LOWER RATES OF LOW BIRTHWEIGHT AND PRETERM BIRTHS IN THE CALIFORNIA BLACK INFANT HEALTH PROGRAM

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Objectives: The objective of this study was to determine the impact of prenatal interventions in the California Black Infant Health (BIH) Program on low birthweight (LBW) and preterm births (PTB) outcomes.

Methods: A prospective observational study design with a comparison group was used. BIH participants with a delivery recorded between July 1996 and September 1998 were included in the birthweight and PTB analyses. These outcomes for BIH participants who entered the BIH program prior to 32 weeks' gestation (n=1,553) were compared to those of all African-American women in the BIH Program targeted ZIP codes (n=11,633).

Results: No statistically significant differences in LBW and PTB were found between the BIH population and the comparison group. However, a comparison of the BIH infant VLBW (<1,500 g) rate (1.9%) with the VLBW rate for the comparison group (3.0%) shows that the BIH rate is 63% of the comparison group rate. For very PTB (<32 weeks), the BIH rate (3.5%) is 81% of the comparison group rate (4.3%). BIH participants had higher risk profiles (pregnancy history, current pregnancy, and psychosocial; p=<0.01) than women in the comparison group.

Conclusions: The BIH Program retained high-risk women in the program to delivery and assisted them with maintenance of prenatal care. Even though the program participants were higher risk, their LBW and PTB outcomes were comparable to the geographic area overall. More importantly, there was a trend among women in the BIH Program toward better outcomes than the comparison group in both VLBW and VPTB. (*J Natl Med Assoc.* 2004;96:315–324.)

Key words: very low birthweight ♦ very preterm birth ♦ prenatal interventions ♦ African-American women

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The toll of infant morbidity and mortality associated with low birthweight (LBW) and preterm birth (PTB) has been investigated in numerous studies over the last 40 years.[1-8] Associated factors, such as demographics, pregnancy history, personal behaviors, and access to prenatal care, are addressed repeatedly in the literature.[9-13] However, there is still a less-than-adequate understanding of the biologic and social factors underlying their association with neonatal outcomes.

Associations between neonatal outcomes and race are by far the least understood. Furthermore, because race is so intertwined with economic and social status, and lifestyle and culture, as well as

access to social and health services, it is difficult to determine its real meaning in relation to poor neonatal outcomes. It is probable that race is a marker for other potentially modifiable population-based factors.[14-21] An understanding of population characteristics, culture, values, and experiences enriches the science of health interventions.[22,23]

Interventions that apply both science and knowledge about the population to be engaged in the intervention are more likely to advance understanding of the relationship between social and healthcare systems, individual behavior, and health outcomes.[22-24] An intervention of this type is the California Black Infant Health (BIH) Program that uses the public health sciences of epidemiology, and health behavioral change interventions,[22,23] as well as community-based and culture-based practice methodologies.[25-31]

Objective

The objective of this study is to determine the impact of prenatal interventions in the California BIH Program on LBW and PTB outcomes.

Similar intervention studies have yielded mixed findings. Korenbrot et al. studied the outcomes of women of the OB Access Projects[32] and the Comprehensive Perinatal Services Program in California.[33-35] Participants in these programs had LBW and very-low-birthweight (VLBW) rates that were significantly less than those of women in care with routine Medicaid providers. Zimmer-Gembeck found that psychosocial services intervention was related to a reduced rate of LBW.[36] Beuscher evaluated publicly funded prenatal care in North Carolina and found that Medicaid women who received this service had substantially lower rates of LBW, VLBW, and infant mortality.[37]

From 1986–1989, the Better Babies Project in the District of Columbia was the first community-based targeted intervention designed specifically for the purpose of reducing African-American infant LBW. Though the project evaluation did not show an overall program impact on LBW, program participants did have a lower rate of LBW than nonparticipants.[38]

Randomized clinical trials methodology has been used in some of the latest research on the impact of prenatal interventions. The effect of a telephone call intervention on LBW was studied by Moore et al. They found statistically significant differences between intervention and control groups for black women only who were 19 years of age and older.[40] A social support intervention designed specifically to be culturally relevant for African-American women was conducted by Norbeck.[40] LBW was found to be 60% less in the intervention group than in the control group.

