# Do Low-Income Women Attain Their Pre-Pregnant Weight by the 6th Week of Postpartum?

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**Objectives:** To assess the proportion of women attaining pre-pregnant weight, and to ascertain the predictors of amount of retained weight at 6 weeks postpartum, in a tri-ethnic sample of low-income women.

**Design:** Short-term longitudinal design from post-delivery to 6 weeks postpartum.

**Participants:** 419 African-American, Hispanic, and White women receiving perinatal care funded by Medicaid.

**Main Outcome Variables:** Proportion of women attaining pre-pregnant weight at 6 weeks postpartum; the amount of weight retained at 6 weeks postpartum.

**Results:** Fifteen percent of women attained their pre-pregnant weight at 6 weeks postpartum. In multiple regression analysis, maternal weight gain during pregnancy was the predominant predictor (B=.88, SE=.02, P=.000). Hispanic ethnicity (B=.69, SE=.33, P=.039) and the interaction between maternal weight gain and gestational length (B=−.04, SE=.02, P=.032) made small, independent contributions to amount of retained weight at 6 weeks postpartum. The interaction of ethnicity and maternal age predicted 1.3% of the variance in retained weight, but this was not significant. Health practices were not associated significantly with the amount of weight retained at 6 weeks postpartum.

**Conclusions:** The majority of women did not return to their pre-pregnant weight by 6 weeks postpartum. The amount of retained weight after delivery is largely influenced by prenatal maternal weight gain. (*Ethn Dis.* 2004;14:119–126)

**Key Words:** Weight Gain, Postpartum, Pregnancy, African-American, Hispanic

## INTRODUCTION

Obstetric patients have traditionally been overlooked in health promotion and health education programs to prevent chronic illness in adults. Yet obesity,[1] and its related conditions of diabetes[2,3] and hypertension,[4] may first appear during pregnancy. Consequently, the epidemic of obesity in the United States[5,6] has highlighted the contribution that weight gain from pregnancy may make to obesity development.[7] Fat deposition is a substantial component of pregnancy-related weight gain in well-nourished women,[8] and 10% to 15% of women may retain weight gained during pregnancy on a long-term basis,[9–11] with some of those becoming obese.[1] Weight gain and obesity development in childbearing women are of concern, because numerous adverse health outcomes, such as hypertension, osteoarthritis, gall bladder disease, coronary heart disease, type 2 diabetes, and some cancers, have been tied to weight gain[12,13] and/or overweight and obesity in women.[14–16] Thus, assessment of return to pre-pregnant weight during postpartum warrants special attention, as do the predictors of the amount of weight retained by women after pregnancy. Because the time period around the 6-week postpartum check-up is usually the last episode of such care for most women in the United States, it may be a sentinel health marker of progress in losing pregnancy-related weight. This is especially important for low-income women, who may lack a regular source of health care after postpartum care ceases.

Furthermore, overweight and obesity are more prevalent among Hispanic (especially Mexican-American) and African-American women,[16,17] compared to White women. Paradoxically, the Centers for Disease Control and Prevention[18] report that African-American women and Hispanic women are more likely than White women to have inadequate weight gains in pregnancy. Still, by the latter half of the first postpartum year (or beyond), African-American women are more likely than White women to retain excessive weight from pregnancy.[10,19–21] For example, in the National Maternal and Infant Health Survey, 45% of African-American women, compared to 25% of White women, retained at least 9 lb (4.1 kg) at 10–18 months postpartum.[20] Furthermore, among normal weight childbearing women, 22% of Black women, compared to 8% of White women, had long-term weight gains of 20 lb (9.1 kg) or more above pre-pregnant weight.[10] Because most studies examining ethnic differences[10,19–21] have focused on long-term weight retention after pregnancy (beyond 6 months postpartum), a better understanding is needed of critical periods for weight retention at various intermediate time points between the end of pregnancy and 6 months postpartum.

For several reasons, this study focused on the period of the 6th week of postpartum. The 6th week of postpartum may be an opportune time to assess weight status after pregnancy, because it is usually the last pregnancy-related healthcare episode for many low-income women covered by Medicaid. Though women may continue to lose pregnancy-related weight across the first postpartum year, the rate of weight loss is greatest in the early postpartum months.[22–24] Furthermore, new mothers may face barriers to accessing health

*. . . the epidemic of obesity in the United States[5,6] has highlighted the contribution that weight gain from pregnancy may make to obesity development.[7]*

care after 6 weeks postpartum.[25] Therefore, the 6th week of postpartum affords a pivotal and accessible time for assessing post-pregnancy weight status, and for providing supportive interventions to aid women in need of postpartum weight management.

