

PUBLIC HEALTH AND SOCIAL MARKETING: ASPECTS OF SOCIAL, BEHAVIORAL, AND BIOLOGICAL INFLUENCES ON LOW BIRTH WEIGHT RISKS AMONG AFRICAN-AMERICANS IN MISSISSIPPI

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Public health nursing and Social Marketing perspectives are used to study biological, social and behavioral influences on low birth weight (LBW) rates among African-American women in Mississippi where African-American LBW and infant mortality rates are double those of Whites. Maternal age, parity, prior fetal loss, preexisting medical risk factors, pregnancy complications, marital status, education, smoking, alcohol use, prenatal care, and weight gain during pregnancy were included. Logistic regression was applied to two samples of Mississippi Vital Records birth certificates representing a fixed number of LBW and non-LBW African-American births. Findings can help health care providers prepare Social Marketing programs to address alternative social supports, weight control, tobacco and alcohol abstinence, and early and continuing prenatal care in this high LBW population, and to educate clinicians regarding potential "red flags" when caring for pregnant African-American women.

INTRODUCTION

Disparity exists, both nationally and in Mississippi, in the incidence of African-American low birth weight (LBW) infant births and those of White Americans and other ethnic and racial groups. Although the United States' infant LBW incidence rate is down overall, LBW rates of African-American infants is twice that of Whites and other minorities (Goldenberg et al. 1996; USDHHS 2000). LBW is significant because birth weight is a major predictor of infant health mortality, morbidity, learning disabilities, and mental retardation (CDC, 2002; Guyer et al., 2000 and 2001; Eisner et al. 1979; NCHS 1998; Susser 1972). LBW infants accounted for 7.5 percent of all births in the United States in 1997, and accounted for 65percent of infant deaths (Guyer et al. 1999). According to Sumits and Bennett (1996), infants weighing less than 2500 grams are 40 times more likely to die than are those of normal weight. The objectives of this paper are

to identify, through literature review and logistic regression analysis of birth registration data, social, cultural, economic and demographic factors that influence the incidence of low birth rate among African-Americans in Mississippi, and to assess the Social Marketing implications of these findings for programs intended to reduce LBW incidence births among this population. Social Marketing has successfully employed commercial marketing concepts and techniques to achieve public health goals. These concepts and techniques are most successful when employing the entire marketing mix rather than just the promotional element (Pirani and Reises 2005). To design such programs, the characteristics of the target market must be understood. The techniques described here illustrate a method for achieving this goal.

BACKGROUND LITERATURE

Epidemiological Trends

National trends in LBW were calculated by the Center for Disease Control (CDC) for the years 1980-2000, using birth certificate data for these

years (CDC 2002). The CDC studies indicated that while infant mortality declined 45.2 percent for all races over the period, the decline was greater for White infants than for African-American infants (CDC). According to the CDC, the persistence of infant mortality in the African-American populations is in large measure due to LBW among African-American infants compared to White infants. LBW rates in Mississippi for the year 2000 were 10.3 per 1000 live births, with 7.4 per 1000 for Whites and 13.8 per 1000 for African-Americans (Hoyert et al., 2001; Mississippi State Department of Health 1999, 2000). Mississippi infant mortality figures for the year 2000 are 10.1 per 1000 live births, with 6.8 per 1000 for Whites and 14.2 per 1000 for African-Americans (Hoyert et al., 2001; Mississippi State Department of Health 1999, 2000). Moreover, African-American babies, on average, are, on average, smaller and born earlier (12.5 percent) than White babies (5.7 percent) (Goldenberg et al. 1996; McCormick 1985; Sumits and Bennett 1996).

It is not readily apparent why birth weight racial disparities exist. While LBW is often attributed to low socioeconomic conditions and lower levels of education (House, Landis and Umberson 1988; Hummer 1996), some researchers have found that the African-American-White LBW gap continues when both parents are African-American and college educated and are in higher socioeconomic brackets (Hoyert et al., 2001; Scanlan 2000; Collins et al. 1997). Risk factors such as maternal age, marital status, low socioeconomic status (SES), type or lack of insurance coverage, education, substance abuse, smoking during pregnancy, previous fetal loss, parity, medical conditions, complications of pregnancy, and lack of prenatal care have all been implicated in studies influencing LBW infant births (Gaffney 2000; Scanlan 2000; Geronimus 1999; Fuller 1999; Frisbie et al. 1997; Reichman and Pagnini 1997; Elbourne et al. 1986; Krieger et al. 1997; Shiono et al. 1997; Sampson et al. 1994; Myhra 1992; Spurlock et al. 1987; NCHS 1971). Goldenberg et al. (1996) noted that many of the

risk factors for LBW, such as low SES, lack of education, substance abuse, and lack of prenatal care, were more common among White women studied than African-American women, but that African-American women had more infants born preterm and with LBW than White women. They concluded that maternal characteristics studied including demographics, medical environment, and behavioral and psychosocial risk factors did not explain the increased risk for LBW among African-American women (Goldenberg et al. 1996). Similar findings are reported by Shiono et al. (1997). In summary, despite many social intervention programs by federal, state, and local institutions, such as Medicaid programs for prenatal care, Women, Infants, and Children (WIC) programs, and programs for substance abuse, AIDS, and high risk pregnancies, LBW and its impacts persist among African-Americans nationally and in Mississippi and the reasons for racial disparities remain unclear.