Klerman studied the effect of an augmented prenatal care intervention on Medicaid eligible African-American women.[41] This randomized trial found no statistically significant differences in LBW and PTB outcomes between the intervention and comparison groups.

METHODS

A prospective observational study design with a comparison group was used. BIH participants with a delivery recorded between July 1996 and September 1998 and who had entered the BIH Program prior to 32 weeks' gestation, were included in the birthweight (BW) and PTB analyses. These outcomes for BIH participants (n=1,553) were compared to those of all African-American women in the BIH Program's targeted ZIP codes (n=11,633). Some descriptive data on the entire BIH population was analyzed in order to provide a context for the study.

Data Sources

The two sources of data for the BIH participants were the BIH computerized management information system, and a psychosocial and life events screening tool. The African-American-specific psychosocial and life events screening tool was designed for and pilot tested on African-American pregnant women. It was used before program enrollment to determine each BIH participant's risk profile.

The computerized data system was developed in FoxPro 6.0.[42] The system reflects an overarching value for the importance of data to document intervention model exposure and outcomes after participation. The system captured BIH participants' demographics, health and reproductive histories, as well as tracked their use of BIH services and other prenatal and postdelivery services. Infant data allowed tracking up to 24 months of age. Information on fathers/male partners and support systems was also collected. Local jurisdiction (site) staff was trained to carry out data collection and entry. System managers in each site handled quality control and produced reports essential to local project operations.

Medi-Cal claims data and California birth cer-

tificate data for 1997 (the most recent and complete birth files at the time of the study) were the data sources for comparison women.

Study Population

In 1997, 6.9% of the 525,455 women who delivered in California were African-American. During the study period—July 1, 1996 and September 30, 1998—3,834 women were enrolled in the BIH Program, which represented 2.6% of all African-American deliveries in the state. Among the enrolled women, 2,132 had a pregnancy outcome recorded (56%), 2,031 of them had singleton live births. Eleven percent of the BIH women were still pregnant, 4% entered the program postpartum, 28% had dropped out, and 1% were missing.

The comparison group was 11,633 African-American women on Medi-Cal (California Medicaid) who delivered in 1997 in the same ZIP codes where BIH projects were located. BIH and comparison women were matched on the selection criteria of race, geographic area, and insurance.

Data Analysis

SAS 8.0[43] and SPSS 11.5[44] software was used for the analysis. Data were presented on the BIH population demographics and risk profiles, and on program and prenatal care participation. Next, demographic and risk profiles for BIH and the comparison group were examined for similarities and differences. Finally, the data was analyzed for differences between the two groups across BW and PTB categories. LBW categories for analysis were <2,500 g (total LBW), 1,500–2,499 g (moderate LBW), and <1,500 g (very LBW-VLBW). PTB categories for analysis were <37 weeks (total PTBs), 32–37 weeks (moderate preterm), and <32 weeks (very preterm). Confidence limits (95%) on the proportions were calculated.

BIH women included in the analyses of PTB and LBW outcomes had entered the BIH Program before 32 weeks of pregnancy (N=1553). This criterion was imposed to avoid bias related to interpretation of program effect caused by the inclusion of women entering the program at 32 or more weeks of gestation. Women who started the BIH Program at 32 or more weeks would bias program results toward larger babies. In addition, pregnancies among these women had already survived a significant amount of the time during which early birth could have occurred.

Table 1. Comparison of Self-Reported Health Risks of Clients Who Remained in BIH with Clients Who Dropped Out of BIH

	Remained in BIH [a]	Dropped out of BIH [b]	OR	P
Any Previous Poor Pregnancy Outcome	14.3	8.3	1.72	<0.01
Previous low birthweight	6.8	4.1	1.66	<0.05
Previous preterm delivery	8.0	4.5	1.78	<0.01
Previous intrauterine fetal demise	1.5	0.6	2.50	<0.01
Previous neonatal death	1.5	0.5	3.00	<0.01
Previous Spontaneous Abortion	25.0	14.2	1.76	<0.01
Any Current Health Problem	27.1	11.5	2.36	<0.01
Anemia	15.4	6.6	2.33	<0.01
Urinary tract infection	6.0	2.9	2.07	<0.01
Preterm labor	4.7	2.1	2.24	<0.01
Gestational diabetes	2.6	0.9	2.89	<0.01
Pregnancy induced hypertension	3.1	0.9	3.44	<0.01

[a] Percent of BIH clients enrolled between July 1, 1996 and September 30, 1998 who stayed in BIH and a had singleton live birth (n=2,031).
[b] Percent of BIH clients enrolled between July 1, 1996 and September 30, 1998 who dropped out of BIH (n=1,060).

