (> 4,000 gm birth weight) and preterm birth (< 37 weeks gestation).

Research by Scholl and colleagues (2001) demonstrated that increases in maternal glucose concentrations are related to maternal and fetal weight gain. Glucose easily passes the placenta and is more available for growth of the fetus. This is especially important in women who are overweight at the beginning of pregnancy. Women with pregestational BMI greater than or equal to 30 kg/m^2 have a nearly four times higher incidence of macrosomic fetal outcomes. Other investigators have reported similar findings (Van Wootten & Turner, 2002; Zamorski & Biggs, 2001).

Recommendations for pregnant women with diabetes include carefully monitoring caloric intake and blood sugar levels, and increasing dietary fiber which reduces insulin

requirements (Kalkwarf, Khoury, Gouge, & Miodovnik, 2001). In addition, exercise during pregnancy increases insulin sensitivity and glucose uptake (Thomas-Doberson, 1999).

Pregnancy Weight Gain and Hypertension

Hypertension complicates 10% of all pregnancies and is associated with perinatal mortality, intrauterine growth restriction, preterm birth and maternal death. Hypertension includes chronic hypertension that predates the pregnancy and hypertension that appears during the pregnancy (pregnancy-induced hypertension or PIH, gestational hypertension, and preeclampsia). Hypertension has the lowest incidence among young White women and the highest incidence among African American women (Chames & Sibai, 2001; Kurdas, 2001). Control of weight gain is important in pregnant women with hypertension to prevent added stress on the cardiovascular system.

Saftlas and colleagues (2000) analyzed the effect of prepregnancy BMI and weight gain during pregnancy on risk of preeclampsia and transient hypertension (hypertension late in pregnancy without the signs of preeclampsia). They found that obese women had a mildly increased risk of preeclampsia, and women in the other BMI categories had risks similar to those of normal BMI groups. In contrast, risk or transient hypertension was increased among obese women and was twofold among women in the highest quartile of the weight gain index.

Chronic hypertension is a complication in up to 5% of all pregnancies. Work by Chames and Sibai (2001) indicates that 10% of pregnant women with chronic hypertension will develop superimposed hypertension during the pregnancy. Chronic hypertension prior to pregnancy requires planning for lifestyle changes that pregnancy may require. If obesity is the condition causing the hypertension, weight reduction prior to pregnancy would be beneficial. Weight loss of as little as 10 pounds, in nonpregnant adults, reduces blood pressure in a large portion of overweight people with hypertension and can significantly enhance the effect of antihypertensive medication (Meredith, Miller, & Renfro, 2000). However, results of research in pregnant women with chronic hypertension discourage aerobic exercise during pregnancy and does not recommend weight reduction even for obese women (Kurdas, 2001).

In summary, weight gain is important in pregnancy for the health of the mother and developing fetus. Excessive weight gain is associated with increases in the incidence of diabetes and hypertension during pregnancy and with fetal complications including macrosomia and preterm birth. Research on adherence to recommended weight gain during pregnancy, especially in women with pregnancies complicated by diabetes and hypertension, is limited. The purpose of this study is to add to this body of knowledge.

Study Purpose

Original Clinical Trial

This study is a secondary analysis from a randomized clinical trial that tested the effects of substituting half of usual physician prenatal care with prenatal care delivered by advanced practice nurses (APNs) in the women’s homes on patient outcomes and health care costs (Brooten et al., 2001). As part of that care, each woman received individual counseling on nutrition and weight gain by the APNs. The total sample consisted of women with pregestational diabetes, gestational diabetes, and chronic hypertension, and women with diagnosed preterm labor or at high risk of preterm labor. A control group of women received usual physician prenatal and postpartum care. The intervention group of women received APN prenatal care in their homes replacing half of the usual physician office or clinic prenatal visits (e.g., for weekly visits, every other visit was an APN home visit). The

intervention group was scheduled to receive the same number of prenatal visits as the control group. The intervention group also received one postpartum home visit by the APN.