THEORETICAL FRAMEWORK

Shaver's (1985) *A Biopsychosocial View of Human Health* provides a model of categories of influence that can help to organize the complex factors that may underlie LBW and racial disparities in LBW. This model distinguishes environmental, social and biological factors, and the interaction of factors on health status. This study assesses the impact of biological, social and behavior factors on the likelihood of LBW infant births with the unit of analysis being individual African-American women in Mississippi.

Biological Factors

According to *Healthy People 2010* (USDHHS 2000), current information regarding biological and genetic characteristics of African-Americans, does not explain racial health disparities in the United States. Instead, disparities are believed to be the result of complex interrelationships among social, behavioral, genetic, and environmental factors (U.S. Department of Health and Human Services 2000). In this study, biological factors

include: (1) maternal age, which has consistently been shown to have an effect on infant birth weight and/or prematurity (Reichman and Pagnini 1997; Fraser, Brockert, and Ward 1995; Kleinman and Kessel 1987; Lieberman et al. 1987); (2) parity, for which study results have been inconsistent regarding birth weight, both as having little effect and having a significant effect (Frisbee et al. 1997; Kleinman and Kessel 1987; Shiono et al. 1986); (3) previous fetal loss, which has been shown to be a risk factor for LBW and premature birth (Baldwin and Larson 1998); (4) preexisting known LBW medical risk factors such as anemia, cardiac disease, acute or chronic lung disease, diabetes, genital herpes, hemoglobinopathy, hypertension (chronic), previous infant 4000+ grams, previous preterm or small for gestational age infant, renal disease, or other; and (5) complications during pregnancy.

Social Factors

Previously recognized social factors include interaction with other individuals, communities, and social institutions (USDHHS 2000). Social factors considered here include: (1) social supports, with marriage as the proxy; and (2) socioeconomic status (SES), with education as the proxy. Marriage has been shown to have a positive effect on pregnancy outcomes (Amin 1996; Anderson 1995; Baldwin 1986; Bird 2000; House et al. 1988) and is often used as a surrogate for social support (Bennett 1992). Studies have shown that social relationships are protective of health (House et al. 1988). Marriage is considered an enabling resource and has been shown to be associated with increased prenatal care use (House et al. 1988; Perloff and Jaffee 1999).

Education has been shown to have a consistent positive effect on general health status, and on LBW specifically (Williams 1990). As a link to positive birth outcomes, some researchers have concluded that education may be the best single indicator of health status and has several advantages over the use of other single SES indicators. These include: (1) stability over

time, (2) ease of measurement, and (3) respondent reliability (Lieberman et al. 1987; Singh and Yu 1995; Sudano 1995; USDHHS 2000).

Behavioral Factors

Behavioral factors are individual responses to internal and external conditions. Behaviors can be shaped by the social and physical environments that affect an individual's life. A reciprocal relationship can occur between behavior and biology (USDHHS 2000). Behavioral factors for this predictive study included:

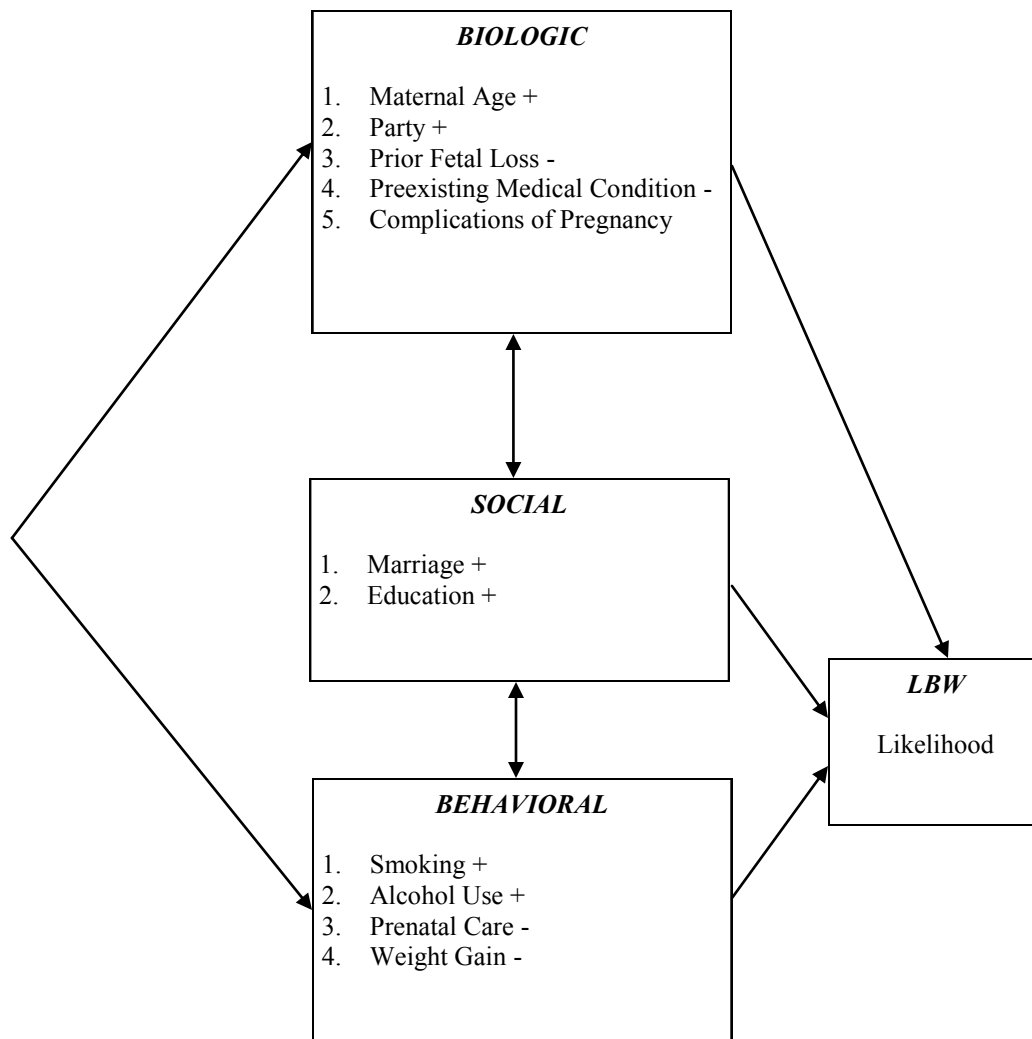
1. Self-report of smoking, smoking having been shown to have a negative effect on LBW (Adler et al. 1993; Baldwin and Larson 1998; Feldman et al. 1992; Hellerstedt et al. 1997; Myhra et al. 1992);
2. Self-report of alcohol use, which has been implicated in problematic pregnancy outcomes (Baldwin 1986; Din-Dzietham and Hertz-Picciotto 1998; Feldman et al. 1992);
3. Prenatal care, which has been shown to have a positive effect on LBW infant births; and
4. Weight gain during pregnancy as an indicator of intrauterine growth and mother's nutritional status has been associated with birth weight outcomes (Strycher 2000; Hellerstedt et al. 1997; Moss and Carver 1998; Tafel 1986). Data regarding weight gain did not include body mass index, therefore, the issue of obesity or underweight was not available for study.

Figure 1 depicts the model tested in this study. The signs beside each independent variable indicate the hypothesized relationship of that variable to the likelihood of a LBW birth from that mother.

OPERATIONALIZATION OF VARIABLES

With consideration of issues relating to official birth records as secondary data (Woolbright and Harshbarger 1995; Buescher et al. 1993), data

FIGURE 1
Selected Biological, Social, Behavioral and Environmental Factors to Predict Risk of Health Status of LBW Infant Births to African-American Women in Mississippi



for selected biological, social and behavioral variables were obtained from the Mississippi Birth Certificate database. African-American women were defined as self reported by race on the Mississippi State Department of Health birth certificate. Operational definitions including coding for each variable included in this study are provided below.

Biological

1. Maternal age: Age categories: 0 = < 15years; 1 = 15-18 years; 2 = 19-35 years; 3 = > 36 years.
2. Parity (the total number of previous births and stillbirths after 24 weeks gestation) (Bobek and Jensen 1993; English, Eskenazi, and Christianson 1994), as reported on the certificate of live birth by the MSHD; Parity categories: 0 = 0; 1 = 1; 2 = 2; 3 = 3; 4 = > 3.

3. Prior fetal loss: 0 = 0 loss; 1 = 1; 2 = 2; 3 = 3; 4 = > 3.
4. Preexisting medical risk factors as reported on the certificate of live birth by the MSDH, which included: (a) anemia (HCT < 30/HGB < 10), (b) cardiac disease, (c) acute or chronic lung disease, (d) diabetes, (e) genital herpes, (f) hemoglobinopathy, (g) hypertension (chronic), (h) previous infant 4000+ grams, (i) previous preterm or small for gestational age infant, (j) renal disease, or (k) other. Preexisting medical risk factors categories: 0 = 0; 1 = 1-2; 2 = 3-4, 3 = > 4.
5. Complications of Pregnancy as reported on the certificate of live birth by the MSHD included: (a) hydramnios, (b) oligohydramnios, (c) hypertension (pregnancy-associated), (d) eclampsia, (e) incompetent cervix, (f) Rh sensitization, (g) uterine bleeding, (h) febrile (> 100 ° F), (i) meconium (moderate or heavy), (j) premature rupture of membranes (> 12 hours), (k) abruptio placentae, (l) placenta previa, (m) other excessive bleeding, seizures during labor, (n) precipitous labor (< 3 hours), (o) prolonged labor (> 20 hours), (p) dysfunctional labor, (q) breech or malpresentation, (r) cephalopelvic disproportion, (s) cord prolapse, (t) anesthetic complications, (u) fetal distress, or (v) other. Categories: 0 = 0; 1 = 1-2; 2 = 3-4; 3 = > 4.

