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Ethnic Disparity in the Performance of Prenatal Nutrition Risk Assessment Among Medicaid-Eligible Women

SYNOPSIS

IN THIS STUDY, the authors compare perinatal health outcomes and nutrition risk assessments in Latina, African American, and white women receiving Medicaid enhanced perinatal services. The objective is to analyze how proper assessment of obesity and underweight depend upon ethnic group, provider practice setting and credentials, and the implications for perinatal outcomes.

The medical records of women who received enhanced perinatal services from specially certified Medicaid providers in California were abstracted for information on nutrition risk assessment and outcomes. Logistic regression analysis was used to test the associations first of obesity and underweight with adverse outcomes in Latina, African American and white women, then the associations of ethnicity with the failure of these women to be classified as overweight or underweight during assessment. Finally, the associations between misclassification of body mass with provider practice setting type and credentials are also tested.

Obese Latinas are twice as likely not to be properly classified as overweight, despite evidence of substantial risk of unfavorable outcomes. For all three ethnic groups, underweight women are uniformly underreported as being at risk. The appropriate classifications of obesity and underweight are not associated with private or public types of obstetric practice settings or whether nutrition risk assessors are registered dietitians, health workers, or nurses of any particular credential.

Providers of prenatal care to low-income women could improve the quality of nutrition risk assessment of overweight Latina women and underweight women of all ethnic groups with expectations of improving perinatal outcomes.

Maternal race and ethnicity may influence the identification of risks during prenatal care, just as providers have been reported to give differing prenatal advice to women of different racial and ethnic groups (*1*). The identification of risks involves some subjectivity on the part of the assessor, and this subjectivity may be subject to a series of influences or biases. Health professionals may have a number of reasons for perceiving risk differently in groups of patients, such as questioning the association between risks and health outcomes across patient groups (*2*). Alternatively, certain characteristics of the risk assessors, such as their specialization or experience, may influence the identification of risks (*3*). Other factors including the type of practice setting may influence the delivery of services to prenatal patients. Patients in public settings, like public health department clinics, public hospital outpatient clinics and community clinics, have been documented to receive more prenatal education than patients in private physician offices (*1*). It is possible that assessors practicing in public sites may perform risk assessments differently than private sites (*1, 4–7*).

Nutrition services are a recommended component of comprehensive prenatal care (*8–10*). The first step is the assessment of nutrition risks, including overweight or underweight extremes of body mass, which leads to further services for women identified with risks (*11*). Being either over- or underweight prior to pregnancy has been associated with undesirable weight gain and birthweight outcomes that are potentially modifiable (*3,12,13*). If such conditions are not identified prenatally, they may not be addressed by available services, and in this way the misclassification of risks may contribute to adverse health outcomes. Standard categorizations of over- and underweight for pregnant women using their height and body weight prior to pregnancy have been developed by the Institute of Medicine (*10*). Although these standards of body mass are based largely on white women, studies to date have determined that the standards are relevant to Latina and black women (*14–16*). The assessment of risk for extremes of body mass can be accomplished by visual assessment or by consulting reference tables of weight, height, or body mass index (BMI) (*12*). Studies have not determined whether these standards are used in the same way in different ethnic groups.

For pregnant low-income women, nutrition services have traditionally been provided in public health department clinics or hospitals and community clinics by dietitians or by multidisciplinary teams that include a dietitian (*11*). In recent years, there has been an expansion in the types of practice settings and providers of the services to low-income pregnant women, with more private physician offices and clinics and non-specialists providing the services (*17*).

Private settings and providers may not have similar experience with the special needs and services of low-income women. In addition to the usual problems in controlling weight gain through behavior modification of diet and exercise, low-income women must be informed of diet and exercise alternatives that are affordable to them. If the low-income women are also of different ethnic groups than those traditionally cared for in the private settings, there may be difficulties providing advice that is ethnically appropriate as well. Registered dietitians are specially trained and credentialed to deal with the appropriate assessment of extremes of body weight and dietary and exercise advice. Some nurses take extended special training in nutrition, but generally they receive varying amounts of information depending on their credentialing program. Health workers receive little or no formal specialist nutrition training, but may have a great deal of insight and experience in helping low-income women with diet and exercise plans that are appropriate for their income and ethnic group. As providers of services to low-income pregnant women expand, it is important to determine whether the quality of prenatal care, including nutrition services, varies in ways that could affect perinatal outcomes.