This study addressed 3 aims in a tri-ethnic sample of low-income women at 6 weeks postpartum. The first aim was to determine the proportion of women who attained their pre-pregnant weight at 6 weeks postpartum. The second aim was to determine demographic, obstetric, and anthropometric factors associated with the amount of weight retained at 6 weeks postpartum. The third was to assess whether health practices were associated with the amount of weight retained at 6 weeks postpartum.

## METHODS

### Sample, Measures, and Procedures

The current study is based on data from the Austin New Mothers Study (ANMS), a longitudinal study of postpartal weight in 560 low-income women with term, singleton, low risk pregnancies.[26] The subsample for this study includes those 556 of 560 cases who reported gaining weight during pregnancy, and omits the 4 cases who reported weighing less at the end of pregnancy than before. The ANMS, conducted in compliance with human subjects guidelines, included African-American, His-

panic, and White women who were at least 18 years of age, had a parity of 1 to 3, and had their perinatal care funded by Medicaid. Under provisions of Medicaid in Texas,[27] women in the ANMS received prenatal care from obstetricians in private practices through a regionalized managed care program. Women were recruited into the study in 1999–2001 during their postpartum stay at a tertiary-level community hospital. Of women eligible for the study, approximately two thirds were recruited to participate. Reasons for not recruiting women were early discharge before women could be approached, or disinterest in participation on the part of the women. A cash incentive was offered for study participation.

In the hospital, post-delivery weight was measured (Fairbanks Portable Digital Scale, Model No. HS100, Fairbanks Scales, Kansas City, Mo) and information on the following variables was abstracted from hospital charts: ethnicity, parity, gravidity, first prenatal weight, date of last menstrual period, and infant birth weight. The women completed a post-delivery questionnaire that included the following self-report variables related to this analysis: pre-pregnant weight, weight at the end of pregnancy, maternal height, ethnicity (with expanded Hispanic options), delivery method, feeding method, maternal age, education, and partner status. Length of gestation was abstracted from hospital charts on about two thirds of cases; the remainder were derived from menstrual dates in hospital charts or mothers' questionnaires, except for 6 cases requiring substitute values because of missing data. At the 6th week of postpartum, mothers visited a university research site for measurement of height and weight (to 0.1 kg). These visits occurred at a mean of 44.2 days (SD=5.5 days) after delivery. Participants also completed a 6-week follow-up questionnaire that included the following variables related to this analysis: infant feeding method, smoking status, employ-

ment outside the home, and the use of 7 weight management strategies, based in part on the qualitative work of Allan[28] (ignoring weight, skipping meals, joining a commercial program, using an over-the-counter meal replacement plan, eating less at meals, exercise, and other methods, left open-ended).

To validate self-reported pre-pregnant weights, 113 cases were identified that could be verified as having initial prenatal weights measured during the first 13 weeks of pregnancy. After omitting 2 cases that were extreme outliers, these measured first trimester weights averaged 2.88 kg (SD=3.97) higher than self-reported pre-pregnant weights. Mean duration of gestation at the time of first trimester weights for these 111 cases was 9.69 weeks (SD=2.11). The difference between pre-pregnant and first prenatal weights in our subsample approximates those in a controlled study of early pregnancy adaptations that included measured weights.[29] Based on IOM[30] criteria, the pre-pregnant weights of the 111 cases were distributed as follows: 11 were underweight (body mass index [BMI] less than 19.8), 53 were normal weight (BMI of 19.8 to 26), 13 were overweight (BMI from greater than 26 to 29), and 34 were obese (BMI greater than 29). Since there were few underweight or overweight women, 2 groups were formed for comparative analyses. Underweight/normal and overweight/obese women did not differ significantly with regard to mean pre-pregnancy/prenatal weight differences: 2.69 kg (SD=3.56) and 3.14 kg (SD=4.49), respectively ($t_{109}=-.589$, $P=.557$).