Study results demonstrated lower infant/fetal mortality (2 vs. 9) compared to usual care, 11 fewer preterm infants, more twin pregnancies carried to term (77.7% vs. 33.3%), fewer prenatal hospitalizations (41 vs. 49), fewer infant rehospitalizations (18 vs. 24), and a savings of more than 750 total hospital days and approximately $2.5 million (Brooten et al., 2001).

Secondary Analysis

The purpose of this secondary analysis was to examine patterns of weight gain in women with high-risk pregnancies, half of whom received routine physician-delivered prenatal care and APN prenatal care and half of whom received only routine physician-delivered prenatal care. The study was designed to answer the following research questions:

1. What are the patterns of weight gain in women with high-risk pregnancies receiving routine physician prenatal care compared to those receiving routine physician prenatal care and APN prenatal care?
2. In which of these two methods of prenatal care delivery is the weight gain closest to the recommended parameters put forth by the Institute of Medicine (IOM)?
3. In which high risk group of women (diabetes or hypertension) is the weight gain closest to the recommended parameters put forth by the IOM?

METHODS

Sample

Women in the original trial with the primary diagnosis of preterm labor, at high risk of preterm labor, and multiple pregnancies were excluded from this secondary analysis due to early deliveries. The number of women from the original trial, with the primary diagnosis of gestational or pregestational diabetes or chronic hypertension, was 77. Five women were excluded due to missing prepregnancy data on height and weight which did not allow classification of BMI. Two women were excluded due to multiple pregnancies. Three women were excluded because of young age (< 18 years) which confounded pregnancy weight recommendations.

The remaining sample of 67 women consisted of 38 women with diabetes (22 physician vs. 16 APN and physician) and 29 women with chronic hypertension (16 physician vs. 13 APN and physician). Thirty-eight of the women received traditional physician prenatal care, and 29 received APN and physician care.

The mean age of the women in the total sample was 29.7 (*SD* = 5.90) with a range of 18 to 40 years. Eighty-seven percent of the total sample were African American and 7.5% were White. The mean gestational age at delivery was 37.6 weeks (*SD* = 3.26) with a range of 25–41 weeks. There were no significant differences between control and experimental groups in age, race, and gestational age at enrollment in the study or at delivery (see Table 1).

Measures

A standard data form was used which captured women's gestational age at enrollment in the original study, gestational age at delivery, estimated date of confinement (EDC), diagnosis (pregestational diabetes mellitus, gestational diabetes mellitus, chronic hypertension), weight gain recommendation as per 1990 IOM guidelines, prepregnancy weight and height, prepregnancy BMI, weight every 4 weeks from date of enrollment, weight at delivery, actual

weight gain during pregnancy (from prepregnancy to delivery), and group assignment (control or intervention). Data were extracted from each chart by one of three master's nursing students. Interrater reliability was established and maintained by having each master's nursing student review every 10th log independently and compare coding. Interrater reliability was maintained at 85%.

RESULTS

Prepregnancy BMI

Each woman was classified according to BMI based on prepregnancy weight and height. According to the IOM, BMI ranges are as follows: normal BMI 19.8 to 26.0, underweight BMI < 19.8, overweight BMI 26.1 to 29.0, and obese > 29.1. Fourteen women (21%) in the sample were classified as normal weight (BMI Group 1), 11 (16%) were classified as overweight (BMI Group 3), and 42 (63%) were classified as obese (BMI Group 4). No women in the sample met the criteria for being underweight (BMI Group 2). The 38 women in the traditional physician care group fell into the following BMI groups: 9 (24%) normal, 5 (13%) overweight, 24 (63%) obese. The 29 women in the APN and physician care group were as follows: 5 (17%) normal, 6 (21%) overweight, 18 (62%) obese. Proportions of the sample in each BMI group were not statistically different by type of care (APN and physician vs. physician only), χ^2 (2, N = 67) = .90, p = *ns.*

Weight Gain by APN and Physician Versus Physician Care

Patterns of weight gain for both physician-only care and APN and physician care were examined for total weight gained through the course of pregnancy as well as weight gained by trimester (see Table 2). Total weight gain and weight gained by trimester were then compared to recommendations on total and trimester weight gain recommended by the IOM report (see Table 3).