The California Department of Health Services implemented the Comprehensive Perinatal Service Program (CPSP) beginning in 1989 for the provision of obstetric, nutritional, psychosocial, and health promotional services to pregnant women eligible for Medicaid (Medi-Cal in California) (*18,19*). Eligible pregnant women receive prenatal services, including nutrition risk assessment, in specially certified public health department, hospital outpatient, or community clinics, as well as private physician's offices or outpatient clinics of private hospitals. In our study, we first investigated whether obesity and underweight differ in their prevalence, severity, or associations with adverse perinatal outcomes for white, Latina, and black women in CPSP. We then analyzed whether the classifications of obesity and underweight are performed as well for the three groups during the nutrition risk assessments in CPSP. Finally, we analyzed whether public and private types of obstetric practice settings and dietitians, nurses, and health workers varied in the classification of obesity and underweight risks.

Methods

Study sample. The sampling procedure has been previously described (*19,20*). In brief, specially certified CPSP provider sites in two metropolitan and two nonmetropolitan regions of California were stratified by region and practice setting type (community clinics, health department clinics, physician offices, private hospital clinics, and public hospital clinics). Sites were then selected at random within the strata. At each of the 28 sites thus selected, the medical records of all Medicaid-eligible women (incomes less than 200 percent of poverty and allowable assets less than $3,000) who delivered a liveborn, singleton infant between July 1989 and December 1990, had at least one obstetric visit and one CPSP risk assessment in any of the three support service areas were abstracted.

The degree to which this sample represents the California Medicaid population giving birth has been reported (*19*). Maternal ethnicity was taken as reported in the medical record (present for 98 percent of the sample). In prenatal practice, maternal ethnicity is either self-reported, or assigned by a provider. All women in this study come from these three most prevalent ethnic groups in the sample: Latinas (46 percent of the total sample), whites (32 percent) and African Americans (11 percent). Additional inclusion criteria were maternal age 12 years or older (99.7 percent), recorded prepregnancy weight and height (92 percent) and receipt of at least one nutrition risk assessment (96 percent). A total of 2,939 women were included.

Nutrition risk assessment. CPSP regulations specified that within four weeks of the initial visit, "A complete nutrition assessment shall be performed and shall include: anthropometric data" (California Department of Health Services Regulation 51348). The risk assessment consisted of an individualized interview of the pregnant woman by the assessor. The issues to be assessed were specified in CPSP regulations, including obese or overweight prepregnancy weight and underweight or low prepregnancy weight. Each risk assessment instrument was designed by the provider and approved by CPSP County Coordinators or nutritionist specialists with the Maternal and Child Health Branch. The Institute of Medicine (1990) standards for classifying body mass index were incorporated into a nutrition manual and circulated to all certified providers, even before their formal publication (*21*). For this study, chart information from the first nutrition risk assessment for study subjects was abstracted for any indication of "obese," "overweight," or "underweight." CPSP regulations also specified that providers were required to work closely with local Women, Infant and Children's Supplemental Food Programs (WIC). If nutrition risk assessments were performed by WIC personnel, the information was shared with the prenatal provider.

Nutrition service variables. From the prepregnancy weight and height in the CPSP medical record, we calculate prepregnancy body mass index (BMI, pounds divided by inches squared (lb/in^2) (*10*). The women are then classified into four mutually exclusive categories: underweight (BMI less than 19.8), normal (BMI 19.8–26.0), moderately overweight (BMI 26.1–29.0) and obese (BMI more than 29.0) (*10*). Determination of prepregnancy weight in prenatal practice is generally reported by the woman, measured at a visit prior to pregnancy, or estimated from the measured weight at first prenatal visit. Height is generally measured.

A variety of health professionals performed nutrition risk assessments at CPSP sites. Nutrition risk assessors were divided into specialists (20 registered dietitians) and three classes of generalists— nurses (14 registered nurses, public health nurses, certified nurse midwives, and nurse practitioners), 11 health workers, and 13 others. The prenatal practice settings were classified into three groups—publicly owned and operated settings (nine public health department clinics and public hospital outpatient clinics), privately owned and operated settings (11 physician offices and private hospital outpatient clinics), and privately owned and operated, but largely publicly financed settings (seven community clinics).

Outcome indicators. Three indicators of unfavorable perinatal outcomes were studied—inappropriate gestational weight gain, inappropriate infant birth weight, and Cesarean section (*10*). Gestational weight gain was determined by subtracting prepregnancy weight from the weight recorded at the last prenatal visit. Infant birth weight and type of delivery (Cesarean section or not) were obtained from the CPSP medical record or the hospital of delivery. For two women, the information was not available and had to be obtained from the State birth certificate database. For underweight women, inappropriately low weight gain was less than 28 pounds (*10*). Because the Institute of Medicine did not recommend an upper limit of weight gain for obese women, we applied the upper limit recommended for moderately overweight women (greater than 25 pounds). Unfavorable birthweight outcome criteria were taken from Institute of Medicine standards of optimal birth weight (3,000 to 4,000 grams) (*10*). Less than optimal birth weight is less than 3,000 grams, while more than optimal birthweight is greater than 4,000 grams.

