

# Influence of the 5A's Counseling Strategy on Weight Gain During Pregnancy: An Observational Study

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## Abstract

**Background:** Healthy weight gain during pregnancy may improve health outcomes for women and infants. The objective of this study was to examine providers' use of the 5A's (*Assess, Advise, Agree, Assist, and Arrange*) in discussions of weight, nutrition, and physical activity during prenatal visits and evaluate the effect of this approach on gestational weight gain.

**Materials and Methods:** We studied audio recordings of prenatal visits between 22 obstetrics providers and 120 of their patients, coding visits for providers' use of the 5A's. The relationship between the 5A's and gestational weight gain (total weight gain and excess gestational weight gain) was evaluated using multilevel models to account for patient clustering within provider, and adjusted for prepregnancy body mass index, parent study intervention assignment, gestational age at the study visit, and study visit length.

**Results:** Overall, 55% of prenatal visits included any weight-related behavioral counseling. Of these, 59.1% included one of the 5A's and 40.9% included two or more of the 5A's. Counseling conversations most commonly included *Assess* or *Advise* (49% and 85% of counseling conversations, respectively). No recorded visits used all 5A's. In adjusted analyses, patients who received counseling with two or more of the 5A's gained an average of 11.8 fewer pounds than patients who received no counseling ( $p=0.001$ ). The odds of excess gestational weight gain were lower among women receiving counseling with at least one of the 5A's ( $p<0.05$ ).

**Conclusions:** The 5A's were associated with lower gestational weight gain and may be a promising counseling strategy to promote healthy weight gain during pregnancy.

**Keywords:** diet, exercise, obstetrics

## Introduction

HEALTHY WEIGHT GAIN during pregnancy may improve health outcomes for women and infants, including healthy infant birthweight, decreased rates of cesarean delivery, and reduced postpartum weight retention.<sup>1-3</sup> Pregnancy may also be an unique opportunity to promote behavior change because infant health may be a powerful motivating factor, and women are more frequently in contact with healthcare providers.<sup>4,5</sup> However, a number of studies suggest that the majority of women in the United States do not achieve gestational weight

gain within the Institute of Medicine (IOM) and American College of Obstetricians and Gynecologists (ACOG) guidelines, with increasing numbers of women gaining weight in excess of recommendations.<sup>3,6-8</sup>

Although behavioral counseling during routine prenatal care may promote healthy gestational weight gain,<sup>9</sup> studies suggest that pregnant women do not routinely receive such counseling.<sup>9-16</sup> In one study, only 12% of pregnant women received behavioral counseling consistent with recommendations.<sup>11</sup> Separately, in a large survey study, researchers found that nearly one-third of pregnant women received no counseling on

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weight gain during pregnancy, whereas more than half of women received counseling that was not consistent with the IOM and ACOG guidelines.<sup>9</sup> These researchers also found that women who were advised to gain in excess of the IOM and ACOG guidelines were 3.6 times as likely to gain weight in excess of recommendations compared with women who received counseling consistent with the IOM and ACOG guidelines. In a survey of obstetric (OB) providers, only 57.9% of providers reported counseling their patients on weight gain during pregnancy “most of the time,” and only 35.7% reported modifying their recommendations based on prepregnancy body mass index (BMI), as recommended by IOM and ACOG.<sup>10</sup>

In 2002, the U.S. Preventative Services Task Force adopted the 5A's (*Assess, Advise, Agree, Assist, and Arrange*) as an evidence-based model for behavioral counseling.<sup>13,17</sup> The framework provides a simple strategy that can be readily implemented during routine prenatal care.<sup>17</sup> Several observational studies have shown that—without specific training—primary care providers most commonly counseled patients using *Assess* and *Advise*.<sup>18–20</sup> Moreover, even incomplete use of the 5A's in routine primary care visits was associated with greater intention and motivation for weight management, in nonpregnant adults.<sup>19</sup> Researchers also found that use of the 5A's in routine primary care visits was associated with improvements in nutrition and weight control after 3 months.<sup>20</sup> If effective in prenatal care, the 5A's may improve women's nutrition, physical activity, and weight management during and after pregnancy.