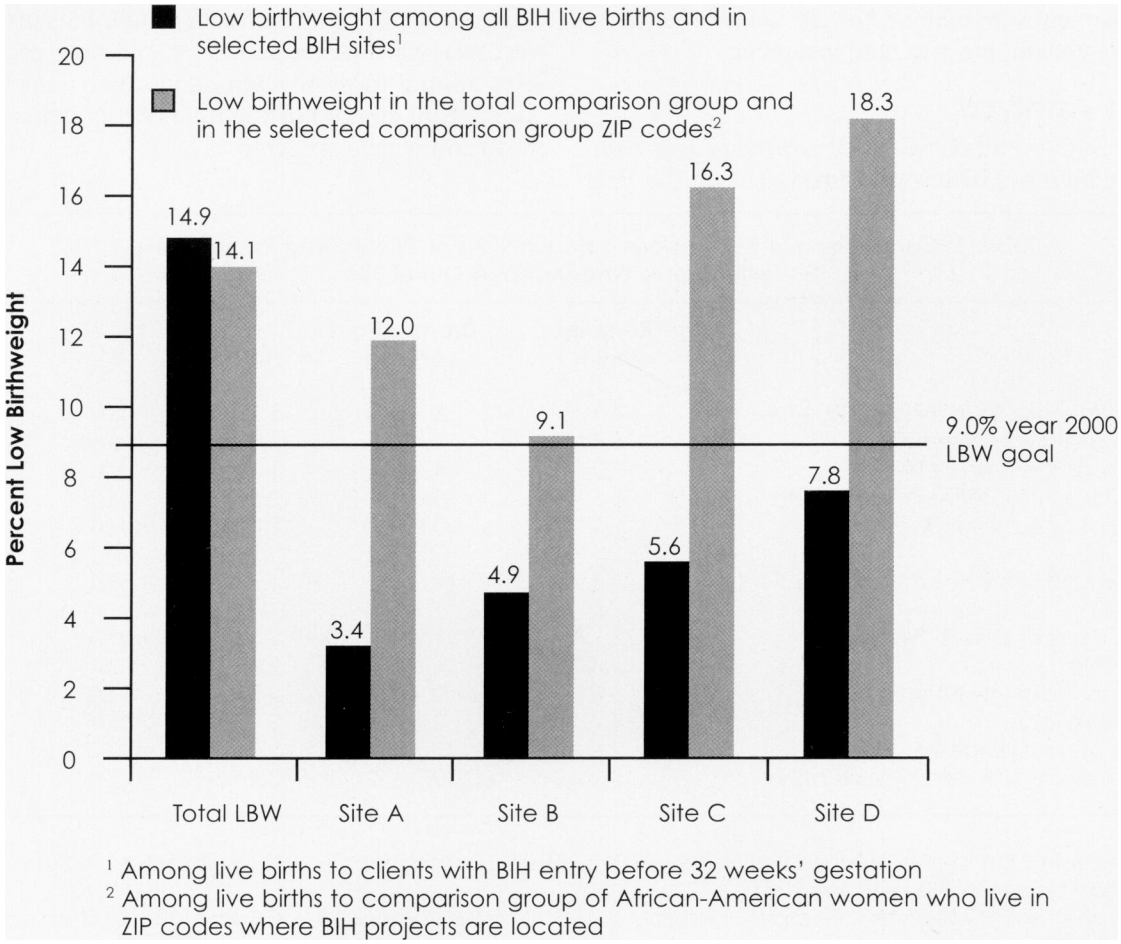
RESULTS

Risk Profiles

Comparison of the risk profiles of women who stayed in BIH and had a singleton birth (n=2031) with those who dropped out of the program (n=1,060, 28% of 3,834 enrolled women) shows that BIH retained the women with the highest risk profiles (Table 1). Table 1 shows that women who remained in the program were more likely to have current health and previous pregnancy problems ($p<0.01$). Risk for any previous poor pregnancy outcome is between 1.66 (LBW), and 3.00 (previous neonatal death). The risk for PTB is 1.78. Furthermore, the risk for any current health problem for women who remained is between 2.07 (urinary tract infection) and 3.44 (pregnancy-induced hypertension).