Health Behaviors

1. Self-report of smoking during pregnancy. Categories: 0 = yes; 1 = no;
2. Self-report of alcohol use during pregnancy. Categories 0 = yes; 1 = no;
3. Prenatal care instituted. Categories: 0 = no prenatal care; 1 = inadequate (less than 50 percent expected visits) care; 2 = intermediate care (50-79 percent of expected visits); 3 = adequate care (80-109 percent of expected visits); 4 = adequate plus (> 110 percent of expected visits) (Kotelchuck 1994b);
4. Weight gain during pregnancy. Categories: 0 = < 15 pounds; 1 = 16-25 pounds; 2 = 26-

35 pounds; 3 = > 35. Note that weight loss was not a factor as this could not be determined from birth certificate data. Body mass index or weight at the beginning of pregnancy was not available from the birth certificate database; therefore, it was not possible to determine if the woman was under or overweight at the beginning of her pregnancy.

Low Birth Weight

LBW is operational defined as the condition of an infant being born alive after at least 24 weeks of pregnancy and weighing less than 2500 grams (Bobek and Jensen 1993; Guyer et al. 2000 and 2001; NCHS 1998; Sable and Herman 1997). This variable is coded as a binary (0=Yes LBW, 1=Not LWB).

Socioeconomic Status (SES)

Education was used as a proxy for SES with education coded as: 0 = 1-8 years; 2 = 9-12 years; and 3 = > 12 years.

Social Support (SS)

As discussed above, Marriage, coded 0=Yes and 1=No, served as an indicator of social supports during pregnancy.

DATA ANALYSIS

The study first used cross-tabulation analysis with Chi-Square for efficient descriptive summary of the data and for an initial assessment of the association of the proposed independent variables with LBW. This was followed by applying logistic regression to a model of the proposed relationships of the independent variables to the dependent variables. Table 1 provides descriptive and cross-tabulation data for the two samples (LBS and Non-LBW). All independent variables produced statistically significant Chi-Square coefficients ($P < .05$). This justifies further investigation within the context of logistic regression.

Table 2 reports the logistic regression results. Logistic regression allows assessment of the statistical influence of a combination of categorical and continuous independent variables on a categorical dependent variable (LBW). The predictor variables do not have to be normally distributed, linearly related, or have equal variances within each group (Mertler and Vasanatta 2001). Forward stepwise logistic regression was used. Table 2 reports the adequacy of the final step model, including classification accuracy and the statistical influence of each independent variable. The model correctly predicted 65.3 percent of the cases (64.1 percent of LBW cases and 66.6 percent of non-LBW cases). This may be considered a moderately predictive model (Mertler and Vanetta 2001). The Chi-Square Goodness of Fit test for the overall model was statistically significant at $P < .001$.

In logistic regression, the effect of an independent variable on a dichotomous outcome is represented by an "odds ratio." The odds ratio is defined as the ratio of probability that an event will occur divided by the probability that the event will not occur. Odds ratio (OR) is defined as the odds of being classified in one category of the dependent variable (DV) for two different values of the independent variable (IV) (Mertler and Vanetta 2001). In the regression model, B represents the regression coefficient and represents the effect the IV has on the DV. $S.E.$ is the standard error of B . The *Wald* statistic represents the significance of each variable in its ability to contribute to the model. The odds ratio represents the increase or decrease in odds of being classified in a category when the predictor variable increases by 1 (Mertler and Vanetta 2001).

All statistically significant variables for predicting LBW status are shown in Table 1 with the significance coefficient and odds ratios reported for the levels of each variable (marital status was not significant). Among these, the most important predictors are: (a) inadequate prenatal care < 50 percent of expected visits $p < .02$, odds ratio 1.284; (b) parity of no previous

births $p < .01$, odds ratio 1.267; (c) Prior fetal loss of 2, $p < .008$. Those factors most significant at $p < .001$ included: (a) no prenatal care, odds ratio 3.423; (b) adequate plus prenatal care, odds ratio 2.467; (c) weight gain under 15 pounds, odds ratio 3.494; (d) weight gain 15-25 pounds, odds ratio 2.042; (e) 3-4 complications of pregnancy, odds ratio 2.772; and (f) 5 or more complications of pregnancy, odds ratio 5.256.