We are not aware of any studies using empirical data from routine prenatal care visits to examine OB providers' behavioral counseling strategies. The objectives of this study were to: (1) characterize OB providers' use of the 5A's to counsel pregnant women on nutrition, physical activity, and weight gain during pregnancy and (2) to examine the association between prenatal care providers' use of the 5A's and weight gain during pregnancy. We hypothesized that OB providers would most commonly *Assess* and *Advise* pregnant women on nutrition, physical activity, and weight gain during pregnancy, similar to findings in primary care. We hypothesized that women who were counseled using the 5A's would have lower total weight gain compared with women who were not. We also hypothesized that women who were counseled using the 5A's would be less likely to gain weight in excess of recommendations.

## Materials and Methods

We conducted a secondary data analysis using audio recordings, surveys, and medical record reviews collected as part of a trial of a patient activation intervention. The details of the parent study are described in detail elsewhere.<sup>21</sup> In brief, 23 providers and 130 of their patients were recruited from a single urban teaching hospital's outpatient OBs clinic in Baltimore, MD. Providers were nurse practitioners, resident physicians, and attending physicians.

Women were eligible for the parent study if they were scheduled to see a participating provider, spoke English, and planned to deliver at the study hospital. All participating women consented to have a single prenatal visit recorded. The sample included audio recordings of 130 unique patients during routine prenatal visits, including 50 audio recordings of prenatal visits from the baseline, preintervention cohort

(June–December 2009), and 80 visits from the intervention cohort (June 2010–January 2011). Women in the intervention cohort received one of two communication skill programs designed to encourage patients to engage actively in their prenatal visits. The interventions did not specifically address nutrition, physical activity, gestational weight gain, or the 5A's, and neither the patients nor providers were directed to discuss nutrition, physical activity, or weight gain at the study visit. The Johns Hopkins Institutional Review Board approved the study procedures.

For the current analysis, we excluded 10 prenatal visits—3 patients who did not have a recorded height to calculate prepregnancy BMI and 7 underweight patients (BMI <18.5 kg/m<sup>2</sup>). The final sample included 22 providers and 120 of their patients.

### *Characterization of behavioral counseling using the 5A's*

We conducted two stages of coding. First, we used the Roter Interaction Analysis System (RIAS; Baltimore, MD) to identify behavioral counseling episodes. Second, we coded providers' use of the 5A's in behavioral counseling episodes.

RIAS is a valid and reliable coding system for applied to medical dialogue.<sup>22</sup> Two trained RIAS coders assigned each complete thought, expressed by the patient or provider, to 1 of 37 mutually exclusive and exhaustive categories representing the functions of the medical dialogue. A random 10% subset of the recordings was double coded to establish intercoder reliability based on the Pearson correlation coefficients across coders. Reliability averaged 0.90 for provider categories and 0.91 for patient categories. RIAS coders were not aware of the study hypotheses or patient group assignments.

The 5A's coder, who was not involved in RIAS coding or the parent study intervention, used RIAS coding logs to identify time stamps for all RIAS lifestyle codes (patient and provider lifestyle questions and lifestyle information giving; and provider lifestyle counseling).<sup>22</sup> The coder listened to the relevant sections of the recordings and transcribed all discussions about nutrition, physical activity, and weight. The first and last RIAS lifestyle statements in a discussion were used to mark the beginning and end of each episode of weight-related behavioral counseling. To validate the use of RIAS lifestyle codes to identify behavioral counseling, the coder listened to the complete audio recording for a 25% random subset of the prenatal visits to confirm that the RIAS codes captured all relevant discussions of weight, nutrition, and physical activity. No additional weight-related behavioral counseling was identified in this subset of prenatal visits.

The 5A's were then coded from the transcripts using ATLAS.ti (Berlin, Germany): (1) *Assesses* weight, nutrition, or physical activity, (2) *Advises* on topics of nutrition, physical activity, or weight, (3) *Agrees* on a specific plan or course of action, (4) *Assists* in identifying barriers and supports behavior change, and (5) *Arranges* a specific plan for follow-up. Table 1 includes definitions and examples of each of these counseling strategies from the recordings. Twenty percent of these transcripts were double coded to assess inter-rater reliability of 5A's analysis. Coders discussed disagreements and made final decisions by consensus. For each category, the inter-rater agreement ranged from 89% to 96%, and the overall kappa (a measure of inter-rater reliability that accounts for chance agreement) was 0.87 (range = 0.78–0.92).