To validate self-reported weight just prior to delivery, we derived an expected pre-delivery weight from the sum of weight measured in the hospital at post-delivery, plus measured infant birth weight, plus a constant of 1.5 kg for weight of placental and amniotic products of conception.[8] Self-reported pre-delivery weights were 1.33 kg (SD=2.45) less than expected pre-delivery weights. The difference between these weights may

**Table 1. Comparison of included versus excluded cases**

| Characteristics | Included (N = 419) | Excluded (N = 137) |
|---|---|---|
| Gravidity | 2.4 ± 1.2 | 2.4 ± 1.1 |
| Parity | 1.9 ± 0.8 | 1.9 ± 0.7 |
| Age (y)* | 22.2 ± 3.8 | 22.6 ± 4.1 |
| Infant birth weight (g)* | 3377 ± 424 | 3309 ± 451 |
| Gestational weight gain (kg)* | 15.8 ± 7.1 | 17.2 ± 7.5 |
| Gestational length (wk)* | 39.3 ± 1.1 | 39.2 ± 1.1 |
| Pre-pregnant weight (kg)* | 66.9 ± 15.1 | 65.9 ± 15.8 |
| Pre-pregnant body mass index*† | 25.6 ± 6.0 | 25.1 ± 5.5 |
| Post-delivery weight (kg) | 79.1 ± 16.0 | 79.7 ± 17.4 |
| Ethnicity‡¶ | | |
| White (%) | 30.3 | 25.5 |
| African-American (%) | 24.1 | 40.1 |
| Hispanic (%) | 45.6 | 34.3 |
| Feeding method in hospital§ | | |
| Bottle feeding (%) | 40.6 | 51.9 |
| Combination (%) | 30.8 | 23.1 |
| Breastfeeding (%) | 28.6 | 25.0 |
| Living with spouse/partner§ | | |
| Yes (%) | 64.7 | 61.0 |
| No (%) | 35.3 | 39.0 |
| Delivery method§‖¶ | | |
| Vaginal (%) | 85.7 | 75.9 |
| Cesarean (%) | 14.3 | 24.1 |
| Education§ | | |
| Partial high school or less (%) | 42.8 | 50.5 |
| High school graduate or higher (%) | 57.2 | 49.5 |

Note: Sample characteristics are reported as percentages (%) or means ± standard deviations.

* Data were missing on 29 cases for maternal age, 1 for infant birth weight, 40 for gestational weight gain, 6 for gestational length, and 35 for self-reported pre-pregnant weight.

† BMI is based on self-reported weight and height.

‡ African-American women were more likely to be excluded than White or Hispanic women.

§ Data were missing on 29 cases for feeding method, 32 for partner status, 4 for delivery method, and 35 for maternal education.

‖ Women with cesarean deliveries were more likely to be excluded.

¶ $P<.01$.

weight outcomes in infants of obese women. Prenatal maternal weight gain was computed as gestational weight gain minus infant birth weight. Maternal weight gain, compared to gestational weight gain, has the advantage of more precisely reflecting the maternal component of prenatal changes in weight.

To compute attainment of pre-pregnant weight at the 6th week of postpartum, women were coded as attaining their pre-pregnant weight if their measured weight at the 6th postpartum week was less than or equal to their self-reported pre-pregnant weight; they were coded as exceeding their self-reported pre-pregnant weight if their measured weight at the 6th postpartum week was greater than their pre-pregnant weight. Finally, amount of retained weight was computed as weight at 6 weeks postpartum minus pre-pregnant weight.

Of the 556 cases meeting eligibility criteria for this study, 124 cases had no measured weight at 6 weeks postpartum, because of early drop out at the hospital ($N$=28), or failure to attend the 6-week follow-up visit ($N$=96); in addition, 13 other cases had missing self-reported pre-pregnant or pre-delivery weights. After excluding these 137 cases with missing weight data, the final sample for this study comprised 419 women. Of these, 127 were White, 101 African-American, and 191 Hispanic; among Hispanic women, 81% identified themselves as Mexican-American. Table 1 presents data comparing women who were excluded, with those included in the study sample, for analysis of the study aims. Further exploration showed that cesarean delivery was only associated with a higher level of attrition among African-American women. Furthermore, among African-American women, there was a trend for those who were excluded to be heavier post-delivery compared to those who were included, 85.2 kg vs 80.1 kg, respectively, ($F_{1,154}$=3.24, $P$=.074).