Prenatal care. "No prenatal care" was significant at $p < .001$. Mothers who had no prenatal care were 3.4 times more likely than mothers who had "adequate care (80-100 percent of expected visits)" to have a LBW infant birth. "Inadequate or < 50 percent of expected visits prenatal care" was significant at $p < .022$. Mothers who had inadequate prenatal care were 1.3 times more likely than mothers who had "adequate care (80-100 percent of expected visits)" to have a LBW infant birth. "Intermediate or 50-75 percent of expected visits prenatal care" was not significant at $p < .149$. Mothers who had intermediate prenatal care were 0.84 times less likely to have a LBW infant birth. An odds ratio below one indicates that the corresponding factor is associated with a lower likelihood of a LBW outcome than would occur by chance. "Adequate plus or 110 percent of expected visits prenatal care" was significant at $p < .001$. Mothers who had adequate plus prenatal care were 2.5 times more likely than mothers who had "adequate care (80-100 percent of expected visits)" to have a LBW infant birth.

Parity. "No previous pregnancies" was significant at $p < .021$. Mothers who had no previous births were 1.3 times more likely than mothers who had one previous birth to have a LBW infant birth. "Two previous pregnancies > 24 weeks" was not significant at $p < .061$. Mothers who had two previous births were 0.82 times less likely than mothers who had one previous birth to have a LBW infant birth. An odds ratio below 1 indicates that the corresponding factor is associated with a lower likelihood of a LBW outcome than would occur by chance. "Three previous pregnancies > 24

TABLE 1
Frequencies and Crosstabulations

	Total		Low Birth Rate		Non-Low Birth Rate	
Predictor Variable	N	%	N	%	N	%
Prenatal Care ($\chi^2=207.87$, $P<.0001$)						
No Care	215	5.4	152	70.7	63	29.3
Inadequate Care <50% of expected visits	623	5.8	291	46.7	332	53.3
Intermediate Care 50-75% of expected visits	440	11.1	159	36.1	281	63.9
*Adequate Care 80-110% of expected visits	1,078	27.3	408	37.8	670	62.2
Adequate Plus >110% of expected visits	1,594	40.4	965	60.5	629	39.5
Parity (Number of Prior Pregnancies over 24 weeks) ($\chi^2=12.856$, $P<.012$)						
None	1,389	35.2	731	52.6	658	47.4
*1	1,095	27.7	518	47.3	577	52.7
2	743	18.8	350	47.1	393	52.9
3	371	9.4	371	9.4	188	50.7
4 or more	352	8.9	193	54.8	159	45.2
Smoked During Pregnancy ($\chi^2=29.385$, $P<.001$)						
*No	3,659	92.6	1,785	48.8	1,874	51.2
Yes	291	7.4	190	65.3	101	34.7
Drank Alcohol During Pregnancy ($\chi^2=13.862$, $P<.001$)						
*No	3,902	98.9	1,942	49.7	1,966	50.3
Yes	42	1.1	33	78.6	9	21.4
Weight Gain During Pregnancy ($\chi^2=169.092$, $P<.001$)						
Under 15 lbs	829	21.0	551	66.5	278	33.5
15-25 lbs	1,310	33.2	691	52.7	619	47.3
26-35 lbs	927	23.5	408	44.0	519	56.0
*>35 lbs	884	22.4	325	36.8	559	63.2
Marital Status ($\chi^2=5.869$, $P<.05$)						
*Yes (low risk)	949	24.0	442	46.6	507	53.4
No (high risk)	3,001	76.0	1,533	51.1	1,468	48.9
Age of Mother ($\chi^2=19.762$, $P<.001$)						
Under 18 years	733	18.6	405	55.3	328	44.7
*18-35 years	3,019	76.4	1452	48.1	1,567	51.9
Greater than 35 years	198	5.0	118	59.6	80	40.4

Table 1 (Continued)	Total		Low Birth Rate		Non-Low Birth Rate	
Predictor Variable	N	%	N	%	N	%
Prior Fetal Loss < 24 Weeks ($X^2=14.891$, $P<.002$)						
*None	3,131	79.3	1,518	48.5	1,613	51.5
1	606	15.3	333	55.0	273	45.0
2	156	3.9	89	57.1	67	42.9
3 or more	57	1.4	35	61.4	22	38.6
Prior Medical Risk Factors ($X^2=28.059$, $P<.001$)						
*None	2,971	75.2	1,415	47.6	1,556	52.4
1-2	838	21.2	485	57.9	353	42.1
3 or more	141	3.6	75	53.2	66	46.8
Number of Complications of Pregnancy ($X^2=123.575$, $P<.001$)						
*None	2,518	63.7	1,103	43.8	1,415	56.2
1-2	1,088	27.5	637	58	457	42
5 or more	55	1.4	43	78.2	12	21.8
Education ($X^2=21.571$, $P<.001$)						
0-12 years	156	3.9	97	62.2	59	37.8
*High school graduate	2,593	65.6	1,333	51.4	1,260	48.6
Greater than high school	1,201	30.4	545	45.4	656	54.6
*Reference for Logistic Regression						

weeks” was not significant at $p < .134$. Mothers who had three previous births were 0.82 times less likely than mothers who had one previous birth to have a LBW infant birth. An odds ratio below 1 indicates that the corresponding factor is associated with a lower likelihood of a LBW outcome than would occur by chance.