TABLE 1. 5A'S CODING FRAMEWORK DEFINITIONS AND EXAMPLES

Strategy	Definition	Example
Assess	Provider asks the patient about weight, nutrition, and/or physical activity.	“How is your diet?” “How often do you exercise?”
Advise	Provider provides the patient with advice about weight, physical activity, or nutrition.	“You should eat at least 3 small meals each day with nutritious snacks in between.” “Your goal would be to gain between 15–25 pounds during the course of your entire pregnancy.”
Agree	Patient and provider agree to a specific course of action with respect to weight, physical activity, or nutrition.	Provider: “How can we work to make sure you are getting in the right fluids?” Patient: “I can drink stop drinking soda. I can also drink no more than a cup of juice and at least 5 or 6 cups of water every day.”
Assist	Provider and patient work together to identify barriers and/or supports for nutrition or physical activity.	Provider: “Is there anyone at home who can help you with cooking?” Patient: “My mother cooks for me at least once per week.”
Arrange	Provider arranges for follow-up with provider, nutritionist, or social worker.	“I know you're having trouble getting healthy food. Would you like to speak to a social worker about that?” “It seems like you are having difficulty figuring out what to eat. I'd like you to talk to a nutritionist about that.”

### Measures

We examined the effect of 5A's counseling on total gestational weight gain. The independent variable was the total count of unique 5A's strategies used throughout the prenatal visit, which was operationalized as a categorical variable using indicator variables for each of three groups: no counseling, one of the 5A's, and two or more of the 5A's.

The dependent variable was gestational weight gain, assessed as a continuous variable for total weight gain, and a binary variable for excess weight gain. To calculate gestational weight gain, each patient's self-reported prepregnancy weight (in pounds, extracted from the medical record) was subtracted from the weight recorded at the last prenatal visit, as recommended by the IOM and ACOG. We created a binary variable for excess weight gain vs. within or below the recommended weight gain. Consistent with IOM and ACOG guidelines, excess weight gain was defined as >35 pounds for patients with normal weight (18.5–25.0 kg/m<sup>2</sup>), >25 pounds for patients with overweight (25–30 kg/m<sup>2</sup>), and >20 pounds for patients with obesity (≥30 kg/m<sup>2</sup>).<sup>3</sup>

### Statistical analyses

Descriptive analyses were used to characterize the patient and provider characteristics. Fisher's exact tests (categorical variables) and ANOVA (continuous variables) were used to explore differences in patient characteristics with respect to the number of 5A's used during the study visit. Multilevel regression models were used to examine the effect of the 5A's on gestational weight gain, accounting for clustering of patients by provider. Total gestational weight gain was normally distributed by Shapiro–Wilk test, and multilevel linear regression was used to model this outcome. Multilevel logistic models were used to model the odds of excess weight gain. Models were fit with an exchangeable correlation

structure and robust standard errors, which tend to produce accurate statistical inferences even if the correlation structure is misspecified. In a secondary analysis, multinomial logistic regression was used to examine the relationship of the 5A's with weight gain as a three-level categorical variable (inadequate, excess, and consistent with guidelines).

We adjusted for several variables, which were selected *a priori* for inclusion in the regression models, based on associations with the independent and dependent variables reported in the literature.<sup>11,15,21–23</sup> Final models were adjusted for prepregnancy BMI (normal weight, overweight, or obese), parent study intervention assignment (nonintervention, treatment, or comparison group), gestational age at the study visit (first, second, or third trimester), and study visit length (continuous). All statistical analyses were completed using Stata 13 (College Station, TX).

## Results

### Sample characteristics

The overall sample included 22 providers and 120 of their patients. The majority of providers were female (95.5%), White (59.1%), and OBs and gynecology residents (81.8%). Providers saw an average of 5.5 patients (range 1–18 patients). Overall, patients' median age was 22.0 years (interquartile range 19–25 years) and mean prepregnancy BMI was 28.4 kg/m<sup>2</sup> (standard deviation [SD] 6.5 kg/m<sup>2</sup>; Table 2). The majority of women (51.7%) had their study visit during the second trimester. The majority of patients were Black (84.2%), and 9.2% of patients had diabetes (gestational or preexisting) and 15.0% had hypertension (pregnancy-induced or preexisting; Table 2). The median gestational age at the final prenatal visit was 38.1 weeks (interquartile range 36.6–39.2 weeks).

