Pergamon

Soc. Sci. Med. Vol. 43, No. 2, pp. 187–197, 1996
Publishee by Elsevier Science Ltd. Printed in Great Britain
0277-9536/96 $15.00 + 0.00

0277-9536(95)00361-4

LOW BIRTHWEIGHT IN A PUBLIC PRENATAL CARE PROGRAM: BEHAVIORAL AND PSYCHOSOCIAL RISK FACTORS AND PSYCHOSOCIAL INTERVENTION

MELANIE J. ZIMMER-GEMBECK* and MARK HELFAND

Oregon Health Sciences University, Biomedical Information Communication Center, 3181 SW Sam Jackson Park Road, Portland, OR 97201-3098, U.S.A.

Abstract—A retrospective, observational study of 3073 low income African American, Latina, and White women receiving comprehensive prenatal care at 26 provider sites was completed. The purpose of the study was to test three hypotheses. First, after adjustment for biomedical complications, the presence of maternal behavioral and psychosocial factors would be associated with an increased rate of low birthweight infants. Second, increased time spent in psychosocial services would negate the relationship between maternal psychosocial factors and low birthweight. Third, after adjusting for biomedical, behavioral, and psychosocial factors, rates of low birthweight would no longer differ by race.

Maternal smoking (over five cigarettes per week), maternal low weight for height and/or weight gain, negative mood (depression, anxiety, and/or hostility) and rejection of the pregnancy were found to be related to an increased rate of low birthweight birth (< 2500 g). Receiving more than 45 min of psychosocial services was related to a reduced rate of low birthweight birth for all women regardless of risk profile. The rate of low birthweight remained higher in African American women after adjusting for all significant maternal biomedical, behavioral, and psychosocial risk and intervention factors.

Further analyses revealed that the strength and direction of the relationship between time spent in psychosocial services and low birthweight remained after controlling for the number of prenatal care visits, the time spent in nutrition or health educational services, and gestational age. Also, the time spent in psychosocial services was related to a reduced rate of low birthweight even after excluding time spent in psychosocial services in the third trimester of pregnancy or excluding women who received their first psychosocial assessment in the third trimester from the analysis. Although definitive evidence from randomized trials of psychosocial services is lacking, receiving over 45 min of psychosocial services was related to a reduced risk of low birthweight for all women in this study. Therefore, general psychosocial services appears to be an important component of prenatal care for all low income women. Published by Elsevier Science Ltd

Key words—low birthweight, psychosocial services, depression, rejection of pregnancy, prenatal care

INTRODUCTION

In the United States, the current rate of low birthweight (LBW; < 2500 g; 5 lb, 5 oz.) is *ca* 7%. Due to the elevated risk of mortality associated with LBW, this rate places the United States 20th among developed nations in infant survival [1]. In recent years, rates of LBW have declined for some demographic groups, but it still remains high for other groups, particularly African American women and low income women [1–3].

Past research has particularly emphasized the identification of maternal demographic, biomedical, behavioral, and psychosocial factors which significantly increase rates of LBW [4–7]. However, the risks for LBW births are still not well established and the components of prenatal care which provides the greatest reduction of risk have yet to be determined [8].

Smoking during pregnancy has been consistently linked with increased rates of LBW, while alcohol use and drug abuse do not always have a consistent relationship with LBW [6, 9–12]. However, in two recent studies with large numbers of drug abusing women, drug use was found to substantially increase the risk of LBW [13, 14]. In addition, race/ethnicity (usually African American) and increasing maternal age have been found to be related to an increased rate of LBW even after controlling for some maternal risk factors [6, 15–18].

It has not been firmly established whether maternal psychosocial factors are related to LBW births [19, 20]. Increasing maternal stress (or life changes) and depression have been found to reduce infant birthweight in some reports [7, 12, 21–23]. The level of emotional or social support women report receiving during pregnancy, which has been hypothesized to reduce or buffer emotional stress, has not consistently changed the impact of stress on birthweight, but has been found to be directly related to increased birthweight [24, 25]. Additionally, low family functioning (defined as "dissatisfaction with the family's emotional and instrumental activities"

*Author for correspondence.

[25]) has been associated with an increased rate of LBW [25, 26] and there is limited evidence for a relationship between maternal anxiety or attitudes toward pregnancy and LBW [7, 12, 25,27, 28].

There have been two primary limitations of the studies attempting to identify maternal behavioral and psychosocial factors which influence the LBW rate. First, small numbers of participants or limited data from each participant has resulted in the inability to include information on biomedical, behavioral, and psychosocial factors in one multivariate analysis. Therefore, patient biomedical risk status is usually not adequately accounted for, and the target of analysis has often been a reduced set of behavioral and/or psychosocial factors [7, 22, 25, 29–31].

The second limitation is the frequent use of self-administered questionnaires for collection of psychosocial data. Self-report may be biased as concerns about self-presentation or misinterpretion of questions could result in inaccurate coding. Clinical assessment or open-ended questionnaires have been suggested as possible alternative data collection methodologies [32].

Increasingly, prenatal care programs include a component of psychosocial assessment and intervention services, but few programs have formally evaluated the impact of this care on pregnancy outcomes. Therefore, there is still a scarcity of information available regarding the effectiveness of these services for reducing rates of LBW.