The proper classification of a woman's prepregnancy body mass is also analyzed as an outcome variable. Misclassification was defined when a woman was determined to be either obese or underweight according to her calculated body mass but is not identified as obese, overweight, or underweight in the medical record containing the results of the nutrition risk assessment.

Potentially confounding variables. For the misclassification outcome indicator, potentially confounding factors are taken into consideration. An assessor may fail to report obesity or underweight and instead report an underlying factor that either rationalizes the weight status, or dictates a treatment regimen to the nutrition advisor. Some of these potentially confounding factors differ for obesity and underweight, while others are the same. For obese women, prior diabetes mellitus, prior hypertension, maternal age or parity could explain differences in the extent to which providers reported obesity in the nutrition risk assessment. For example, a history of diabetes mellitus may be used as the reason to develop a diet and exercise regime, and obesity may not be independently noted. For underweight women, prior hypertension, smoking, maternal age, or parity could explain differences in the extent to which providers reported underweight. Thus there are different potentially confounding variables used in analyses of obesity and underweight.

For rare factors (less than three percent of women), like diabetes or hypertension, women were excluded from analysis. For more prevalent conditions variables were constructed to adjust analyses. We constructed a maternal smoking variable to adjust analyses for underweight women (women who consumed at least ten cigarettes per day during pregnancy). Likewise for underweight women, a history of hypertension may have been seen as the underlying factor for the body mass condition. For this reason we also include adjustment variables for maternal age (high risk, younger than age 20, older than age 34, and low risk, ages 20–34) and parity (no previous live birth or at least one) in models for both groups (*22*). We include a variable for a referral to

WIC at the first nutrition assessment since this referral may have been recorded in lieu of a nutrition assessment.

Since proper classification of body mass is influenced by how obese or underweight the women are, we tested continuous and discrete adjustment variables to adjust for the maternal BMI in the misclassification models. We tested the continuous measure BMI as well as alternative constructs (BMI^2, BMI^3, the 25th, 50th and 75th percentile). We selected the construct that best fit the model which was the 50th percentile (the median, for both overweight women and underweight women). Thus the final determinations of the association of ethnicity with being misclassified are adjusted for whether or not the woman is in most obese (or most underweight) half of the women in their group.

Analyses. Bivariate analyses are performed to compare (*a*) the prevalence and severity of obesity and underweight among the ethnic groups, (*b*) the odds of unfavorable perinatal outcomes for each extreme BMI group relative to the normal BMI group within each ethnic group, and (*c*) the sensitivity, specificity, and positive and negative predictive values of the assessment of obesity and underweight for each ethnic group (*23*). Bivariate differences in proportions are evaluated using Chi-square tests with the level of statistical significance set at 0.01 ($P < 0.01$) to account for multiple comparisons. Differences in mean BMI between ethnic groups are tested using t-tests. Within ethnic groups, differences in the unadjusted odds ratios (OR) between extreme and normal BMI groups are tested by calculating 95 percent confidence intervals (CI) for the ratios, and significance was defined when the CI did not include 1.00. Since the provider setting and patient characteristics may have been correlated, we used General Estimation Equations (GEE) to group observations by site (*24*).

Multivariate logistic regression analysis is used to calculate the adjusted odds ratio (OR) for misclassification of body mass among obese and underweight women. We measure the association between misclassification of obesity and underweight and the following variables: maternal ethnicity (white reference group), high risk maternal age (age 20–34 reference group), nulliparity (parous reference group), BMI (obese reference group: BMI below the median, underweight reference group: BMI above the median), assessor credential (specialist reference group), provider setting (public setting reference group), and WIC referral group (no WIC referral reference group).

Significant correlations were detected between provider setting and assessor type (correlation coefficients greater than 0.2 with $P < 0.05$). However, we were unable to test the independent effects of setting and assessor due to limited sample size. Therefore, tests of the associations of assessor and provider setting with misclassification are modeled separately. The adjusted odds ratios for these provider characteristics are calculated without adjustment for the other characteristic. The extent of goodness of fit of each multivariate logistic regression model is evaluated by two methods, the significance of the -2LogLikelihood value and the c-statistic (*25*). For the former, the smaller the P values the better the fit, with P values less than 0.05 significant. For the c-statistic, the larger the P values the better the fit, with P values greater than 0.05 significant.

Results

Extreme body mass and perinatal outcomes. *Obesity.* The prevalence of obesity does not differ significantly between ethnic groups in these low income women (table 1). The severity of the obesity in the three ethnic groups, however, does differ. Obese Latinas (32.7 BMI) are not as overweight as obese African-Americans (36.0, $P < 0.05$) or whites (34.6, $P < 0.05$).