Overall, 66 prenatal visits (55.0%) included any weight-related behavioral counseling with at least one of the 5A's. The most commonly used strategies were Assess (48.5%) and

TABLE 2. SELECTED CHARACTERISTICS FOR PATIENTS RECEIVING NO WEIGHT-RELATED BEHAVIORAL COUNSELING AND PATIENTS RECEIVING COUNSELING WITH ONE OR TWO OR MORE OF THE 5A'S

	Total (n=120)	Number of 5A's			p
		None (n=54)	One (n=39)	Two or more (n=27)	
Total counseling duration (minutes)					
Mean (SD)	1.1 (0.9)	—	1.0 (0.9)	1.3 (0.9)	0.16
Visit length (minutes)					
Mean (SD)	24.8 (11.1)	22.3 (10.7)	25.6 (10.7)	29.0 (11.6)	<b>0.03*</b>
Age; n (%)					
<20 years old	32 (26.7)	12 (22.2)	9 (23.1)	11 (40.7)	0.27
20–35 years old	83 (69.2)	38 (70.4)	29 (74.4)	16 (59.3)	
>35 years old	5 (4.1)	4 (7.4)	1 (2.6)	0 (0.0)	
Race; n (%)					
Black	101 (84.2)	44 (81.5)	33 (84.6)	24 (88.9)	0.45
White	14 (11.7)	6 (11.1)	6 (15.4)	2 (7.4)	
Other	5 (4.1)	4 (7.4)	0 (0.0)	1 (3.7)	
Education; n (%)					
Less than high school	39 (32.5)	18 (33.3)	11 (28.2)	10 (37.0)	0.81
Completed high school or GED	38 (31.7)	20 (37.0)	12 (30.8)	6 (22.2)	
Some college	28 (23.3)	11 (20.4)	10 (25.6)	7 (25.9)	
No answer	15 (12.5)	5 (9.3)	6 (15.4)	4 (14.8)	
Insurance; n (%)					
Medicaid	93 (77.5)	43 (79.6)	30 (76.9)	20 (74.0)	0.28
Private insurance	7 (5.8)	4 (7.4)	3 (7.6)	0 (0.0)	
Self-pay	5 (1.7)	2 (3.7)	0 (0.0)	3 (11.1)	
No answer	15 (12.5)	5 (9.3)	6 (15.4)	4 (14.8)	
Gestational age at study visit; n (%)					
First trimester	24 (20.0)	7 (13.0)	11 (28.2)	6 (22.2)	0.14
Second trimester	62 (51.7)	27 (50.0)	22 (56.4)	13 (48.2)	
Third trimester	34 (28.3)	20 (37.0)	6 (15.4)	8 (29.6)	
Study prenatal visit; n (%)					
First visit	61 (50.8)	24 (44.4)	30 (55.6)	10 (37.0)	0.29
Second or later visit	59 (49.2)	30 (55.6)	24 (44.4)	17 (63.0)	
BMI; n (%)					
Normal	39 (32.5)	19 (35.2)	14 (35.9)	6 (22.2)	0.85
Overweight	37 (30.8)	16 (29.6)	13 (33.3)	8 (29.6)	
Obese	44 (36.7)	19 (35.2)	12 (30.8)	13 (48.2)	
Comorbidities; n (%)					
Diabetes (preexisting or gestational)	11 (9.2)	7 (13.0)	2 (5.1)	2 (7.4)	0.47
Hypertension (preexisting or pregnancy-induced)	18 (15.0)	9 (16.7)	7 (18.0)	2 (7.4)	0.49

BMI, body mass index; SD, standard deviation.