The implementation of psychosocial services has primarily been operationalized as the provision of maternal social or emotional support during pregnancy. The effectiveness of these services for improving maternal and birth outcomes has been assessed after randomly assigning a small number of women, usually of high risk, to receive:

1. increased levels of supportive communication;
2. home visits by social workers, midwives or other health care providers; and/or
3. increased feedback, care, or test results over the course of the pregnancy [33–35].

Few studies have reported that these services influenced pregnancy outcome, but, in two fairly recent studies, a reduction in the rate of LBW (or very LBW) was found when a program of social support was provided during pregnancy [34, 36]. Although the evidence is not strong for a relationship between social support provision and LBW, increases in support during pregnancy has usually been found to have other benefits including decreased levels of maternal worry, nervousness, and negative feelings about the pregnancy [32].

This study makes use of data collected retrospectively from medical charts to determine maternal behavioral and psychosocial risk factors for LBW and to assess the relationship between psychosocial services and LBW. All women were participating in a comprehensive public prenatal care program. Psychosocial services were a portion of the care provided in this program. Medical charts were abstracted for a range of information including demographic data, biomedical risks, behavioral factors, psychosocial difficulties, and services provided. The three specific hypotheses of this study were:

1. After controlling for maternal biomedical risk status, the following maternal factors would be associated with higher rates of LBW:
   (a) smoking during pregnancy;
   (b) alcohol consumption and/or drug use during pregnancy;
   (c) small weight for height/weight loss;
   (d) family conflict/stress;
   (e) no emotional support;
   (f) negative mood; and
   (g) rejection of the pregnancy.
2. Increased time spent in psychosocial services would negate any relationship between the four psychosocial factors (d, e, f, and g above) and LBW.
3. After accounting for biomedical, behavioral, and psychosocial risk factors, rates of LBW would no longer vary by race/ethnicity.

METHODS

Sites of prenatal care

Health care provider sites in California were selected for possible inclusion in the study if they responded to a 1990 survey of all California Perinatal Services Provider (CPSP) sites, had billed for CPSP services by April 1989, and had provided CPSP care to at least 50 women [37]. CPSP care included prenatal visits and testing, psychosocial services, nutritional services, health educational services, and behavioral assessment.

The site selection criteria resulted in a population of 89 sites. The sites were then stratified by four areas of the state and by type of site (private physician, private hospital clinic, community clinic, public hospital clinic, and public health department clinic). Two sites (or less if there were less than two in the strata) were then randomly selected from each strata. This study includes 26 of the 28 sites from this stratified random sample. Two sites were excluded due to inadequate access to psychosocial data. Additionally, data from one site which was gathered as part of another research study was included. The final 27 sites included five private physicians, five private hospital clinics, eight community clinics, three public hospitals, and six health department clinics.

Study participants

All participants in CPSP were low income women who were eligible for Medi-Cal benefits (income < 200% of the federal poverty level and allowable assets not over *ca* $3000). The birth log or

clinic roster listing the estimated dates of confinement was reviewed at each site and women were selected for participation if their estimated birth dates fell between 30 June 1989 and 31 December 1990. Medical charts were reviewed for this group of women at each site. If a woman had one CPSP clinical visit, one CPSP risk assessment, and a singleton birth within the time period, her medical chart was selected for inclusion in the study. This process continued until all medical charts of women who fit the criteria were included up to a maximum of 140 charts at a site. The number of charts reviewed from each site ranged from 62 to 140.

Since assessing LBW rates by race/ethnicity was a specific hypothesis of this study, African American, Latina, and White women were selected from the database for inclusion in the analysis. Five of these women did not have an infant birthweight recorded and were excluded from the study. These criteria resulted in a final study set of participants which included 3073 women receiving prenatal care at 26 clinic sites.

Women excluded from this study were more likely to be White, smoke during pregnancy, use alcohol during pregnancy, and use drugs during pregnancy ($p < 0.001$ for each). There were no differences in mean gestational or maternal age, rate of LBW, rate of preterm birth, or rates of biomedical risk factors.

Data collection

Information was abstracted from medical charts by five accredited research technicians (ARTs) with extensive training and repeated audits of the data collection. One additional abstractor, a social worker, collected the psychosocial information at one site. Three training sessions included interrater reliability testing of eight sample charts and individual and group discussions to resolve discrepancies in abstraction. A Project Director was available for consultation by telephone throughout the data collection period to provide any information that the ARTs may have requested. The data collected from each woman's chart which was pertinent to the current study included: demographic information; birth and medical history; prenatal care visit dates, maternal weight, tests completed, test results and gestational age; ultrasound tests, dates, gestational age, and diagnoses; problems and complications of the pregnancy; birth information and outcomes; care of specific problems during pregnancy (diabetes, gestational diabetes, hypertension, preeclampsia, urinary tract infection, vaginal bleeding); psychosocial risks and actions noted on assessments; and use of tobacco, alcohol, and drugs.

Psychosocial information was reported on state approved forms which varied by site of care. In order to increase the ability to abstract psychosocial data uniformly, a 72-item coding system, which was comprised of 122 phrases to be abstracted, was devised [38].

Variables. Independent variables identified as possible risks for LBW were limited to those maternal factors assessed prior to the third trimester of pregnancy which prenatal care programs could possibly impact. All biomedical, behavioral, and psychosocial items were indicator variables coded as 1 if the factor was present, and 0 if not.