We also examined whether the included vs excluded subsamples differed

derive from the women confusing their earlier weight at their last prenatal visit with their pre-delivery weight, and slight weight gains in actual post-delivery weight related to intravenous fluids during labor and adaptive changes related to lactation.

## Computation of Weight-Related Variables

Pre-pregnant BMI was computed following IOM[30] criteria (see above). Gestational weight gain was computed as weight at the end of pregnancy minus pre-pregnant weight. Adequacy of gestational weight gain (gaining less than, more than, or as recommended, based on pre-pregnant BMI) was based on IOM[30] guidelines. The recommended range of gestational weight gain for underweight women is 12.5–18 kg, for normal weight women is 11.5–16 kg, for overweight women is 7.0–11.5, and for obese women is at least 7.0 kg. Because IOM guidelines for obese women do not give an upper limit for gestational weight gain, for purposes of statistical analysis we used the upper boundary for overweight women. This upper limit (11.5 kg) is congruent with findings of Bianco et al[31] regarding gestational weight gains for optimal birth-

on the 1990 IOM pre-pregnant BMI categories. The percentages of women included in the study who fell into the 1990 IOM pre-pregnant BMI categories of underweight, normal weight, overweight, and obese categories did not differ from those women excluded, and were similar to a 5-state WIC population.[32]

## Data Analysis

Descriptive data analysis methods were used to summarize all study variables. Continuous variables were described with means and standard deviations, and categorical variables with percentages. Bivariate relationships with retained weight at 6 weeks postpartum were evaluated using 2-tailed analysis of variance tests for categorical variables, and correlation tests for continuous variables. To build a preliminary multiple regression model to predict retained weight at 6 weeks postpartum, variables cited in prior literature[33] were considered, as were study variables with statistically significant bivariate relationships with retained weight. Therefore, the initial full model included maternal weight gain, pre-pregnant BMI, parity, maternal age, gestational length, and all possible 2-way interactions among these variables. To eliminate nonessential multicollinearity,[34] all continuous variables were centered about their sample mean, and interaction terms were formed using these centered variables.

Using SPSS GLM procedure with Type III sums of squares (version 11.0 Advanced Models; Statistical Package for the Social Sciences Inc., Chicago, Ill), intermediate models were formed based on estimated effect size. For this analysis, an effect size estimate is a more effective criterion than a *P* value, because it is not a function of the sample size (and thus the statistical power). In our multiple regression, the effect size as measured by partial eta squared is considered small if it is at least .01.[35] Ethnicity was retained in all models because of its inherent importance. The final

model, then, consisted only of effects considered inherently important, first-order effects involved in retained interactions, or effects with a partial eta squared greater than .01.[34,36,37] Acceptance of the final model was preceded by residual analysis.

## RESULTS

### Percent Attaining Pre-pregnant Weight at 6 Weeks Postpartum

For the 419 women in this study, 63 (15.0%) attained their pre-pregnant weight at 6 weeks postpartum. White (12.6%), African-American (12.9%), and Hispanic (17.8%) women did not differ significantly in the proportion attaining pre-pregnant weight by 6 weeks postpartum ($\chi^2_2=2.10$, $P=.349$). Gestational weight gains below, within, or above IOM guidelines were associated with attaining pre-pregnant weight ($\chi^2_2=105.19$, $P=.000$): 48.8% of women who gained below recommended limits attained their pre-pregnant weights compared to 14.3% and 2.3% for those who gained within and above guidelines, respectively.

### Factors Associated with the Amount of Retained Weight

Table 2 presents differences in amount of weight retained at 6 weeks postpartum based on demographic (maternal age, ethnicity, partner status, employment), obstetric (cesarean birth, parity, gestational length), and anthropometric factors (pre-pregnant body mass index categories, gestational weight gain categories). Because gravidity and parity were highly correlated ($r=.72$, $P<.001$), only associations between parity and amount of retained weight were explored. Table 2 demonstrates that pre-pregnant BMI categories and gestational weight gain categories were the only significant predictors of amount of retained weight. Obese women retained significantly less weight than normal weight and overweight women. For ad-

equacy of gestational weight gain, significant and progressively larger amounts of retained weight occurred as women gained below, within, or above recommended amounts during pregnancy. Of note, women who gained less weight than recommended during pregnancy, on average, weighed slightly less at 6 weeks postpartum than before pregnancy. Furthermore, when pre-pregnant BMI and prenatal maternal weight gain (which excluded infant birth weight) as continuous variables were correlated with the amount of retained weight at 6 weeks postpartum, $r$'s were $-.19$, $P=.000$, and .90, $P=.000$, respectively.