The relative odds of unfavorable perinatal health outcomes in obese women compared to normal weight for height women within each group varies among the ethnic groups (table 2). Obese Latinas are at increased odds of all three adverse outcomes studied compared with normal weight-range Latina women—excessive weight gain (OR

Table 1. Distribution of women and their Mean Body Mass Index (BMI) values among weight for height categories by ethnicity, California, 1989–90

	White				Latina				African American			
Categories	*Number*	*Percent*	*Mean BMI*	*SD*	*Number*	*Percent*	*Mean BMI*	*SD*	*Number*	*Percent*	*Mean BMI*	*SD*
Obese by BMI	162	14.7	[1]34.6	5.4	222	15.0	[1,2]32.7	3.8	59	16.2	[2]36.0	6.2
Overweight by BMI	114	[3]10.4	27.5	0.8	208	[3]14.1	27.2	0.8	46	12.6	27.4	0.8
Normal by BMI	535	[4]48.7	[1]22.2	1.7	858	[4]58.1	[1,2]22.9	1.7	190	52.2	[2]24.5	1.7
Underweight by BMI	288	[3,4]26.2	18.3	1.1	188	[4,5]12.7	18.5	1.0	69	[3,5]19.0	18.3	1.1
Totals	1,099	100.0	[1,2]23.6	5.8	1,476	100.0	[1]24.4	4.6	364	100.0	[2]22.5	6.3

Means in the same row thus marked are statistically different by Tukey's studentized range test for multiple comparisons of means at the following levels: [1]$P < 0.05$; [2]$P < 0.05$. Proportions in the same row thus marked are statistically different by Chi Square test at the following levels: [3]$P < 0.01$; [4]$P < 0.001$; [5]$P < 0.01$.

Table 2. Unadjusted odds ratios (OR) and 95 percent confidence intervals (CI) of unfavorable outcome indicators for extreme weight-range groups compared with normal weight-range groups by ethnicity, California, 1989–90

Outcome indicators	White		Latina		African American	
	OR	CI	OR	CI	OR	CI
Obese:						
Inappropriate high weight gain	0.87	0.62, 1.23	1.60	1.09, 2.35	1.42	0.62, 3.27
More than optimal birthweight	1.86	1.18, 2.92	2.69	1.73, 4.21	1.25	0.43, 3.67
Cesarean section	2.47	1.68, 3.63	2.13	1.46, 3.11	2.13	1.16, 3.91
Underweight:						
Inappropriate low weight gain	1.56	1.13, 2.16	1.20	0.91, 1.58	2.64	1.47, 4.74
Less than optimal birthweight	1.83	1.40, 2.39	1.26	0.99, 1.61	1.94	1.26, 2.97

1.60, CI 1.09, 2.35), more than optimal birthweight infants (OR 2.69, CI 1.73, 4.21), and cesarean section (OR 2.13, CI 1.46, 3.11). Obese white and African American women, on the other hand, demonstrate an association with some adverse outcomes, but not others.

Underweight. Fewer Latina and African American women in this sample meet the criterion for underweight than do the white women in the sample (table 1). For women who meet the criterion of underweight, however, average BMI values do not vary significantly among the three ethnic groups.

The relative odds of unfavorable perinatal health outcomes in underweight women compared with normal-range women vary among the ethnic groups (table 2). Underweight African American and white women demonstrate significant odds of adverse outcomes, but Latinas do not (table 2). Underweight white women have significant odds of inappropriately low gestational weight gain (OR 1.56, CI 1.13, 2.16) and less than optimal birth weight (OR 1.83, CI 1.40, 2.39), as did African Americans (OR 2.64, CI 1.47, 4.74 and OR 1.94, CI 1.26, 2.97). Underweight Latinas do not demonstrate significant risks of unfavorable outcomes.

Misclassification in risk assessment. *Obesity.* The extent to which women who are obese are not identified as overweight or obese during nutrition risk screening varies by ethnic group (sensitivity, table 3). More white and black obese women are appropriately classified as obese or overweight than are obese Latinas, and the difference is statistically significant when Latinas were compared with whites. Although little more than half of Latinas who are obese for their height are appropriately classified overweight or obese during their risk assessment (58.6 percent), more than three-quarters of the obese whites (82.7 percent) are correctly classified ($P < 0.001$). Nearly three-quarters of the obese black women are appropriately classified (72.9 percent) than whites. In the case of black women, however, the difference from Latinas is not statistically significant because of the small number of obese African Americans available for comparison in the sample (59 women). For the women in each of the three groups, women identified as obese during the assessment are very likely to be obese (specificity, 91.6 percent to 94.3 percent).