Biomedical

Maternal biomedical risks included a history of a LBW birth, vaginal bleeding in the second trimester, and a medical composite item (MR). MR included prior or current hypertension, prior renal disease, diabetes, oligohydramnios, two positive urine protein findings in a row measured at prenatal care visits, or a structural abnormality of the cervix. MR was coded 1 if a woman had one of these complications and 2 if a woman had greater than 1 of these risks [39].

Behavioral

Maternal behavioral factors included smoking greater than five cigarettes per day during pregnancy, a composite of alcohol and/or drug use, and a low weight composite item. Alcohol or drug use was indicated if a woman consumed > 7 oz of alcohol per week during pregnancy or used drugs during pregnancy (primarily marijuana, cocaine, crack, PCP, heroin, or amphetamines). Only 24 women used over 7 oz of alcohol per week during pregnancy, 143 used drugs during pregnancy, and seven women used both alcohol and drugs during pregnancy. Univariate analyses indicated that both alcohol use and drug use conveyed similar risk for LBW (LBW rate = 12.5% for women using over 7 oz of alcohol per week, and 10.5% for women using drugs) and, therefore, they were combined to form one composite item.

The low weight composite was indicated if there was a weight loss from prepregnancy to the end of the second trimester ($N = 67$; LBW rate = 14.9%), and/or low weight for height (based on Quetelet index of weight/height^2 with a cutoff of the lowest 10% of the study participants; $N = 260$, LBW rate = 10.4%). Six women had both of these weight risks.

Psychosocial

Maternal psychosocial variables included a family conflict/stress composite item, an indicator of lack of emotional support, a negative mood composite item, and a composite item indicating rejection of the pregnancy. 'Family conflict/stress' was indicated by a report of one or more of the following: excessive stress, conflict/stress/fights with partner, parents, children or other intrafamilial stress. Since the most common characteristics that increase the likelihood that events will be considered stressful are unpredictability, lack of control, and conflict [40, 41], and family relationships which are functioning poorly often contain high levels of conflict, family conflict

was combined with a report of excessive or emotional stress to form this composite item.

'Lack of emotional support' was a composite item indicated by an assessment that a woman felt alone and lonely, lacked social contact, had no friends, lived alone, or had minimal general emotional support. These items were combined to form this indicator since most scales which measure level of emotional/social support rate individuals low in support if they are lonely or lack personal networks or intimacy.

'Negative mood' was a composite indicator of an assessment of clinical, severe or acute depression, being angry or hostile, having severe anxiety, or having a suicidal episode. These items were combined as the symptoms of depression and anxiety often coexist, clinical research has found that it is often difficult to distinguish one disorder from the other, symptoms of both are sometimes relieved by the same antidepressant medication, and some researchers argue that anxiety and depression are variants of the same disorder [42–44]. These similarities made it difficult to conceptualize how one disorder could be differentially related to pregnancy outcomes. Anger/hostility was included in this composite because this item, like depression and severe anxiety, suggests a strong negative emotional mood and a commonly used measure of mood includes a scale for hostility (The Multiple Affect Adjective Checklist; [45]).

The indicator of 'rejection of pregnancy' included assessment that the woman was regretting the pregnancy, rejecting the pregnancy, did not want the baby, was refusing to prepare for labor or delivery, or had negative feelings about the pregnancy.

Clinic sites had multiple individuals with various educational backgrounds completing psychosocial interviews with women receiving prenatal care in the program. Because psychosocial information was noted on assessment forms that were site specific, the internal validity of the psychosocial data is difficult to assess and the data could be considered subjective. However, the items used in this study were selected based on their increased face validity, and due to evidence of construct and convergent validity from significant correlations with items that were expected to be related. Also, variables were combined to form composites to increase the probability that differences in interpretation and notation could be reduced. Composites were then assessed to determine if they varied systematically between provider settings (metropolitan vs nonmetropolitan), provider types (private physician, private hospital clinic, community clinic, public hospital, and health department clinic), and abstractors. A similar approach to determining the validity of psychosocial information was taken in a previous and related manuscript [38].

No consistent pattern of relationships between psychosocial factors and provider setting was found. Rural sites reported higher rates of family conflict/stress and lack of emotional support, while urban sites had higher rates of rejection of the pregnancy and negative mood. Health departments did have the highest rates of all psychosocial factors except family conflict/stress, while private physicians also had high rates of most of the composite psychosocial items and private hospitals had lower rates. Two abstractors consistently noted lack of emotional support, family conflict/stress, and negative mood more frequently. Because of the differences found in these analyses, provider setting, provider type, abstractor, and the interactions of these variables with the four psychosocial variables were controlled for in the multivariate models described below.

Psychosocial services

Psychosocial services were defined as time spent in assessment and intervention separate from the medical/obstetric, nutritional, or health educational components of prenatal care. Psychosocial services included assessments of mental illness, emotional problems, abuse and violence, homelessness, financial difficulties, substance abuse, etc., and actions taken to alleviate these problems. Time spent in psychosocial (TSP) services was recorded and used as the measure of the amount of psychosocial intervention services women received. TSP services was then coded as high or low based on the median value of the study participants (45 min). Over 45 min of TSP services was considered a high amount of intervention and coded 1. Forty-five minutes or less was coded as a low amount of intervention (0).