Advise (84.9%), with Agree (3.0%), Assist (3.0%), and Arrange (10.6%) used rarely. Of the visits that included any weight-related behavioral counseling, the majority (59.1%) included only one of the 5A's, whereas 34.9% included two of the 5A's. A small number of visits included counseling

with three (3.0%) or four (3.0%) of the 5A's. No visits included all 5A's. Providers spent an average of 1.1 minutes (SD 0.9 minutes) on weight-related behavioral counseling. Patient characteristics did not differ, comparing patients who had study visits with none, one, or two or more of the 5A's

TABLE 3. CRUDE AND ADJUSTED MEAN GESTATIONAL WEIGHT GAIN AMONG PATIENTS RECEIVING COUNSELING WITH 1 OR ≥2 5A'S STRATEGIES COMPARED WITH THOSE RECEIVING NO COUNSELING

Number of 5A's strategies	Gestational weight gain (in pounds) mean (SD)	Crude difference in mean weight gain β (95% CI)	p	Adjusted difference in mean weight gain β (95% CI)	p
0 (ref.)	35.6 (2.2)	—		—	
1	30.2 (3.0)	−5.4 (−12.3 to 1.5)	0.12	−5.6 (−14.2 to 3.0)	0.20
≥2	23.2 (2.9)	−12.4 (−20.3 to −4.5)	0.002*	−11.8 (−19.0 to −4.6)	0.001*

Multilevel linear regression models with exchangeable correlation structure, robust standard errors, and adjustments prepregnancy BMI (normal weight, overweight, or obese), parent study intervention assignment (nonintervention, treatment, or comparison group), gestational age at the study visit (first, second, or third trimester), and study visit length (continuous).

CI, confidence interval.

TABLE 4. CRUDE AND ADJUSTED ODDS OF EXCESS WEIGHT GAIN AMONG PATIENTS RECEIVING COUNSELING WITH 1 OR  $\geq 2$  5A'S STRATEGIES COMPARED WITH THOSE RECEIVING NO COUNSELING

Number of 5A's strategies	Proportion of women gaining weight in excess of guidelines (%)	Crude OR (95% CI)	p	Adjusted OR (95% CI)	p
0 (ref.)	74.1	—		—	
1	56.4	0.45 (0.19–1.09)	0.08	0.32 (0.12–0.86)	0.02*
$\geq 2$	51.9	0.38 (0.14–0.98)	0.04*	0.24 (0.08–0.62)	0.004*

Odds ratios estimated from multilevel logistic regression models with exchangeable correlation structure, robust standard errors, and adjustments for prepregnancy BMI (normal weight, overweight, or obese), parent study intervention assignment (nonintervention, treatment, or comparison group), gestational age at the study visit (first, second, or third trimester), and study visit length (continuous).

( $p > 0.05$ ; Table 2). The average visit length was 24.8 minutes (SD 11.1 minutes; Table 2). On average, prenatal visits with one of the 5A's (25.6 minutes; SD = 10.7 minutes) or two or more of the 5A's (29.0 minutes; SD = 11.6 minutes) were significantly longer than visits with no weight-related behavioral counseling (22.3 minutes; SD = 10.7;  $p = 0.03$ ; Table 2).

The association between behavioral counseling and total gestational weight gain is summarized in Table 3. In the adjusted analysis, women who received counseling with one of the 5A's gained an average of 5.6 fewer pounds compared with women who did not receive any counseling (95% CI -3.0 to 14.2 pounds,  $p = 0.20$ ), a nonstatistically significant difference. Women who received counseling with two or more 5A's gained an average of 11.8 fewer pounds compared with women who did not receive any counseling (95% CI 4.6–19.0 pounds,  $p = 0.001$ ).

The association between behavioral counseling and the odds of gestational weight gain in excess of recommendations is summarized in Table 4. The odds of excess gestational weight gain was 68% lower (OR = 0.32, 95% CI = 0.12–0.86) among patients receiving counseling with one of the 5A's compared with patients who received no counseling. The odds of excess gestational weight gain was 76% lower (OR = 0.24, 95% CI = 0.08–0.62) among patients receiving counseling with two of the 5A's compared with patients who received no counseling. As summarized in Table 5, there was no significant difference in the relative risk of excess of inadequate or excess weight gain, comparing women who received counseling with the 5A's compared with those who did not. We did a sensitivity analysis excluding women who did not have a weight recorded at 37 weeks or later ( $n = 29$ ; 21 preterm births and 7 women who did not continue prenatal care at the participating clinic), which did not change the results.