The proportion of women assessed as obese who actually are obese does not vary among the ethnic groups (positive predictive values 72.6–78.2 percent, table 3). The chances that a woman assessed normal is actually normal weight for height differs among the groups (negative pre-

Table 3. Validity of classification of obese and underweight women by ethnicity, California, 1989–90

Classification category	White		Latina		American	
Obese:						
Sensitivity (percent)	[1]82.7	(134 of 162)	[1]58.6	(130 of 222)	72.9	(43 of 59)
Specificity (percent)	91.6	(490 of 535)	94.3	(809 of 858)	93.7	(178 of 190)
Positive predictive value (percent)	74.9	(134 of 179)	72.6	(130 of 179)	78.2	(43 of 55)
Negative predictive value (percent)	[2]94.6	(490 of 518)	[2]89.8	(809 of 901)	91.8	(178 of 194)
Underweight:						
Sensitivity (percent)	25.7	(74 of 288)	25.5	(48 of 188)	27.5	(19 of 69)
Specificity (percent)	98.5	(527 of 535)	96.5	(828 of 858)	98.9	(188 of 190)
Positive predictive value (percent)	[1]90.2	(74 of 82)	[1]61.5	(48 of 78)	90.5	(19 of 21)
Negative predictive value (percent)	[1]71.1	(527 of 741)	[1]85.5	(828 of 968)	79.0	(188 of 238)

[1]Proportions in the same row thus marked are statistically different from each other at the $P < 0.001$ level.

[2]Proportions in the same row thus marked are statistically different from each other at the $P < 0.01$ level.

dictive values). The likelihood that a woman who is identified by default as non-obese actually meets the criteria is higher for whites (94.6 percent) than Latinas (89.8 percent, $P < 0.01$). The likelihood for blacks is higher than for Latinas but not significantly so in this sample.

Generally, the more obese a woman is, the more likely she is correctly assessed as obese. The mean BMI values for correctly classified obese Latinas (33.3), as well as for obese whites (35.2), are higher than the Latinas misclassified as non-obese (31.9) and the whites (32.1), ($P < 0.01$). The same trend is found for African American women, although the difference was not significant (36.5 and 34.6 lb/in^2 $P > 0.05$).

Underweight. Only a quarter of all underweight women are appropriately identified as underweight during the nutrition risk assessment, and the rate does not vary significantly by ethnicity (sensitivity 25.5–27.5 percent, table 3). Of all women classified as underweight, however, nearly all were in fact underweight for their height (specificity 96.5–98.9 percent for all groups). Latinas who are assessed underweight are significantly less likely to be underweight by prepregnancy BMI positive predictive value (61.5 percent) compared with whites (90.2 percent, $P < 0.001$).

On the other hand, identification of non-underweight women (negative predictive value) is highest for Latinas (85.5 percent) and lowest for whites (71.1 percent, $P < 0.001$). Correct classification of underweight women is more likely the more underweight the women were for African Americans and whites but not Latinas. Correctly classified whites have a significantly lower mean BMI (17.7 versus 18.4, $P < 0.001$) than those incorrectly classified, as do African American women (17.8 versus 18.5, $P < 0.05$) but not Latinas (18.3 and 18.6, $P > 0.05$).

Table 4. Adjusted odds ratios (OR) and 95 percent confidence intervals (CI) of misclassification for obese and underweight women adjusted for assessor credentials, California, 1989–90

	Obese model		Underweight model	
Risk factor	*OR*	*CI*	*OR*	*CI*
Latina	2.07	1.30, 3.30	0.93	0.51, 1.67
African American	1.48	0.74, 2.92	0.65	0.34, 1.26
BMI	2.68	1.77, 4.06	2.51	1.50, 4.20
Smokes cigarettes	...	...	0.97	0.77, 1.22
Nulliparous	0.81	0.56, 1.19	0.85	0.60, 1.22
High-risk maternal age	1.35	0.89, 2.05	1.16	0.64, 2.09
Nurse assessor	.0.61	0.29, 1.26	1.80	0.85, 3.83
Perinatal health worker assessor	0.97	0.31, 3.01	1.42	0.56, 3.60
Other assessor	0.92	0.28, 2.95	0.98	0.35, 2.74
Referred to WIC	0.98	0.50, 1.93	1.24	0.75, 2.05
Goodness of fit of each model:				
-2 Log Likelihood	36.48, P = 0 .0001		16.62, P = 0.083	
c-statistic[1]	8.35, P = 0.400		6.75, P = 0.563	

[1]Hosmer-Lemeshow, 1989 (reference 25)

Risk factors for misclassification. *Obesity.* The relative odds that obese Latinas are incorrectly classified as normal weight for height are significantly higher than for obese whites, even after adjusting for potentially confounding factors (tables 4 and 5). Latinas have odds twice as high as whites for being misclassified regardless of the type of nutrition risk assessor (OR 2.07, CI 1.30, 3.30; table 4) or whether the practice setting is public or a private type (OR 2.21, CI 1.41, 3.46; table 5). The ethnic effect is not found to depend on whether women were referred to WIC at the time of the first assessment or not. The adjusted odds for obese African merican women are not statistically different from obese whites.