Pregnancy outcome

The pregnancy outcome (dependent) variable in this study was LBW. Infants were categorized as LBW if they weighed < 2500 g and were categorized as normal birthweight (NBW) otherwise.

Data analysis

Since all variables were categorical, χ^2 statistics were calculated initially to describe the relationship between all independent variables and LBW. Next, multiple logistic regression was used to determine the independent contribution of each of the maternal risk and service variables to the outcome of LBW. To observe how relationships between risk and service variables and LBW changed as new information was added to the model, variables were entered in steps. In step 1, age, parity, race, provider setting, provider type, and abstractor were entered in the model to control for the relationship of these variables with the rate of LBW. Step 2 added maternal biomedical variables to the model. Next, to test hypothesis 1, maternal behavioral factors were added to the model (step 3) and psychosocial factors were added in step 4.

The goal of steps 5 and 6 was to test hypothesis 2 which stated that increased TSP services provided to women with psychosocial difficulties would negate any increase in the rate of LBW associated with

Table 1. Characteristics of the study participants

Variable	All participants	African Am women	Latina women	White women
Age (mean ± SD)	24.1 ± 5.7	23.5 ± 5.6	24.6 ± 5.8	23.6 ± 5.5
Gestational age (mean ± SD)	39.5 ± 2.0	39.2 ± 2.4	39.5 ± 1.9	39.8 ± 1.9
Nulliparous	40.0%	37.1%	39.5%	41.7%
Married	40.0%	8.7%	53.3%	30.5%
Under 18	8.5%	12.5%	7.1%	9.1%

Total sample $N = 3073$; two missing age information.

psychosocial factors. To test this hypothesis, the indicator of TSP services was added to the model in step 5 and the interactions between TSP services and the four psychosocial composite variables were included in step 6. If TSP services only reduced the rate of LBW in women with psychosocial difficulties, then TSP services entered in step 5 would not be related to LBW and the interactions entered in step 6 would be significantly related to LBW.

After all six steps were completed, variables were excluded from the multivariate model using backward elimination [46] until only variables which were significantly ($p < 0.05$) related to LBW remained.

Odds ratios (OR) and the confidence intervals of the ORs (CI) were calculated for all independent variables significantly related to LBW. The OR is the change in the odds of the outcome associated with each independent variable. The OR and CI are calculated from the coefficient, B, and the standard error of B, SE(B), for the corresponding independent variable using the following formulas ([46], Cary, NC: SAS Institute, Inc.).

$$OR = e^{B}$$

$$CI(OR) = e^{B \pm [1.96 * SE(B)]}.$$

Finally, a second multiple logistic regression model which included all risk and intervention variables significantly related to LBW except race/ethnicity was used to obtain predicted rates of LBW for women grouped by race. These predicted rates of LBW were used to adjust the rates of LBW observed within these groups [47, 48]. A risk ratio was calculated for each race/ethnicity as the proportion of women of a particular race/ethnicity who had LBW births divided by the mean predicted rate of LBW for each race. This risk ratio for a group was multiplied by the overall rate of LBW for all study participants to obtain the adjusted rate of LBW for each race.

All analyses were completed with Statistical Analysis System (SAS) software (Cary, NC: SAS Institute, Inc.) or JMP statistical software (Cary, NC: SAS Institute, Inc.) on an IBM RS6000 workstation or a Macintosh computer.

RESULTS

Participant characteristics

Of the final sample, 53.1% ($N = 1631$) were Latina, 34.9% ($N = 1073$) were White, and the remaining 12.0% ($N = 369$) were African American. Descriptive information for the final study participants and for women grouped by race/ethnicity is shown in Table 1.

The rates of all biomedical, behavioral, and psychosocial risk factors for the total sample and by race/ethnicity are shown in Table 2. Smoking during pregnancy was the most prevalent behavioral factor (15.8%), while psychosocial difficulties were even more common. For example, 19.0% of women were assessed to have had a negative mood.

The overall rate of LBW was 5.5% ($N = 170$). As expected, African American women had a higher rate of LBW than Latina women or White women ($p < 0.001$; see Table 3). Except for lack of emotional

Table 2. Summary of biomedical, behavioral, psychosocial factors and psychosocial services

Variable	All participants	African Am women	Latina women	White women
Biomedical, N(%)				
Prior LBW birth	220 (7.2)	51 (13.8)	108 (6.6)	61 (5.7)
Second trimester vaginal bleed	58 (1.9)	9 (2.4)	20 (1.2)	29 (2.7)
1 medical risk	316 (10.3)	58 (15.7)	91 (5.6)	167 (15.6)
> 1 medical risk	18 (0.6)	4 (1.1)	9 (0.6)	5 (0.5)
Behavioral, N(%)				
Smoking during pregnancy	484 (15.8)	68 (18.4)	44 (2.7)	372 (34.7)
Alcohol and/or drug use	157 (5.1)	24 (6.5)	20 (1.2)	113 (10.5)
Small maternal weight or weight loss	316 (10.3)	40 (10.8)	148 (9.1)	128 (11.9)
Psychosocial, N(%)				
Negative mood	584 (19.0)	97 (26.3)	277 (17.0)	210 (19.6)
Rejection of pregnancy	367 (11.9)	32 (8.7)	221 (13.6)	114 (10.6)
Family conflict/stress	379 (12.3)	38 (10.3)	139 (8.5)	202 (18.8)
No emotional support	562 (18.3)	45 (12.2)	309 (18.9)	208 (19.4)
Psychosocial services				
Mean	61.5 ± 62.1	62.8 ± 61.9	54.3 ± 51.3	71.9 ± 74.4
Median	45	30	45	60
> 45 min, N(%)	1372 (44.6)	141 (38.2)	640 (39.2)	591 (55.1)

All variables are defined in Section 2. Total sample $N = 3073$.