“Four or more previous pregnancies > 24 weeks” was not significant at $p < .157$. Mothers who had four or more previous births were 0.80 times less likely than mothers who had one previous birth to have a LBW infant birth. An odds ratio below 1 indicates that the corresponding factor is associated with a lower likelihood of a LBW outcome than would occur by chance.

Smoking during pregnancy. “Smoking during pregnancy” was significant at $p < .001$. Mothers who smoked were 1.8 times more likely than mothers who did not smoke to have a LBW infant birth.

Drinking alcohol during pregnancy. “Drinking alcohol during pregnancy” was not significant at $p < .051$. Mothers who drank alcohol were 2.2 times more likely than mothers who did not drink alcohol to have a LBW infant birth. This may be classified as a moderately predictive model (Mertler and Vanetta 2001).

Weight gain during pregnancy. “Weight gain < 15 pounds” during this pregnancy was significant at $p < .001$. Mothers who gained less than 15 pounds were 3.5 times more likely than mothers who had gained > 35 pounds to

TABLE 2
Logistic Regression Final Step Model Coefficients

Predictor Variable	B	SE	Wald	Odds Ratio
Prenatal Care				
No Care	1.231	0.173	50.641**	3.423
Inadequate Care <50% of expected visits	0.250	0.110	5.212*	1.284
Intermediate Care 50-75% of expected visits	0.179	0.124	2.083	0.836
Adequate Plus >110% of expected visits	0.903	0.066	111.032**	2.463
Parity (Number of Prior Pregnancies over 24 weeks)				
None	0.237	0.095	6.24*	1.267
2	-0.197	0.105	3.514	0.822
3	-0.204	0.136	2.245	0.815
4 or more	-0.220	0.155	1.999	0.803
Smoked During Pregnancy				
Yes	0.600	0.144	17.370**	1.821
Drank Alcohol During Pregnancy				
Yes	0.806	0.412	3.820	2.239
Weight Gain During Pregnancy				
Under 15 lbs	1.251	0.108	134.578**	3.494
15-25 lbs	0.714	0.095	56.621**	2.042
26-35 lbs	0.344	0.102	11.376**	1.411
Age of Mother				
Under 18 years	0.175	.0106	2.714	1.191
Greater than 35 years	0.316	0.167	3.602	1.372
Prior Fetal Loss Pregnancies < 24 Weeks				
1	0.446	0.106	17.713**	1.582
2	0.520	0.196	7.021	1.682
3 or more	0.367	0.322	1.302	1.444
Prior Medical Risk Factors				
1-2	0.326	0.086	14.474**	1.386
3 or more	0.190	0.189	0.010	1.019
Number of Complications of Pregnancy				
1-2	0.576	0.079	53.336**	1.779
3-4	1.020	0.142	51.674**	2.772
5 or more	1.659	0.347	22.929**	5.256
Education				
0-12 years	0.297	0.186	2.559	1.346
Greater than high school	-0.231	0.082	8.035*	0.794
Notes: * $p < .05$, ** $p < .001$. Overall correct classification-65.3% (66.6% for LBW and 64.1 for non-LBW), Chi-Square=593. DF=25, $P < .001$.				

have a LBW infant birth. "Weight gain of 15-25 pounds" during this pregnancy was significant at $p < .001$. Mothers who gained 15-25 pounds were 2 times more likely than mothers who had gained > 35 pounds to have a LBW infant birth. "Weight gain of 25-35 pounds" during this pregnancy was significant at $p < .001$. Mothers who gained 25-35 pounds were 1.4 times more likely than mothers who had gained > 35 pounds to have a LBW infant birth. Mothers who gained more than 35 pounds were less likely to have a low birth weight infant.

Maternal age. "Maternal age under 18 years" was not significant at $p < .099$. Mothers under age 18 years were 1.2 times more likely to have a LBW infant birth than mothers age 18-35 years of age. Although the odds ratio was slightly higher than 1, it was not found to be significant in the regression model. "Maternal age over 35 years" was not significant at $p < .058$. Mothers over age 35 years were 1.4 times more likely to have a LBW infant birth than mothers age 18-35 years of age.

Fetal loss. "Fetal loss" of one previous pregnancy less than 24 weeks was significant at $p < .001$. Mothers with one prior fetal loss were 1.6 times more likely to have a LBW infant birth than mothers with no prior fetal loss. "Fetal loss" of two previous pregnancies less than 24 weeks was significant at $p < .008$. Mothers with two prior fetal losses were 1.7 times more likely to have a LBW infant birth than mothers with no prior fetal loss.

Maternal risk factors. "Maternal risk factors of 1-2" was significant at $p < .001$. Mothers with 1-2 maternal risk factors were 1.4 times more likely to have a LBW infant birth than were mothers with no maternal risk factors. "Maternal risk factors of 3 or more" was not significant at $p < .920$. Mothers with three or more maternal risk factors were no more likely to have a LBW infant birth than mothers with no maternal risk factors (OR 1). This may be because women with three or more maternal risk factors may more readily seek out or be

referred to more comprehensive or intense prenatal care.