Table 2 presents data on the self-reported previous pregnancy and current health risks for all BIH Program women who had a singleton birth during the study period (total BIH), and for selected BIH sites. Focusing on total BIH, the data shows that the highest prevalence of previous poor pregnancy outcomes are PTB (8.0%) and LBW (6.8%). One in four women (25%) reported a previous spontaneous abortion. Somewhat more than one in four women (27.1%) reported a current health problem. Specific current health problems were anemia (15.4%), urinary tract infection (6.0%), and preterm labor (4.7%). The data for the selected sites will be presented later in the paper.

Figure 1. Total Low Birthweight in BIH and the Comparison Group Contrasted with the Year-2000 Health Objectives



Psychosocial risks for total BIH participants and for selected sites are presented in Table 3. It shows that among total BIH women, there is a particularly high prevalence of concern about resources. This includes worries about making ends meet (78.4%), a decrease in income in the last 12 months (55.2%), and no financial support from a partner (53.7%). Other significant risk factors were having moved in last 12 months (61.3%), and having a partner who is now or has been in jail (50.1%). Similar proportions of women were uncomfortable with their living arrangements (37.8%) or had someone close who had drug or alcohol problems (40%). Nearly 30% had a friend die in the last 12 months. The prevalence of these risk factors in the comparison population is not known. (The psychosocial risk factors for the selected sites are discussed later.)

Though 75% of BIH women reported not having smoked during the current pregnancy, 20% of the participants smoked for some part of the pregnancy. Eighty-four percent reported no alcohol use, and 80% reported no drug use in pregnancy. Data on these behavioral risk factors for the comparison population were not available. However, MacDorman[13] reports that smoking during pregnancy has declined overall nationwide by 37% since 1989, with a rate for black women of 9.1% in 2000.

Lastly, demographic and past pregnancy histories for BIH, Medi-Cal comparison group, and all Californian African-American women were compared. The BIH population has fewer high-school graduates (32.8%, 50%, and 51%, respectively); more single women (80.9%, 77% and 59%, respectively), and significantly more previous LBW (7%, 2%, and 2%, respectively); and PTBs (8%, 2%, and 2%, respectively).

Prenatal Care

BIH participation and prenatal care are not synonymous but *complementary* services.

Of the BIH women who had a singleton live birth (n=2,031), 60.8% began prenatal care in the first trimester, 27.6% in the second trimester, and 11.6% in the third trimester. Five-hundred-twenty-eight women enrolled in BIH without prenatal care, and 444 (84%) of them were assisted with initiation and maintenance of prenatal care. Among the Medi-Cal comparison group, 75.8% initiated prenatal care in the first trimester, 20.7% in the second, and 3.5% in the third trimester.

BW and PTB outcome comparisons were made

Table 2. BIH Clients Self-Reported Previous Pregnancy and Current Health Risk Factors (Percent)

	BIH Total[a]	Selected BIH sites A	B	C	D
Any Previous Poor Pregnancy Outcome	14.3	14.3	20.7	7.5	7.1
Previous low birthweight	6.8	11.7	6.9	1.3	5.4
Previous preterm delivery	8.0	5.2	10.3	1.3	3.6
Previous intrauterine fetal demise	1.5	0.0	1.1	2.5	0.0
Previous neonatal death	1.5	2.6	2.3	2.5	0.0
Previous Spontaneous Abortion	25.0	26.0	28.7	30.0	16.1
Any Current Health Problem	27.1	18.2	13.8	52.5	25.0
Anemia	15.4	5.2	5.7	42.5	16.1
Urinary tract infection	6.0	6.5	2.3	16.3	8.9
Preterm labor	4.7	6.5	3.4	2.5	5.4
Gestational diabetes	2.6	0.0	0.0	1.3	3.6
Pregnancy induced hypertension	3.1	0.0	2.3	7.5	1.8