Table 3. Univariate relationships between each independent variable and LBW

Variable	Percent low birthweight	χ^2 *P*-value
Demographic		
Age		
≤ 38 years	5.4	0.003
> 38 years	15.6	
Parity		
Nulliparous	6.6	0.035
Multiparous	4.8	
Race		
African American	10.6	0.000
Latina	4.7	
White	5.0	
Biomedical		
Previous LBW birth		
No	4.8	0.000
Yes	14.6	
Second trimester vaginal bleeding		
No	5.1	0.000
Yes	29.3	
Medical risk composite		
No	4.8	0.000
1 risk	11.1	
> 1 risk	27.8	
Behavioral		
Smoking during pregnancy		
No	4.7	0.000
Yes	10.1	
Alcohol and/or drug use		
No	5.3	0.009
Yes	10.2	
Maternal low weight for height/weight loss		
No	4.9	0.000
Yes	11.1	
Psychosocial		
Negative mood		
No	4.7	0.000
Yes	9.1	
Rejection of pregnancy		
No	5.1	0.009
Yes	8.5	
Family conflict/stress		
No	5.2	0.054
Yes	7.7	
No emotional support		
No	5.3	0.316
Yes	6.4	
Time spent in psychosocial services		
≤ 45 min	6.6	0.005
> 45 min	4.2	

All variables are defined in Section 2. Total sample $N = 3073$; two missing age.

support and family conflict/stress, all biomedical, behavioral, and psychosocial risk variables were related to an increased rate of LBW in univariate analyses (see Table 3). Over 45 min of TSP services was associated with a decreased rate of LBW.

Multivariate analysis

Table 4 lists all risk variables added to the multiple logistic regression model, the significance value and the associated *OR* and *CI* of each variable remaining in the final model, and the significance value associated with each variable of the full multivariate model. In the final model, age, parity, and race/ethnicity were all significantly related to LBW. Women over age 38 and nulliparous women had increased rates of LBW. Compared to Latina women, African American women had a higher rate of LBW and White women had a decreased rate. Provider setting, provider type, and abstractor were not related to LBW.

All maternal biomedical risk factors were significantly related to an increased rate of LBW. Smoking during pregnancy and small weight for height/weight loss were also associated with an increased rate of LBW. Even though alcohol/drug use had a significant univariate relationship with LBW, it was no longer related to LBW after accounting for these variables. Among psychosocial factors, maternal negative mood and rejection of pregnancy were associated with an increased risk of LBW.

The relationship between TSP services and LBW was significant, but no interaction between TSP services and psychosocial factors was related to LBW. Therefore, spending over 45 min in psychosocial services was related to a reduced rate of LBW for all women, rather than being limited to women with a psychosocial difficulty.

To conclude, the final model to predict LBW included the following independent maternal risk and intervention variables: maternal age > 38, race/ethnicity, parity, the three biomedical risk factors, smoking more than five cigarettes per day during pregnancy, low maternal weight for height/weight loss, negative mood, rejection of the pregnancy, and TSP services.

Race/ethnicity

African American women continued to have a higher rate of LBW compared to Latina and White women after adjustment for all significant risk and intervention variables included in this study. The adjusted rate of LBW for African American women was 8.3%, 5.7% for Latina women, and 4.3% for White women (see Fig. 1). Latina women had a higher adjusted rate of LBW than White women ($p < 0.001$), and the adjusted rate of LBW of African American women was higher than the rate of LBW in Latina women ($p < 0.001$). Both African American and White women had lower adjusted rates of LBW than actual rates, indicating that the prevalence of other specified risk factors in these groups led to an increased rate of LBW. However, Latina women had an adjusted rate of LBW higher than actual which indicates a lower prevalence of LBW risk factors in this group.

Post hoc analyses

Psychosocial services. Post hoc analyses were completed to further examine the relationship between psychosocial services and LBW (see Table 5). If TSP services were restricted to *only the first assessment* and dichotomized at the median (30 min), there was a trend towards a relationship between psychosocial services and LBW ($p = 0.08$; $OR = 0.72$; $CI = 0.50$–1.04). Including the time spent in up to the *first two psychosocial assessments* dichotomized at the median (45 min) significantly reduced the risk of LBW ($p = 0.003$; $OR = 0.56$;