Neither assessor credentials nor provider setting are found to have significant associations with misclassification of obesity (tables 4 and 5). The odds of misclassification for neither nurses nor health workers differ significantly from those of registered dietitians. The odds of misclassification for neither private settings (physician offices and hospital outpatient clinics) nor community clinics, differ from those of public health clinics (free-standing and hospital outpatient clinics).

Underweight. Ethnicity is not associated with the misclassification of underweight (tables 4 and 5). Underweight Latinas and African Americans are as likely to be misclassified as underweight white women, even after controlling for potential confounders. The lack of ethnic effects did not depend on whether or not the women are referred to the

Table 5. Adjusted odds ratios (OR) and 95 percent confidence intervals (CI) of misclassification for obese and underweight women adjusted for practice setting type, California, 1989–90

	Obese model		Underweight model	
Risk factor	*OR*	*CI*	*OR*	*CI*
Latina	2.21	1.41, 3.46	1.00	0.58, 1.71
African American	1.47	0.72, 3.01	0.65	0.35, 1.21
BMI	2.58	1.74, 3.83	2.55	1.50, 4.32
Smokes cigarettes	...	...	0.95	0.76, 1.20
Nulliparous	0.80	0.55, 1.15	0.88	0.60, 1.31
High-risk maternal age	1.38	0.88, 2.17	1.21	0.64, 2.25
Private setting	1.38	0.49, 3.87	1.75	0.69, 4.43
Community clinic	1.25	0.35, 4.52	1.36	0.53, 3.49
Referred to WIC	0.93	0.47, 1.85	1.27	0.78, 2.07
Goodness of fit of each model:				
-2 Log Likelihood	38.81, P = 0.0001		15.43, P = 0.080	
c-statistic[1]	6.70, P = 0.569		10.33, P = 0.242	

[1]Hosmer-Lemeshow, 1989 (reference 25)

WIC program. Neither assessor credentials (table 4) nor provider practice settings (table 5) are predictive of misclassification of underweight women. Only underweight women with BMIs above the median are found in these analyses to be at significant risk of misclassification and that is when they are compared with underweight women below the median. Regardless of the practice setting or assessor credential, these underweight women are at more than a two-fold higher relative odds of being misclassified.

Discussion

Both the ethnic bias in the assessment of nutrition risk among obese low-income pregnant women and the low levels of assessment of nutrition risk among underweight women documented in this study raise concerns about the performance of nutrition services in prenatal care for low income women. Prenatal nutrition risk assessment has become a widely recommended component of prenatal care, but performance of the assessment can vary a great deal in actual practice (*26*). Assessing diet and nutritional status are particularly important, since they are modifiable factors that may reduce the risk of adverse pregnancy outcomes (*27*). The practice of classifying women by their body mass is a basic assessment skill needed to develop a nutrition care plan for diet and weight gain recommendations (*10*).

Our findings raise several concerns about the performance of nutrition risk assessors in actual practice. The practice variation, however, did not differ significantly between these specially certified public and private provider settings or between these specially certified public health or community clinics. Misassessment was not predictable from knowing an assessor's credentials either. Dietitians and lay health workers did not differ significantly in the extent of underassessment of underweight or overweight women. Nurses did not differ significantly from dietitians. This remained true whether registered nurses were tested alone (results not shown), with public health nurses, nurse practitioners, or with certified nurse midwives (tables 4 and 5). Obese Latina women, however, were essentially twice as likely as white women not to be assessed as overweight. Only about half of obese Latinas and a quarter of underweight women of any ethnic group were classified appropriately. The evidence is consistent with a conclusion that stereotypical generalizations may have lead to ethnic bias in the assessment of obesity, while no explanation is apparent for why underweight is uniformly underreported in all three groups.

Disparities in assessment of obesity in Latinas. Obese Latina women were twice as likely as white women not to be assessed accurately. There are several potential explanations for this difference in classification of obese Latina women. Assessors may have decided that for Latinas (*a*) the obesity standards were not valid, (*b*) the care they provided to reduce excess weight gain or obesity was not effective, or (*c*) that adverse birth outcomes were not as likely as in the other ethnic groups. If the first explanation were true, then assessors must have made informal ethnic-specific adjustments for Latina women, accepting that Latinas were more likely to be overweight, so it was not as extreme a condition for them.

We found no difference in the prevalence of obesity, however, and a lower, not higher, mean BMI for the obese group of Latinas in our study. In another study, Hispanic reference data for height and weight from the Hispanic Health and Nutrition Examination Survey did not improve the ability to explain variation in Hispanic birthweight outcomes more than that using white reference data (*14*). The prevalence of prepregnancy obesity in all three of these ethnic groups is within the range of those in other prenatal populations (*15,16*). Thus, if assessors were biased in discounting obesity standards for Latina women, we did not find evidence to justify this practice.