## Discussion

This study of empirical data from routine prenatal visits revealed that approximately half of visits included discussions about weight, nutrition, and physical activity, and behavioral counseling with more of the 5A's was associated with less weight gain and lower odds of weight gain in excess in recommendations. Although the IOM and ACOG recommend that OB providers provide all pregnant women with behavioral counseling to promote healthy weight gain in pregnancy,<sup>2,3,24</sup> our results are consistent with previous studies—using self-reported data—which suggested that these guidelines are not being implemented.<sup>9–12</sup>

OB patients in this study received limited behavioral counseling on nutrition, physical activity, and weight gain from their providers during routine prenatal care visits. Overall, 55% of the prenatal visits included any discussion of weight, nutrition, or physical activity. Among those who received counseling, OB providers addressed only one of the 5A's for the majority of patients. No patients received counseling that included all 5A's. Similar to observations in primary care settings with nonpregnant adults, the quality of 5A's counseling was limited most commonly to *Advise* and *Assess*.<sup>19,20</sup> As noted by Alexander et al.<sup>20</sup> these are the strategies—data gathering and information giving—that are most consistent with clinical training and practice. The less frequently used strategies—*Agree*, *Assist*, and *Arrange*—may require more time, follow-through, and perhaps greater confidence in a positive outcome, and may not be consistently taught or role modeled.<sup>10,14,15</sup> Nevertheless, increasing attention to these counseling strategies may enhance counseling effectiveness.<sup>9,13,25,26</sup>

Even incomplete use of 5A's counseling was associated with less weight gain in our study. Additionally, our results

TABLE 5. ADJUSTED RELATIVE RISK OF INADEQUATE OR EXCESS WEIGHT GAIN AMONG PATIENTS RECEIVING COUNSELING WITH 1 OR  $\geq 2$  5A'S STRATEGIES COMPARED WITH THOSE RECEIVING NO COUNSELING

Number of 5A's strategies	RR of inadequate weight gain (95% CI)	Weight gain consistent with guidelines (ref.)	RR of excess weight gain (95% CI)
0 (ref.)	—	—	—
1	1.91 (0.40–9.14)	—	0.47 (0.12–1.85)
2 or more	1.23 (0.23–6.72)	—	0.26 (0.06–1.15)

Relative risk ratios estimated from multinomial logistic regression models with adjustments for prepregnancy BMI (normal weight, overweight, or obese), parent study intervention assignment (nonintervention, treatment, or comparison group), gestational age at the study visit (first, second, or third trimester), and study visit length (continuous).

support the hypothesis that use of multiple 5A's strategies is associated with less weight gain than use of only one of the 5A's.<sup>27</sup> Patients who were counseled with two or more of the 5A's gained less weight compared with women who were not, adjusting for prepregnancy BMI, parent study intervention assignment, gestational age at the study visit, and study visit length. Moreover, pregnant women who were counseled using a greater number of 5A's had lower odds of gaining weight in excess of the IOM and ACOG recommendations. In a secondary analysis, there was no significant difference in the relative risk of excess of inadequate or excess weight gain, comparing women who received counseling with the 5A's compared with those who did not. Surprisingly, there was no association between patient BMI and the number of 5A's providers used in discussions of weight, nutrition, and physical activity. Nevertheless, patient BMI was included as a covariate in our models to account for the theoretical correlation of BMI with both the number of 5A's and gestational weight gain.

OB providers cite many barriers to integrating behavioral counseling on nutrition, physical activity, and weight gain into routine practice.<sup>10,13-15</sup> In one study, 83% of OB providers ( $n=58$ ) believed that obesity was an important problem, but only 63% of OB providers correctly reported the BMI threshold for obesity, and only 29% of OB providers correctly reported the recommendations for healthy weight gain based on prepregnancy BMI, as recommended by IOM and ACOG.<sup>12</sup> In a separate study, researchers found that only one-third of OB providers surveyed reported that prenatal care is an opportunity to modify behaviors that will lessen the likelihood of maternal obesity, and the majority of providers endorsed lack of patient motivation, time constraints during visits, and limited support services as barriers to behavioral counseling on nutrition, physical activity, and weight gain during pregnancy.<sup>10</sup> In qualitative studies, OB providers reported concerns that weight was a sensitive issue for their patients, who would not be responsive to or interested in behavioral counseling on nutrition, physical activity, and weight gain during pregnancy.<sup>16</sup> Moreover, OB providers cited numerous barriers to behavioral counseling, including lack of training, perceived inefficacy of counseling, the inability to override conflicting advice from patients' friends and family, perception that much of gestational weight gain is beyond a woman's control, and OB providers' own experiences and challenges related to weight.<sup>15</sup>