Table 4. Results of multiple logistic regression analyses

Dependent variable: low birthweight indicator	Final model *p*-value	Final model *OR*	Final model CI(OR)*	Full model *p*-value‡
Variable				
Age > 38	0.002	4.27	1.72–10.58	0.002
Nulliparous	0.000	2.30	1.60–3.33	0.000
African American (Latina†)	0.047	1.58	1.01–2.48	0.069
White (Latina†)	0.050	0.65	0.42–1.00	0.140
Provider setting§	—	—	—	0.163
Provider type§	—	—	—	0.724
Abstractor§	—	—	—	0.808
Previous LBW birth	0.000	3.50	2.12–5.79	0.000
Second trimester vaginal bleeding	0.000	8.13	4.20–15.73	0.000
1 medical risk (0 medical risks†)	0.000	2.40	1.56–3.71	0.000
> 1 medical risk (0 medical risks†)	0.001	7.03	2.18–22.72	0.001
Smoking during pregnancy	0.000	2.65	1.71–4.11	0.000
Alcohol/drug use	—	—	—	0.265
Small maternal weight/weight loss	0.000	2.51	1.64–3.83	0.000
Negative mood	0.012	1.65	1.12–2.42	0.057
Rejection of pregnancy	0.015	1.75	1.12–2.75	0.099
Family conflict/stress	—	—	—	0.078
No emotional support	—	—	—	0.421
Psychosocial services (> 45 min)	0.000	0.44	0.31–0.63	0.000
Interactions				
Psychosocial services × negative mood	—	—	—	0.535
Psychosocial services × rejection of pregnancy	—	—	—	0.667
Psychosocial services × family conflict/stress	—	—	—	0.093
Psychosocial services × no emotional support	—	—	—	0.808

All variables are defined in Section 2. Total sample $N = 3071$; two missing age.
*Odds ratio confidence interval.
†Reference group.
‡All *p*-values for variables in the full model are reported prior to inclusion of interaction terms.
§Main effect estimates are reported for provider setting, provider type, and abstractor.

$CI = 0.39$–0.82). In fact, women with two or more psychosocial visits had approximately one-half the risk of having a LBW infant when compared to women of similar risk with one visit ($OR = 0.47$; $CI = 0.33$–0.66). In summary, after adjustment for patient risk factors, at least one repeat visit and over 45 min in psychosocial services were both associated with a reduced risk of LBW in low income women.

Alternative explanations

The following alternative explanations for the relationship between TSP services and LBW were considered. First, TSP services could be associated with a reduced risk of LBW because these services are a marker for other interventions that were responsible for the reduction in the rate of LBW. For example, increased TSP services may be an indicator

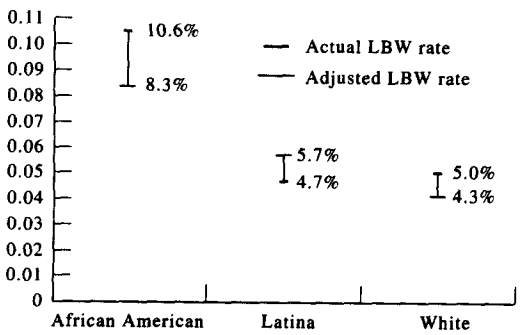

Fig. 1. Actual and adjusted rates of LBW for women grouped by race/ethnicity.

of increases in other types of prenatal care services such as medical/obstetric visits, time spent in nutritional assessments, or time spent in health education interventions. Instead of TSP services, these other services may have provided the benefits that lead to reduced rates of LBW. However, the number of prenatal visits was not correlated with TSP services ($r = 0.02$, $p = 0.254$), and controlling for the number of prenatal care visits (adjusted for time of entry to care and gestational age at birth) in the final multiple logistic regression model did not change the relationship between TSP services and LBW ($OR = 0.45$; $CI = 0.31$–0.66). Also, even though TSP services were significantly correlated with both time spent in nutritional assessments and time spent in health educational assessments ($r = 0.24$ and 0.23, respectively; $p < 0.000$ for both), adjustment for time spent receiving these services did not substantially change the relationship between TSP services and LBW ($OR = 0.49$; $CI = 0.34$–0.71).

Second, women who had longer pregnancies (and, hence, were at lower risk of LBW) have a greater chance for receiving multiple psychosocial assessments and increased TSP services. This could bias the results since the relationship between TSP services and LBW may be in the opposite direction (longer pregnancies lead to more TSP services). However, women were required to get a psychosocial assessment within the first 30 days of prenatal care in order for reimbursement of services to occur. Therefore, 88% of women who had entered care

Table 5. Percent LBW births by maternal risk profile and time spent in psychosocial services

Maternal risk profile*	Time in psychosocial services	
	≤ 45 min; percent LBW (*N*)	> 45 min; percent LBW (*N*)
No specified risk factors	3.4% (946)	1.1% (529)
Negative mood	7.7% (91)	2.3% (126)
Rejecting the pregnancy	4.7% (64)	3.4% (89)
Smoking more than five cigarettes per day during pregnancy	6.7% (119)	1.6% (122)
One biomedical risk	7.7% (78)	5.9% (68)
Small maternal weight for height and/or weight loss	11.1% (108)	3.7% (54)
Smoking, and negative mood	18.8% (16)	4.0% (25)
Smoking, and rejecting the pregnancy	25.0% (8)	12.5% (8)
Smoking, and small maternal weight for height and/or weight loss	17.7% (17)	14.3% (14)

*Maternal risk profiles include women who had ONLY the risk factors noted and combine women of all ages, parity, and race/ethnicities.

before the third trimester had a psychosocial assessment prior to the third trimester, and 78% of all women in the study had a psychosocial assessment prior to the third trimester.