The proportions of women whose weight gain exceeded recommendations were similar in the physician-only group and the APN and physician group, χ^2 (1, N = 67) = 1.48, p = *ns.* Of the 24 (63%) women in the physician-only prenatal care group who exceeded the IOM recommendations on total weight gain, 7 were in the normal BMI group, 2 in the overweight group, and 15 in the obese group. Of the 14 (48%) women in the APN and physician care group who exceeded the IOM recommendations, 2 were in the normal BMI group, 3 in the overweight group, and 9 in the obese group.

Based on the 3 trimesters of pregnancy, 11 (29%) of the women in the physician care group exceeded the recommendations in the first trimester compared to 6 (21 %) of the APN and physician care women. In the second trimester, 20 (53%) of the women in the physician care group exceeded the recommendations compared to 15 (52%) of the APN and physician group. In the third trimester, 12 (32%) of the physician group exceeded the recommendations for weight gain compared to 7 (24%) of the women in the APN and physician group. There was no significant difference in total weight gain or weight gain by trimester between the experimental and control group. Fortunately there was no significant difference in the proportion of preterm infants either by type of care, χ^2 (1, N = 67) = .09, p = *ns*, or by whether the mother exceeded IOM weight-gain recommendations during pregnancy, χ^2 (1, N = 67) = .80, p = *ns.*

Weight Gain by Diagnosis

In examining weight gain by diagnostic group, 16 (55%) women with hypertension and 22 (58%) with diabetes exceeded the IOM recommendations on total weight gain (see Table 2). When examining the data by trimesters, 8 (28%) women with hypertension and 9 (24%)

with diabetes exceeded the recommendations in the first trimester. In the second trimester, 16 (55%) women with hypertension and 19 (50%) women with diabetes exceeded the recommendations. In the third trimester, 6 (22%) women with hypertension and 13 (34%) women with diabetes exceeded the recommendations. In comparing groups by diagnosis, there were no significant differences in the numbers of women exceeding IOM recommendations in total weight gained or weight gained by trimester.

DISCUSSION

Study results demonstrated several important points for clinical care of high-risk pregnant women. First, based on prepregnancy weight and height, only 21% of the sample was classified as normal weight, while 16% were overweight and 63% were obese. Thus 79% of the sample entered pregnancy with health conditions that physiologically tax the well-being of both the woman and fetus. In addition, many of these women entered pregnancy with chronic health problems of diabetes and chronic hypertension. Prepregnancy counseling on nutrition and weight reduction prior to becoming pregnant would potentially reduce risks of superimposed hypertension, severe stress on the cardiovascular system, and hyperglycemia, all threats to maternal and fetal well-being, especially in women who are obese.

While there was no statistically significant difference between type of prenatal care (physician vs. APN and physician) and weight gained during pregnancy, the trend in favor of APN and physician care was evident. In women receiving physician prenatal care, 63% exceeded IOM recommendations on total weight gain in pregnancy compared to 48% of women receiving APN and physician care. In addition, the mean total weight gain and mean weight gain in all but the second trimester was less in the APN and physician care group compared to physician care only. Although well over IOM recommendations for total weight gain, maximum total weight gain by women receiving APN and physician care was 73 pounds compared to 83 pounds for physician care. Maximum trimester weight gain was similarly skewed in favor of APN and physician care with maximum gains of 8 versus 18 pounds in the first trimester, 31.5 versus 35 in the second, and 23 versus 51 pounds in the third trimester. Conceivably statistical significance might be reached with a larger sample.

Recommendations

Obesity is reaching epidemic proportions in this country. The need for education on nutrition, diet, weight reduction, and weight maintenance is critical for the health of all. Results of this study demonstrate the need for such education before pregnancy to reduce the physiologic burden on mother and fetus. For those women entering pregnancy with a chronic health condition compounded by obesity, education on nutrition, diet, and behavioral modification becomes even more important.