[a] Percent of BIH clients enrolled between July 1, 1996 and September 30, 1998 who stayed in BIH and a had singleton live birth (n=2,031).
[b] Percent of BIH clients enrolled between July 1, 1996 and September 30, 1998 who dropped out of BIH (n=1,060).

between women who entered BIH before 32 weeks' gestation, and the Medi-Cal comparison group. Birthweight outcomes are presented in Table 4 (n=1,545, eight missing). Birthweight was analyzed in three categories: <2,500 g, 1,500–2,499 g, and <1,500 g. Total LBW (<2,500 g) among BIH clients was higher than that of the comparison women. It was 14.9% for BIH neonates and 14.1% for the comparison group. The estimated risk for BIH to comparison group is 1.07 (CI 0.83–1.38, p=0.61). Thirteen percent of BIH neonates were in the 1,500–2,499-g BW category, and 11% of the comparison neonates. This estimated risk for BIH to comparison group is 1.21 (CI 0.91–1.6, p=0.17). The rate of VLBW (<1,500 g) among neonates born to women in BIH was 1.9% as compared to 3.0% among comparison women. The BIH to comparison estimated risk is 0.63 (CI .34–1.16, p=0.11).

PTB outcomes (n=1,553) are shown in Table 5. The total PTB rate (<37 weeks) for BIH neonates was 17.9%, which was the same as the comparison group (17.9%). BIH had a slightly higher proportion (14.4%) of moderately PTBs (32–37 weeks) than the comparison group (13.6%). The estimated risk for BIH to comparison is 1.07 (CI 0.82–1.39, p=0.61). At less than 32 weeks' gestation, the rate of BIH PTBs was 3.5%—less than that for the comparison births (4.3%). The estimated risk for BIH very preterm to the comparison group is 0.81 (CI 0.50–1.3, p=0.36).

Finally, to analyze BIH outcomes in relation to goals set forth by the Healthy People 2000 Objectives for the Nation, comparisons were made between the outcomes in BIH and the Healthy People 2000 LBW objective (Figure 1). Figure 1 data compares LBW in BIH and the Medi-Cal comparison group to the 2000 goal. Total LBW for both groups did not meet the 2000 goal. Figure 1 also compares LBW in four selected BIH sites and in the corresponding Medi-Cal comparison ZIP codes. The selected BIH project sites are presented, because they achieved LBW rates well below the year-2000 goal of 9.0%. The LBW rate in Site A was 3.4%, which is 62% lower than the 2000 objective. The LBW rate in Site B was 4.9%, which is 46% lower, while the 5.6% in Site C, and 7.8% in Site D are 38% and 13% lower, respectively, than the Healthy People 2000 objective. Furthermore, each of the BIH selected sites is between 28% and 55% less than the corresponding comparison ZIP codes.

In order to determine whether the selected sites have differential risk factors from the BIH population

Table 3. BIH Clients Self-Reported Psychosocial Risk Factors (Percent)

	BIH Total[a]	Selected BIH Sites A	B	C	D
Worries about making ends meet	78.4	75.4	80	86.7	81.7
Income has decreased within 12 months	55.2	45.8	60.9	68.4	53.4
Partner not available for financial support	53.7	46.4	44.3	51.5	57.3
Moved within last 12 months	61.3	43.7	60.0	72.2	64.4
Not comfortable w/living arrangements	37.8	42.3	42.6	39.8	37.8
Partner is now or has been in jail	50.1	48.6	68.4	54.1	50.0
Someone close w/alcohol or drugs problems within the last 12 months	40.0	31.8	47.0	39.4	44.4
Close friend died within the last 12 months	27.2	23.9	27.8	25.0	30.7

[a] BIH clients screened and enrolled from July 1, 1996 to September 30, 1998 (N=3,810). Missing n=24.

overall, which could account for the favorable results, the data in Tables 2 and 3 is reviewed again here. Table 2 stratifies the self-reported health risk factors for these four sites so that they can be compared to the total BIH population. Though previous pregnancy and current pregnancy risk factors vary somewhat across the selected sites, the distribution of these factors appears to be random. Finally, an examination of Table 3 for differences in the psychosocial risk factors for the selected BIH sites, compared to the total BIH population, does not reveal any psychosocial factor differences which may have given an outcomes advantage to the selected sites.