Three additional analyses were completed to further investigate the possibility of this bias. First, the final multivariate logistic regression analysis was repeated including only those women who had their first psychosocial assessment prior to the third trimester. The relationship between TSP services and LBW did not change ($OR = 0.44$; $CI = 0.30$–0.66). Second, a new measure of TSP services was calculated limiting the time spent to the first and second appointments and, third, time spent in a second psychosocial services assessment which occurred in the third trimester was excluded. Neither of these measures substantially changed the relationship between TSP services and LBW ($OR = 0.45$; $CI = 0.31$–0.66 and $OR = 0.54$; $CI = 0.37$–0.79, respectively). Therefore, even after limiting the measure of TSP services to early assessments, over 45 min of TSP services was associated with a reduced rate of LBW.

Gestational age-specific LBW. Risk and interventions factors found to be related to LBW can either:

1. directly influence the rate of LBW;
2. indirectly influence LBW through changing the length of gestation; or
3. have both indirect and direct effects on LBW.

Controlling for gestational age of the infant at birth in a multivariate analysis will serve to partially separate these paths of influence and allow conclusions regarding the association between maternal risk factors or intervention and gestational age-specific LBW. Therefore, an additional *post hoc* analysis was completed including length of gestation as a covariate in the final model shown in Table 4. Length of gestation was added to the model both before and after the addition of TSP services. The length of gestation was estimated by one of the following methods with priority:

1. ultrasound dating completed between 14 and 22 weeks of gestation;
2. clinician estimate; or
3. estimated date of confinement.

Although all relationships between maternal risk factors and LBW were slightly weakened after control for length of gestation, only two maternal risk factors were not associated with gestational age-specific LBW before inclusion of TSP services in the model—having 1 MR (such as hypertension or diabetes) and negative mood. In addition, there was no longer a difference in LBW rates between Latina and White women ($p = 0.76$), but African American women had a higher rate of gestational age-specific LBW when compared to Latina women ($OR = 1.80$, CI 1.02–3.18, $p = 0.04$).

Receiving over 45 min of TSP services was associated with a reduced risk of gestational age-specific LBW ($OR = 0.50$; CI 0.32–0.78). The addition of TSP services to this analysis reduced the difference in gestational age-specific LBW rates between African American women and Latina women to a trend ($OR = 1.77$, CI 0.99–3.16, $p = 0.05$).

DISCUSSION

This study examined the relationship between maternal behavioral and psychosocial factors, psychosocial services, race, and the pregnancy outcome of LBW after controlling for biomedical risk in a group of low income women. Study participants included a high percentage of ethnic minorities and all women were receiving care in a public prenatal care program.

Based on multivariate analysis, the maternal behavioral and psychosocial variables which were directly and/or indirectly (through reduced length of gestation) related to an increased rate of LBW were smoking more than five cigarettes per day during pregnancy, small weight for height/weight loss, negative mood, and rejection of the pregnancy. Small weight for height/weight loss was indicated by a small body mass index or weight loss from prepregnancy to the second trimester. Negative mood included assessment of maternal depression, anxiety, or hostility. Rejection of the pregnancy included assessment of maternal regret of the pregnancy, rejection of the pregnancy, refusal to prepare for labor or delivery, or negative feelings about the pregnancy.

The impact of smoking and small weight for height/weight loss on LBW found in this study is comparable to past research [6, 11, 49, 50]. Smokers are usually found to have an odds of a LBW birth between 1.8–2.4 times higher than the odds for nonsmokers. This study found that women who smoked over five cigarettes a day had an increased odds of a LBW birth slightly higher than this range ($OR = 2.7$). Alcohol/drug use was not found to be related to LBW in this study. This result is also consistent with past research [6, 11].

Maternal psychosocial variables related to LBW included negative mood and rejection of pregnancy. Family conflict/stress and lack of emotional support were not related to LBW. No previous research on birth outcomes has combined depression, anxiety, and hostility into one composite risk item, but all these factors were expected to indicate a negative mood state. Combining these mood states in future research may lead to the emergence of a more consistent relationship between these psychological states and LBW or other birth outcomes.

Usually, maternal rejection of the pregnancy or pregnancy wantedness are measured with interviews that ask women how worried they felt when they thought they might be pregnant, or ask questions regarding the level of hope for pregnancy [27]. Other studies have used standardized questionnaires (such as the Maternal Attitudes Towards Pregnancy [28]). These measurement techniques are more focused on assessing women's pregnancy wantedness at the point of conception or very early in pregnancy. This early timing of the administration of the measurement may have influenced the inconsistent relationship with LBW reported in past research. This study identified women who were overtly rejecting the pregnancy later in the term (after entering prenatal care). Continued or late feelings of rejection of the pregnancy may be the important criteria which leads to an increased risk of LBW.

Spending over 45 min in psychosocial services reduced the odds of LBW by approximately one-half for all low income women regardless of their profile of demographic, biomedical, behavioral, or psychosocial risk factors. This relationship was not changed after adjustment for the number of prenatal care visits, the time spent in nutritional assessment, the time spent in health educational services, or the gestational age of the infant at birth. In addition, excluding women who had their first psychosocial assessment in the third trimester from the analysis, excluding from consideration all TSP services during the third trimester, or limiting the measure of TSP services to the time spent in the first two assessments prior to the third trimester did not change this relationship. In summary, spending either more than 45 min. in services targeted at psychosocial issues and/or having more than one session of psychosocial services decreased women's risk of LBW before and after control for length of gestation.