One of the biggest challenges for nurse clinicians is how to provide such education within the time constraints of daily practice. Videos on nutrition, diet, and simple and effective ways to reduce high-fat, high-salt, and high-carbohydrate foods can be shown in the clinic and office settings. These aids can help without adding to the clinician’s time. Such videos are available commercially from health departments and from pharmaceutical, formula, and similar companies as well as professional organizations. Written materials are also available from these same sources.

High school and college students can augment the clinician’s workforce. Students majoring in communication and marketing can develop or customize videos and make wall displays, brochures, and pamphlets to meet college course requirements. Students in nursing and nutrition can provide educational sessions for women before and during pregnancy on nutrition, diet, weight gain, and behavioral modification as part of their clinical practicum

experiences. High school students in need of community service hours may also be another source of help. Developing and testing the most time-efficient, effective, and acceptable methods for offering this education is an important area for research.

Acknowledgments

The original study was supported by grant #R01 NR02897 from the National Institute of Nursing Research, National Institutes of Health.

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TABLE 1

Age, Race, and Gestational Age at Enrollment and Delivery

	Physician Only	APN & Physician	Statistic*
Maternal age [*M* (*SD*)]	28.9 (6.31)	30.9 (5.19)	$t = 1.34$
Maternal race [*N* (%)]			$\chi^2 = 1.16$
Black	34 (89.5%)	27 (93.2%)	
White	4 (10.5%)	1 (3.4%)	
Other	0 (0%)	1 (3.4%)	
Gestational age at enrollment [*M* (*SD*)]	20.4 (9.25)	21.6 (7.69)	$t = 0.54$
Gestational age at delivery [*M* (*SD*)]	37.8 (3.05)	37.3 (3.53)	$t = 0.70$

* $p > .05$ (none of the comparisons were statistically significant).

TABLE 2

Patterns of Weight Gain by Group

		Physician Only	APN & Physician	*t* Value*
Prepregnancy weight	*M* (*SD*)	182.0 (42.65)	193.3 (51.29)	0.91
	Range	120 to 292 lbs	116 to 325 lbs	
Total pregnancy weight gain	*M* (*SD*)	31.2 (22.80)	26.0 (18.73)	0.91
	Range	−11 to 83 lbs	3 to 73 lbs	
Weight gain, 1st trimester	*M* (*SD*)	1.4 (4.95)	0.5 (2.33)	0.87
	Range	−7.5 to 18 lbs	−3 to 8 lbs	
Weight gain, 2nd trimester	*M* (*SD*)	10.5 (11.54)	10.6 (8.13)	0.07
	Range	−21 to 35 lbs	−1 to 31.5 lbs	
Weight gain, 3rd trimester	*M* (*SD*)	8.3 (10.87)	5.6 (7.12)	1.12
	Range	−10 to 51 lbs	−7 to 23 lbs	

* $p > .05$ (none of the comparisons were statistically significant).

TABLE 3

Patterns of Recommended Weight Gain by Type of Care, Trimester, and BMI Group

	Physician Only			APN & Physician		
	Less Than Recommended	**As Recommended**	**Exceeded Recommended**	**Less Than Recommended**	**As Recommended**	**Exceeded Recommended**
Normal BMI (9 physician, 5 APN & physician)						
Total weight gain	1	1	7	2	1	2
1st trimester	6	0	3	5	0	0
2nd trimester	2	1	6	3	0	2
3rd trimester	5	1	3	3	0	2
Overweight BMI (5 physician, 6 APN & physician)						
Total weight gain	3	0	2	2	1	3
1st trimester	4	0	1	4	0	2
2nd trimester	3	1	1	3	0	3
3rd trimester	4	0	1	2	1	3
Obese BMI (24 physician, 18 APN & physician)						
Total weight gain	6	3	15	4	5	9
1st trimester	16	1	7	14	0	4
2nd trimester	7	4	3	6	2	10
3rd trimester	13	3	8	12	4	2

Clin Excell Nurse Pract. Author manuscript; available in PMC 2014 January 02.