Complications of pregnancy. "Number of complications of pregnancy of 1-2" was significant at $p < .001$. Mothers with 1-2 complications of pregnancy were 1.8 times more likely to have a LBW infant birth than mothers with no complications of pregnancy. "Number of complications of pregnancy of 3-4" was significant at $p < .001$. Mothers with 3-4 complications of pregnancy were 2.8 times more likely to have a LBW infant birth than mothers with no complications of pregnancy.

"Number of complications of pregnancy of 5 or more" was significant at $p < .001$. Mothers with 5 or more complications of pregnancy were 5.3 times more likely to have a LBW infant birth than mothers with no complications of pregnancy.

Education. "Number of years of education 0-12" was not significant at $p < .110$. Mothers who had 0-12 years of education were 1.3 times more likely to have a LBW infant birth than mothers who had graduated from high school; however, this finding was not found to be statistically significant in the regression model. "Number of years of education greater than high school" was significant at $p < .005$. Mother who had greater than high school education were .794 times less likely to have a LBW infant birth than mothers who had graduated from high school. An odds ratio below 1 indicates that the corresponding factor is associated with a lower likelihood of a LBW outcome than would occur by chance.

SOCIAL MARKETING IMPLICATIONS

Social Marketing is defined as "The application of commercial marketing technologies to the analysis, planning, execution and evaluation of programs designed to influence voluntary behavior of target audiences in order to improve their personal welfare and that of society" (Andreasen 1995, 7). later, Kotler and Andreasen (1996) elaborated the Social Marketing concept to note that Social

Marketing is intended to lead people to overcome detrimental behavior by changing deep-seated beliefs that affect their well-being and/or that of society. Andreasen (2002) further clarified the definition by saying "Social Marketing is a well-defined set of processes for promoting individual behavioral change to alleviate social problems."

The roots of Social Marketing go back a long way to an idea by the sociologist G. D. Wiebe (1952) who, in *Public Opinion Quarterly*, asked why social causes were not sold in a manner similar to how soap and other commodities are sold. He noted that social causes are often performed under "less than marketing like circumstances." He noted that when social causes were addressed similar to a marketing problem, the result became much more effective and desirable. Some attempts at Social Marketing have failed due to lack of understanding and application of sound marketing techniques, and a sound marketing plan including necessary marketing components (Hill 2001; McDermot 2000; Wiebe 1952). Both health education and regulation are often used to effect social change but, these risk failure if Social Marketing is not used to link program goals to an understanding of the target audience (Pirani and Reizes 2005).

To be effective, a Social Marketing message should be straightforward and establish a tone of mutual trust, and be delivered by someone from the target audience. In this way, the targeted people may find the message to be more believable and respectful, and may be able to identify with both the message and the recommended behavior changes. Six identifiers of Social Marketing can be identified based on data gleaned from Andreasen (1995) and McKinzie-Mohr and Smith (1999) articles on Social Marketing. The six identifiers place Social Marketing apart from other marketing functions because it has the fundamental Social Marketing goal, of changing behavior for both individual and social benefit. Based on this premise we can suggest a process for implementing behavioral change through a Social Marketing program as including:

1. Identify the primary target audience and the geographic areas to be served so as to understand the scope of the distribution and assure contact. The target audiences here are the universe of people for which the social change would be desirable;
2. Assess the target market's needs, wants, desires, values and perceptions in order to better identify and understand the motivators for change;
3. Convert assessment findings into program attributes that offer the audience benefits in exchange for behavioral change. Members of the target market must perceive and want a benefit in exchange for the behavioral change;
4. Design a plan and strategy for Social Marketing around the motivators as identified and converted to attributes;
5. Pre-test the strategy (message, product or offering) with a representative group from the audience and incorporate validated feedback that will help the appeal for social change;
6. Implement the plan and strategy with a vigilant eye to the mini-successes. Do not hastily revise the plan as it may take some time for the strategy to motivate some or all members of the group (Andreasen 1995; McKinzie-Mohr and Smith 1999; AED 2000).

Social Marketing suggests that health care professionals assess the priorities and immediate needs that hold value for the target audience (Icard et al. 2003). Social Marketing concentrates on advising a target audience of the benefits resulting from a change in behavior and reducing barriers to change (Almendarez et al. 2004; Beckmann et al. 2000). The LBW infant crisis in the African-American population is one of these problems that can be remedied through Social Marketing technology (Baffour et al. 2006) as it involves behavioral changes that not only produce benefits for the larger society, but also have high value, intrinsic benefits for the individual as it addresses a mother's valuation of her child's well-being.