Maternal weight gain dominated the final regression model, uniquely accounting for 82% of the variance in retained weight. The coefficient (B=.88, SE=.02, $P=.000$) for maternal weight gain indicated that for women with otherwise identical values on the variables in the model, the predicted mean increase in retained weight was .88 kilograms for each one kilogram increase in maternal weight gain. When examined as a 3-level 2-*df* effect, ethnicity was not statistically significant ($P=.117$). However, the contrast between Hispanic and White women was statistically significant ($P=.039$). The coefficient (B=.69, SE=.33) for the effect of Hispanic ethnicity (vs White) indicated that for women with otherwise identical values on the variables in the model, the predicted mean increase in retained weight was .69 kilograms larger for Hispanic than for White women. The interaction effects between ethnicity and maternal age (Table 3) uniquely accounted for a small amount of the variance ($P=.066$, partial eta squared=.013), although it was not statistically significant. The interaction between maternal weight gain and gestational length (B=$-.04$, SE=.02, $P=.032$) made a small, but significant, contribution to the amount of the variance. Gestational length and maternal age had near zero first-order effect size estimates and were included in the final model because they were components of a retained interaction.

**Table 2. Amount of retained weight at 6 weeks postpartum by selected characteristics of women**

| Characteristics | N | Kg ± SD | P |
|---|---|---|---|
| Ethnicity | 419 | | .659 |
| White | 127 | 6.89 ± 6.77 | |
| African-American | 101 | 6.67 ± 6.22 | |
| Hispanic | 191 | 6.21 ± 7.02 | |
| Parity | 419 | | .229 |
| I | 151 | 7.24 ± 6.30 | |
| II | 160 | 5.93 ± 6.82 | |
| III | 108 | 6.41 ± 7.21 | |
| Gestational length | 419 | | .239 |
| 37–38 weeks | 93 | 5.60 ± 6.66 | |
| 39–40 weeks | 280 | 6.67 ± 6.84 | |
| 41–42 weeks | 46 | 7.52 ± 6.32 | |
| Age | 419 | | .120 |
| 18–22 y | 263 | 7.02 ± 6.77 | |
| 23–27 y | 113 | 5.47 ± 6.51 | |
| 28 or more y | 43 | 6.25 ± 7.10 | |
| Living with spouse/partner | 419 | | .737 |
| Yes | 271 | 6.61 ± 6.97 | |
| No | 148 | 6.38 ± 6.75 | |
| Employment | 419 | | .167 |
| No | 329 | 6.76 ± 6.89 | |
| Yes | 90 | 5.65 ± 6.17 | |
| Delivery method | 419 | | .964 |
| Vaginal | 359 | 6.53 ± 6.79 | |
| Cesarean | 60 | 6.49 ± 6.54 | |
| Pre-pregnant body mass categories | 419 | | .000 |
| Underweight | 36 | 6.43 ± 4.52 | |
| Normal weight | 213 | 7.21 ± 6.43* | |
| Overweight | 66 | 8.13 ± 8.51* | |
| Obese | 104 | 4.14 ± 6.23* | |
| Gestational weight categories‡ | 419 | | .000 |
| Less than recommended | 86 | −0.34 ± 3.44† | |
| Within recommended | 112 | 3.86 ± 3.45† | |
| More than recommended | 221 | 10.55 ± 6.14† | |

Note: Pre-pregnant weight categories are based on IOM classifications and were derived using measured height at 6 weeks postpartum.

\* Obese women differed significantly from normal and overweight women.

† All 3 groups differed significantly from each other.

‡ Controlling for gestational length made minimal differences in adjusted retained weights: −0.32, 3.89, and 10.53, respectively, for less than, within, or more than recommended gains.