Two other possible explanations for the relationship between TSP services and LBW could not be examined. First, women receiving over 45 min of TSP services may have been more motivated to engage in positive self-care during their pregnancy in addition to attending scheduled prenatal care appointments and assessments. Instead of TSP services decreasing the risk of LBW, this motivation, or other variables associated with it, could have resulted in improved birth outcomes.

Second, psychosocial care providers could have engaged in 'provider selection' in which they chose to spend more time with women who had some difficulties, but did not spend increased amounts of time with women whose difficulties were so severe that an attempt at intervention under the time constraints of prenatal care would have been difficult. Therefore, the women at highest risk would have received a reduced amount of services as compared to women of somewhat lower risk levels. This study could not examine either of these possibilities due to lack of information and the limitations of binary scaled measures of maternal risk status. Both of these possible explanations should be examined in future research.

In almost every previous study, African American women continue to have a higher rate of LBW after adjustment for maternal risk factors [5, 6, 16]. This study corroborates these previous results by demonstrating that after adjustment for multiple risk factors, African American women still had a higher chance of LBW than Latina women and Latina women had a higher chance than White women. This association between race/ethnicity and LBW was reduced, but not eliminated, after controlling for length of gestation. However, when both TSP services and length of gestation were accounted for, LBW rates no longer differed significantly between race/ethnicities. Therefore, African American women appear to have a higher rate of LBW due to increased rates of preterm birth and intrauterine growth retardation, but all subgroups appear to have received benefits from spending > 45 min in psychosocial services.

Certain limitations exist when interpreting the results of this analysis. Previous research has been equivocal about the relationship between maternal negative mood (depression or anxiety) or pregnancy rejection (or pregnancy wantedness) and LBW [7, 12, 20]. This past research primarily employed self-report survey instruments to collect the bulk of the psychosocial information. In comparison, this study was based on variables noted on clinical assessments and gathered through medical chart review. Both self-report and chart review methods have limitations. Self-report methods may be influenced by participant reporting biases such as concerns about self-presentation and may have questionable content validity. Psychosocial assessment and medical chart review methods are at the

mercy of the assessment process and the chart abstractor. These challenges may result in gathering some information that is subjective, incomplete, and/or inaccurate. Therefore, the conclusion that women with negative mood or women who are rejecting their pregnancy during prenatal care are at increased risk for LBW should be considered preliminary until further research corroborates these findings.

Since the sites providing prenatal care in this study had no standardized behavioral or psychosocial assessment protocols and no standardized intervention strategies, the external validity and the ability to replicate this study could be limited. Also, although psychosocial services were found to reduce the risk of LBW, this does not identify certain actions or interventions that were responsible for this beneficial effect. Since the services in this study included smoking and other substance abuse assessments and referrals, diagnoses of depression or anxiety, as well as referrals for housing and financial resources, any or all of these components may be important to include in programs which are designed to optimize maternal well-being and pregnancy outcomes.

Finally, it is recognized that the LBW infants identified in this study included a subgroup with a shortened period of gestation and a subgroup with intrauterine growth retardation [6, 49, 51]. It was not possible to completely disentangle behavioral and psychosocial risk factors for preterm birth from risk factors for intrauterine growth retardation within this study. However, after controlling for length of gestation, rejection of the pregnancy, smoking during pregnancy, and small maternal weight for height/weight loss continued to be associated with an increased rate of LBW. Therefore, these risks may be related to both reduced length of gestation and gestational age-specific LBW. Only maternal negative mood was no longer related to LBW after control for length of gestation. It appears that maternal depression, anxiety, or hostility influenced LBW only by reducing the length of gestation.

The relationship between LBW and psychosocial services did not change after adjustment for length of gestation. Psychosocial services appears to have either a direct or both direct and indirect paths of influence on LBW. Future research should further examine specific risk factors for both subgroups of LBW infants, while simultaneously attempting to account for the cross-over in these groups [49, 52]. Future research should also examine whether interventions targeted at reducing risk behaviors and psychosocial difficulties increase the length of gestation, reduce the rates of intrauterine growth retardation or improve both outcomes.

In summary, this retrospective, observational study, found that receiving over 45 min of psychosocial services during the course of prenatal care was beneficial for all women in a public program. While definitive evidence from randomized trials is lacking, other recent research has found that advice about health behaviors during prenatal care can reduce the odds of a LBW birth [8]. Therefore, general psychosocial care which, at a minimum, attempts to identify a range of problems and intervene as needed appears to be an important and integral component of prenatal care for all low income women.

Acknowledgements—We thank Patricia Shiono, Ph.D., Carol Korenbrot, Ph.D., Deborah Wilkinson, M.S.W., and Judith Veum-Stone, M.S. for comments on eariler drafts of this manuscript. We also thank John Gaines, Ph.D. for statistical advice. Supported by a grant from The Center for the Future of Children, The David and Lucile Packard Foundation, Los Altos, California, U.S.A.

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