A second explanation for the ethnic disparity in assessment is that risk assessors may have been less likely to record obesity as a risk for Latinas because they perceived Latinas to be less amenable to nutrition interventions. Mexican Americans of certain sociodemographic groups appear less concerned with obesity and losing weight than whites, and overweight Mexican Americans less likely to consider themselves overweight (*28–30*). Other investigators have reported that overweight Mexican Americans in Arizona were less likely than other Mexican Americans to have been advised to lose weight, to be trying to lose weight, or to be participating in weight control programs (*28*). Some health professionals caring for Latinas may thus believe that Latinas are less likely to agree with the assessment that they are overweight and that being overweight is a risk to themselves or their baby. Therefore, they are also less likely act on weight control advice during pregnancy. Alternatively, a cultural gap such as language may complicate nutrition service delivery in general and lead the provider to conduct a more perfunctory risk assessment. For either reason, health providers may be less concerned with assessment of obesity in Latina women.

Finally, it is possible that risk assessors discount the risk of obesity among pregnant Latinas, believing that adverse perinatal outcomes are less common among Latinas. In California, the risk of low birth weight among Latinas is similar to the white population (*31*). Some assessors also may have assumed that obese Latinas were not at elevated risk of high birth weight. Previous investigations of the risk of maternal weight and perinatal outcomes have tended either not to include Latinas or not analyzed the results for Latinas separately (*32–34*).

For several adverse perinatal outcomes associated with obesity, however, our study found obese Latinas to be at significantly increased risk. The relative odds that obese Latinas would gain inappropriately large amounts of weight were 1.6 times those of normal weight-range Latinas. They were 2.7 times as likely to have inappropriately high birth weight babies and 2.1 times as likely to have Cesarean sections as normal BMI Latinas. These outcomes have implications for the health of both mother and the infant, including higher morbidity, longer hospitalizations, and greater weight retention after birth (*28,35–37*). Women who have greater weight retention after birth are also more likely to have health complications of being overweight later in life (*37*). We were unable to test the association between misclassification of body mass and adverse outcomes among obese Latinas due to limited sample sizes (34 misclassified obese Latinas had high weight gain, 14 had high birth weight infants, and 23 had Cesarean sections).

Different perinatal risks and outcomes have been noted for Latina women born in different countries, particularly lower risks for Latina women born outside the United States (*38–42*). The Latina women in this study were largely born in Mexico (66 percent), although eight percent were born in Central America and almost one quarter (23 percent) were born in the United States. We found that obese Latina women were more likely to be assessed accurately if they were born in the United States (analyses not shown). However, almost one fifth (17 percent) of the Latinas in this study were missing information on birth place in the CPSP record, and therefore these analyses by place of birth must be considered preliminary.

Provider disparities in nutrition risk assessment. Using assessment of body mass as a criterion, we did not find that low income pregnant patients received better nutrition risk assessment in public, rather than private, settings as others have with other criteria (*4,5,43*). Among these CPSP sites that had been through a certification process to provide enhanced prenatal services, private and public settings were comparable in their performance. It is possible that the private providers who chose to participate in CPSP were more experienced or motivated than other private providers to provide special support services to low-income women. Certainly, these private practice settings were committed to nutrition services, since half of the nutrition risk assessors they had providing nutrition services were registered dietitians. Only 38 percent were dietitians at public sites and 20 percent at community clinics. We did not find that sites that had delivered enhanced services for longer periods of time were more likely to perform nutrition risk assessments better.

We did not find that specialist nutrition risk assessors assessed risks better than generalists. Comparisons of other kinds of specialists and generalists have been potentially confounded by differences in the risks of their patients (*44,45*). In this study, we were able to adjust for differences in severity of body mass and medical complications contributing to nutrition risk (hypertension and diabetes in obese women). We then compared the degree to which nutrition specialists and generalists, according to their credentials, performed the primary assessment of risk. We did not find systematic differences in the performance of nutrition risk assessment explained by the credentials, even when dietitians were compared to lay health workers. Thus, our findings indicate that improvements in practice should be aimed at all assessors regardless of credential.

Efforts to reduce low weight births through improved prenatal care have increased in recent years, especially among low-income and underweight women (*9*). Underweight women of all three ethnic groups in this study were at elevated odds of less than optimal birthweights, and the odds were significant in black and white women. Thus, it is was most frustrating to find that their risk assessors identified only 26–28 percent of them in their charts or care plans. Random controlled trials of nutritional interventions have not concentrated on underweight women. Since underweight may be related to limited accessibility of nutritious food, low-income women may be at elevated risk for associated unfavorable outcomes. More research is needed on improving birthweight outcomes in underweight women. An additional focus on different ethnic populations should be emphasized in future research.