## Health Practices and Amount of Retained Weight

Health practices were examined for statistically significant associations with amount of retained weight at 6 weeks postpartum. Although differences for infant feeding method were in the expected direction, with fully and partially breastfeeding women retaining less weight (5.8 kg and 6.1 kg, respectively) than women who bottle-fed (6.8 kg) their infants, these differences were not statistically significant. Women who were smokers retained amounts of weight similar to non-smokers (6.8 kg and 6.5 kg, respectively). With regard to individual weight management strategies, the most frequently used strategy was eating less at meals ($N$=146), followed by ignoring weight ($N$=142),

and exercising ($N$=126). Except for ignoring weight, those who used strategies had higher retained weights than those who did not. None of the 7 weight management strategies, however, was significantly associated with amount of retained weight at 6 weeks.

## DISCUSSION

In this study of low-income women, 15.0% attained their pre-pregnant weight by the 6th week of postpartum. The percentage was lower in our study than in those by Schauberger et al,[38] and Olsen and Mundt,[39] in which 22% and 28% of women, respectively, attained their pre-pregnant weight at 6 weeks postpartum. Several factors may have contributed to these differences. First, data for both of the preceding studies were gathered before current, and more liberal, IOM[30] guidelines for gestational weight gain were widely disseminated. For example, Olsen and Mundt[39] reported the mean gestational weight gain of their sample as 27.8 lb (12.6 kg), in contrast to the 15.8 kg in this study (Table 1). The higher gestational gains in this study likely contributed to a lower proportion of women who were able to attain pre-pregnant weight at 6 weeks postpartum. Another factor contributing to the lower rates of attaining pre-pregnant weight observed in this study may have been that for many low-income women, weight loss in the first 6 weeks postpartum was not a priority. This hypothesis is supported by the findings that the most frequent weight management strategy (eating less at meals) was reported by slightly more than one third of women at 6 weeks postpartum, and that a comparable number mentioned they were ignoring their weight.

It is also noteworthy that the 3 ethnic groups did not differ significantly in the proportion attaining pre-pregnant weight by the 6th week of postpartum. This finding supports the premise that

**Table 3. Adjusted means of retained weight (kg) by maternal age and ethnicity***

| Maternal Age | Ethnicity | | |
|---|---|---|---|
| | White | African-American | Hispanic |
| 18–22 y | 5.99 ± .33 (N=76) | 6.10 ± .39 (N=57) | 7.03 ± .26 (N=130) |
| 23–27 y | 6.21 ± .52 (N=32) | 7.09 ± .51 (N=33) | 6.64 ± .42 (N=48) |
| 28 or more y | 6.72 ± .67 (N=19) | 6.92 ± .88 (N=11) | 6.00 ± .80 (N=13) |

* Adjusted for covariables: ethnicity, gestational length (at mean=39.27), maternal weight gain (at mean=12.38), and the interaction of maternal weight gain and gestational length.

*The higher gestational gains in this study likely contributed to a lower proportion of women who were able to attain pre-pregnant weight at 6 weeks postpartum.*

weight changes during the first 6 weeks post-delivery reflect primarily physiological adjustments common to all women.[40] Furthermore, if this premise regarding common weight changes is true, then the impact of culturally derived beliefs, preferences, and behaviors on postpartum weight is more likely to emerge after these early changes are completed. That is, with follow up of women further into the first postpartum year, ethnic differences may be more evident.[19]

In this study, 2 sets of factors were associated with amount of retained weight at 6 weeks in bivariate analyses: 1) maternal weight gain, or its grouped analog—adequacy of gestational weight gain (which included infant birth weight); and 2) pre-pregnant BMI, or its grouped analog—pre-pregnant BMI categories. These findings are consistent with those of Parham et al[41] who also examined factors associated with the amount of weight retained by low-income women. Retained weight at 6 weeks postpartum is closely coupled with prenatal maternal weight gain and presumably reflects carryover of fat deposits laid down during pregnancy to postpartum.[42] In comparison, a less strong and negative relationship was found between pre-pregnant body mass index and retained weight. The negative direction of the relationship is consistent with the fact that obese women (based on pre-pregnant weight) retained significantly less weight than did normal or overweight women.