This study contributes to the information needed for Social Marketing programs, first, by identifying and documenting a high need population to serve as the target market. Second, by identifying specific areas of behavior change which that would likely have the greatest effect for reducing LRW rates. Third, by alerting researchers and program developers to possible differences in social support structures that differentiates this African-American population. This last benefit relates to the lack of statistical significance regarding marital status and age, whereas these variables have been found to be significant in general population studies (Davis 1988). This finding calls for further research to better understand sources of support in this target population, and to better understand the role extended family members, peers and close friends might play in reducing LBW risks (Umberson 1987). Such persons might serve as caregivers for the pregnant mother, spokespersons for programs, and as opinion leaders who legitimate the Social Marketing message.

Limitations of the Study

This study has three important limitations. First, it has focused on only one state and one race. This prevents cross-race and cross-region comparisons. While such comparisons are not necessary for designing programs for this clearly defined population, the external validity of the study would depend on further research that would allow such comparisons.

Second, because the study depended on vital statistics records, potentially useful psychographic, social, psychological, and biological data was not available. Psycho-social factors specific to African-Americans have been found to be important to African-American case management (Gonzales-Calvo et al. 1998; Kogan et al. 1994). Future research into such factors should be considered and may involve interviews with mothers who have had LBW infants and those that have not had LBW infants.

Third, aggregate geographic, demographic and socio-economic environmental data were not considered. Ideally, a variety of environmental factors should be considered as these may have independent effects of LBW rates and therefore LBW likelihood (Susser 1997; Tresserras et al. 1992). Important environmental factors to consider in future research would include:

1. Unemployment, which has been associated with higher infant mortality rates (Collins and David 1990; Kleinman and Kessel 1987);
2. Mean income, as low income has been associated with a greater risk of LBW regardless of race (Bird and Bauman 1995; Collins and David 1990);
3. Population, in order to determine percentage of LBW as related to population; and
4. Racial mix of each county, as highly segregated areas may be associated with inadequate prenatal services, low income, inadequate access to care, and differences in cultural expectations regarding what is a "normal" pregnancy (Aneshensel et al. 1991; Aneshensel and Sucoff 1996; Kotelchuck 1994b; Loveland-Cook et al. 1999; Willians and Jackson 2000).

CONCLUSIONS

The research presented here supplements extant literature by focusing explicitly on American-American women in a largely rural state with large African-American populations that have multi-generational histories in the state. The model has the potential to assist health care providers better understand and prepare Social Marketing outreach programs to address this population with exceptionally high LBW and infant mortality rates. With the insights from this model, providers will be better prepared to develop programs to promote healthy pregnancy outcomes by alerting clinicians to potential "red flags" while caring for pregnant African-American women, and develop Social Marketing programs to address specific behavioral change objectives such as weight control, tobacco and alcohol abstinence, and early and continuing prenatal care.

However, further research is needed to adequately support Social Marketing initiatives. Health care providers need to be aware of the many facets of risk involved relative to the African-American woman in Mississippi and the factors that make the greatest contribution to unhealthy outcomes of LBW. To this end, this study provides a framework for future study of factors affecting LBW birth rates in the African-American community. With increased understanding of the risk factors that have the greatest impact upon the African-American population in Mississippi, strategies can be developed to improve assessment, delivery of culturally sensitive care, and evaluation of programs to improve pregnancy outcomes.

Practitioners involved in clinical assessment will also benefit from increased awareness of risk factors predictive of LBW infant births may be able to provide more informed and timely interventions for improved health outcomes (Main et al. 1987). In sum, this understanding assists policy makers in developing Social Marketing programs to promote healthy pregnancy outcomes through healthy pre-natal behaviors that include but go beyond pre-natal care (Fiscella 1995), and this study assists health care providers by alerting clinicians to potential “red flags” when caring for pregnant African-American women. By increasing understanding of which risk factors that have the greatest impact upon the African-American population in Mississippi, strategies can be developed to improve assessment, delivery of culturally sensitive care, and evaluation of programs to improve pregnancy outcomes. Lessons from the field indicate that segmenting the audience and conducting research into their needs and lifestyles is essential to an effective Social Marketing program (Priani and Reizes 2005). Information gained here regarding the biologic, social and behavioral characteristics of mothers of low birth rate infants can be the basis for the design of Social Marketing programs that seek to educate these at-risk populations and motivate behavioral changes to reduce the likelihood of LBW outcomes.

Additional Research Recommendations

Psychological factors such as depression, anxiety, stress, perception of racism, and self-concept have not been addressed here. These may have relationships to the risk factors identified here and may have implications for the design of Social Marketing programs. Hypothesized risk factors of age and marital status also need further study. Previous research with general populations identified these as LBW factors. However, this study did not find age or marriage to be statistically significant. Study of social support relationships beyond marriage relative LBW should be explored. The risk factor of alcohol use during pregnancy appears also needs further study. Although other studies have shown alcohol use during pregnancy to be a LBW risk factor, a very low incidence was observed here and the variable was not statistically significant. This might have been due to respondent error resulting from socially preferential responses. Similarly, the small number of cases of three or more fetal losses probably led to this factor being found to be non-significant in this study. This variable needs further research with this population with a larger sample size.

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