Limitations. This study has several limitations that qualify the interpretation of the results. Since the study is observational, any associations between ethnicity and misclassification of body mass do not necessarily imply a causal relationship. Although the analyses were adjusted for potentially confounding factors, it is possible that other factors not controlled in the analyses could explain the study findings.

Ethnic biases in accurately determining prepregnancy weight could contribute to the ethnic disparity in proper classification of the Latinas or their worse perinatal outcomes but not both. Although self-reported prepregnancy weight is generally reliable in categorizing women, overweight adult women and overweight Mexican American adolescents have been reported to underestimate their weight (*30,46–48*). If this occurred more often in obese Latina women than in obese white and black women, then those women categorized as obese were more obese than the obese black and white women. Although this might explain the worse outcomes for the Latinas, it is difficult to explain their higher risk of misclassification, since classification improved as BMI increased.

On the other hand, Latinas were more likely to have missing prepregnancy weights, and if assessors tended to rely more on the first prenatal weight measured for Latinas to estimate prepregnancy weights, they may have recorded a pregnancy weight for these Latinas with unknown weights and judged these Latinas not to be obese, just more pregnant. Latinas in this sample did not start care later than other ethnic groups (64 percent in the first four months, compared with 65 percent of whites and 69 percent of African Americans), but providers may have depended on weight at first visit to estimate prepregnancy weights for Latinas. If they overestimated their prepregnancy weights, Latinas that have obese BMIs should be less obese than white and black women with obese BMIs. This would be consistent with greater misclassification but not the worse perinatal outcomes. Finally, the prevalence of obese BMIs in the Latinas is not lower or higher than in blacks or whites, as would be expected with a bias in reporting for Latinas. We cannot, therefore, find any way to explain our findings by inaccuracies of reporting of prepregnancy weight in any of the ethnic groups.

Latinas were overrepresented in the group for whom data for one or more variables were missing (missing data, 64 percent Latinas; study sample, 52 percent Latinas). If the Latinas with missing data were similar to the remainder of the sample, 15 percent of these women would be expected to be obese. If 15 percent of the Latina women with missing data, selected at random, were assumed to be obese and classified appropriately, then the odds ratios for misclassification would have been lower, but not significantly lower, than those in tables 4 and 5. Thus, missing data do not seem to explain the study findings.

The sample size for the African American subgroup was small and may have explained the lack of statistical significance in some findings. To explore this possibility, we doubled the sample for African Americans, assumed that these women had the same characteristics as the original sample, and repeated all the analyses of outcome indicators that failed to show a significant effect (tables 2, 4, and 5). None of the insignificant effects became significant. Thus, the limited sample size for African Americans does not appear to explain the lack of significant bias in assessing nutrition risk or the lack of risk for certain adverse birth outcomes in extreme BMI groups.

The absence of an indication of overweight or underweight in the CPSP medical record was assumed to indicate that the provider did not perceive maternal body size as a significant risk factor. Consequently, the obese woman was presumably more likely not to have received counseling on the implications of gaining too much weight, and the underweight woman, too little weight. The instruments used at each site for the risk assessment varied, and conditions may have been identified during counseling in spite of the lack of written documentation. Since comprehensive prenatal care involves multiple providers and professional liability, the usual admonition that complete and accurate medical record keeping is one measure of the quality of performance of providing care takes on added importance (*49,50*).

Another limitation of the study relates to the determination of race-ethnicity. The basis for deciding a person's racial or ethnic identification can be problematic and inconsistent (*51*). The ethnicity variable used in this study was either self-reported or assigned. If Latina women were more likely to be assigned their ethnicity than the other groups, then the provider perception of maternal ethnicity (rather than self-reported ethnicity) was significantly predictive of misclassification of prepregnancy body mass. It is also possible that the ethnicity of the risk assessor, and possibly the BMI of the risk assessor, may have influence the classification of body mass. The available data, however, do not report information on either of these potential confounders.

Policy implications. The growing ethnic diversity of the population of childbearing women in the United States requires ongoing surveillance of ethnic-specific care and outcomes. Cultural competence among perinatal providers requires that they understand ethnic-specific risks and deliver ethnically appropriate, effective interventions. Both the Preventive Services Task Force and the Expert Panel on the Content of Prenatal Care recommend nutrition services as an essential component of prenatal care (*9,37*). Whether low-income pregnant women will benefit from improved access to Medicaid-sponsored comprehensive care will depend, in part, on whether the services are culturally appropriate and effective. Accurate information on ethnic-specific risks is fundamental to the process. We have found a tendency among specially certified providers of prenatal care to low-income women in California to underdiagnose obesity among Latina women. There is, therefore, evidence that cultural competence to provide health care for Latinas will require greater attention to the assessment and care of their risks. Improving health outcomes for women and infants in the future is not just a search for new treatments but more effective implementation of measures known to be associated with better health outcomes for mothers and infants (*26*).

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