Our findings suggest that behavioral counseling during routine prenatal care is associated with lower weight gain during pregnancy. The findings raise the possibility that high-quality counseling—with complete use of all 5A's—implemented throughout routine prenatal care may contribute to positive health outcomes for pregnant women and their infants.

#### *Study limitations and strengths*

Our findings should be interpreted with caution in light of several limitations. First, while this small, observational study of a convenience sample provides important insight into weight-related behavioral counseling in routine prenatal care, future randomized studies would be necessary to establish a causal association between the behavioral counseling with the 5A's and weight gain during preg-

nancy. It will also be important to study possible mediators of the relationship between counseling and weight gain during pregnancy (behavioral intention, motivation, and changes in actual nutrition and physical activity behaviors) and other health outcomes in addition to weight gain in pregnancy (medical comorbidities in pregnancy, neonatal and child health outcomes, etc.).

Second, a small minority of women (14.2%) gained weight consistent with recommendations, and we created a single category for women who gained less weight than recommended and those who gained weight consistent with guidelines. This approach—using logistic regression analysis—ensured adequate cell frequencies across all levels of the independent variable and covariates to estimate the statistical model without overfitting. We completed a secondary analysis, which showed no significant difference in the relative risk of inadequate weight gain, excess weight gain, or weight gain consistent with guidelines, comparing women who received counseling using the 5A's and those who did not. It is possible that this analysis is limited by our sample size, and larger studies are needed to examine the association between the 5A's and gestational weight gain as a three-level categorical variable, given the health risks associated with weight gain less than and in excess of recommendations. Given that the majority of women in this sample (63.3%) gained weight in excess of recommendations, we believe that the statistical approach in our main analysis is appropriate and that our findings are meaningful.

Third, we recorded a single prenatal visit for each patient, and it is possible that these visits were not representative of the behavioral counseling patients received at other times during pregnancy. We adjusted for gestational age to attempt to account for these differences. Finally, we believe that our sample represents an urban prenatal care clinic staffed primarily by trainees, and practices without resident physicians or in other settings may have different experiences. However, given that many OB providers train and deliver care in similar environments, we believe that this is an important first study in this area.

Our study also has a number of strengths. We used audio recordings of actual prenatal visit communication to examine the relationship between behavioral counseling and total gestational weight gain, eliminating the recall bias inherent in studies that rely on self-reported data. Although there is some concern that recording prenatal visits may cause Hawthorne (observer) effect, previous studies suggest that these methods provide important insight into the content of medical dialogue without significantly or systematically affecting provider or patient communication.<sup>28-30</sup> We are not aware of any other studies using audio recordings to study behavioral counseling in routine prenatal visits. We used RIAS, a coding system with demonstrated validity and reliability, to identify behavioral counseling discussions, and 5A's double coding demonstrated high inter-rater reliability. To our knowledge, this is the first study to combine these two robust analytic methods to characterize behavioral counseling discussions. Moreover, while a randomized 5A's intervention study would be needed to establish causality, the observational methods in the current study provide insight into routine practice patterns of OB providers and suggest that the 5A's are associated with weight gain during pregnancy.

## Conclusions

We have contributed a unique characterization of behavioral counseling on weight, nutrition, and physical activity, as well as an examination of the association between the 5A's and gestational weight gain. While studies to confirm our findings and examine the relationship in other settings are needed, our findings suggest that brief counseling during routine prenatal care may reduce the proportion of pregnant women who experience excess gestational weight gain in an urban prenatal care clinic population. Improving counseling practices among OB providers—perhaps by using the full 5A's framework—may lead to improved health outcomes for women and infants. If these findings are confirmed in larger, more diverse samples—including randomized controlled trials—additional training should be provided to OB providers to enhance behavioral counseling skills.

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## Author Disclosure Statement

No competing financial interests exist.

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