In regression analyses, maternal weight gain was the predictor with the largest statistical effect on retained weight at 6 weeks postpartum. Several other variables in our regression model made small contributions to the amount of retained weight. One of these was Hispanic ethnicity. Hispanic women, on average, were predicted to retain 0.7 kg more than the reference group (White women). Although this difference is small, it is of interest, given the evidence that weight changes in the first 6 weeks postpartum are relatively fixed.[40] Interactions between maternal weight gain and gestational length, and between ethnicity and maternal age, made only small contributions, predicting less than 1.5% of the variance in retained weight.

None of the health practices examined, including infant feeding method, were associated with statistically significant differences in amount of retained weight at 6 weeks postpartum. Our findings related to feeding method are consistent with other studies[38,39] that show infant feeding method is not associated with significant weight changes at 6 weeks postpartum. This may be due to the brief time span under study. Although health practices were unrelated to weight retention, they should not be discounted in early postpartum.

Our finding that women in this study, regardless of ethnic group, retained an average of about 6 kg at 6 weeks postpartum, supports the recommendations of Lederman et al[43] who have argued for extended and expanded postpartum care of women. Features of

that care would include a series of contacts similar to prenatal visits that focus on weight changes, diet, physical activity, and the importance of attaining a healthy weight for long-term health. Such expanded care could be especially critical for African-American women, who are disproportionately affected by obesity, and who may have difficulty losing pregnancy-related weight.[43] At present, except in a few states with Medicaid waivers, many low-income women receiving reproductive care through Medicaid automatically lose inclusive health coverage at 6 to 8 weeks postpartum. This results in their becoming uninsured, and severely limits access to direct health care, as well as to the beneficial referral mechanisms between the perinatal and primary care settings.[25] As a result, continuing health care aimed at monitoring and counseling women about loss of pregnancy-related weight is likely to be unavailable to many low-income women. It is imperative, therefore, that every healthcare visit, whether it is in WIC programs, family planning clinics, or other settings, be used to provide weight management information and support throughout the first year after a pregnancy.

There are several limitations of this study. Pre-pregnant weight was based on self-report, and, consequently, may be underestimated. We analyzed a subsample of self-reported pre-pregnant weights against prenatal weights measured dur-

ing the first trimester. On average, the discrepancy between pre-pregnant and first trimester weights (2.88 kg) was within the range expected using findings from a study of maternal physiological adaptations in the first trimester.[29] Self-reported weights were also used for weight at the end of pregnancy. These were validated against expected weights based on post-delivery measured weights for women and their infants, and were less than 1.5 kg below expected weights. The self-reported nature of pregnancy-related weights in this study should be borne in mind.

Some initial data were not available on participants (approximately 30) who dropped out of the study early in the hospital. This reduced the completeness of comparisons between cases included and excluded from the study. The included sample had a lower proportion of women who had cesarean deliveries, and women who were African-American. Although cesarean delivery was not associated with amount of retained weight (Table 2), African-American women who dropped out tended to be heavier in the hospital after delivery. If these heavier women underestimated their pre-pregnant weights, this could reduce their likelihood of attaining their pre-pregnant weight by 6 weeks postpartum. Loss of these women from the study could have biased the percentage of women attaining pre-pregnant weight upward. However, the percent of African-American women who attained their pre-pregnant weight was low, less than 13%. Thus, biasing effects are small, if present. The finding that measured post-delivery weights, which were available on all 556 cases, did not differ significantly for women included or excluded from the study, supports the view that the included sample was minimally biased by attrition.

Finally, there may also be selection bias in our sample because it was drawn from a population of women whose maternity care was funded by Medicaid. Therefore, our findings may not apply to low-income women with care financed through other means, or to women from more economically advantaged backgrounds.

In summary, coupling our findings with those of studies showing weight gains among some minority women between 2 and 6 months postpartum,[43] and presence of higher weight retention among minority women at 7–12 months postpartum,[19] suggests that ethnic differences in retained weight may emerge between 6 weeks and 6 months postpartum. Therefore, this interval may be an important transitional period for postpartum weight retention in Hispanic and African-American women. It is also an interval during which they may face a lapse in their access to health care.[25] Creative and alternative approaches need to be developed and adopted as best-practice criteria to offer personalized and culturally sensitive strategies based upon the readiness of women to adopt new health promotion practices. Extended and expanded postpartum care is one way to reach low-income women during this transitional period for weight retention and gain.

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