DISCUSSION

The BIH intervention program contributed to the observed lower rates of very preterm and VLBW outcomes. The content and characteristics of the intervention are important to the discussion of study results. The BIH intervention program was funded by the California legislature in 1989 to improve the health of African-American women, infants, and children, thereby reducing African-American infant mortality. The guiding principles for the program were: participant self-empowerment, community involvement and ownership of the response to the problem, and partnership among the State Health Department, Maternal and Child Health Branch, local BIH projects, and academia. It was implemented in the 16 health jurisdictions (17 separate sites in cities and counties) throughout the state where 97% of the African-American live births and infant deaths occurred.

The BIH Program did not provide prenatal care but consistently enabled and supported clients with prenatal care entry and continuance. Therefore, BIH interventions were *complementary* to usual prenatal care. The program is similar to previous interventions because it uses some of the same structural elements: augmented services during the prenatal period, services designed specifically for African-American women, outreach and tracking, office-based services enhanced by telephone and in-home contacts, and preservice risk screening. There is, however, considerable uniqueness due to common infrastructure development and support, a focus on community-based strategies for health education, behavior change and risk reduction, and the design of program elements into a relational whole to create models of best practice.

Four best practice models comprised the program intervention. The Prenatal Care Outreach model utilizes community health outreach workers to conduct intensive outreach to identify and link pregnant African-American women to BIH, general prenatal care, and other appropriate services. It also deals with client tracking. The Case Management model utilizes public health nurses to conduct home visits for the purpose of assessment, referrals, provision and coordination of services, monitoring, and follow-up. The Social Support and Empowerment model provides social support to pregnant and parenting women. It assists women to identify their own strengths, and to utilize health and related resources to improve their lives. Finally, in order to foster the active involvement of fathers in the lives

Table 4. Birthweight Outcomes in BIH Program Newborns and Medi-Cal Comparison Group Newborns

Birthweight Categories	BIH[1] July 1996–Sept. 1998 (N=1,545)[3]	Comparison Group[2] (N=11,633)	OR	95% CI	P
<1,500 grams	1.9%	3.0%	0.63	0.34-1.16	0.11
1,500–2,499 grams	13.0%	11.0%	1.21	0.91-1.60	0.17
<2,500 grams	14.9%	14.1%	1.07	0.83-1.38	0.61

[1] BIH live births with known birthweight born to clients with BIH entry before 32 weeks' gestation, July 1996 through September 1998.
[2] Live births with known birthweight born to African-American women with a Medi-Cal paid delivery in BIH targeted ZIP codes; 1997 Birth certificate data.
[3] Missing = 8.

of their infants, the Role of Men model was developed. Fathers are taught fatherhood and parenting skills, personal and legal rights, options for completion of education, and vocational and job skills.

Each site implemented the Prenatal Outreach model and at least one more model, based on the results of their local needs assessment. Regardless of the models implemented, the unifying link between them was the engagement of community support for the BIH mission. This buy-in and partnership created an environment in which positive changes made by the individual woman were recognized and supported by the community overall. Community organizations and agencies—such as beauty shops and barber shops, retail stores, churches, and service clubs—were recruited to participate in a "Healthy African-American babies" network. The network also contributed to the dissemination of knowledge and skills about healthy reproduction and parenting.

The study results did not find statistically significant differences between the LBW and PTB outcomes of BIH participants and the outcomes of the comparison group (Tables 4 and 5), however, because there is a consistent downward trend observed in the rates of VLBW and very PTB among the California BIH participants. The rate of VLBW for BIH women is 63% of that for comparison women, and the PTB rate for BIH women is 81% of the rate for the comparison group. The effect appears to be a redistribution of newborns out of the VLBW and VPT categories into the next highest BW category. The occurrence of the observed effect in both LBW and PTB adds to the weight of evidence for these findings.[45]

The data on the four sites selected out of the 17 total projects sites showing BIH LBW rates lower than the year-2000 objective (Figure 1), suggest that these sites had programmatic experiences that were unique among the sites. However, their results do not appear to be explained by differential client risk factors associated with good outcomes (Tables 2 and 3). These results also point to the fact that there are lessons to be learned across sites in the BIH Program.

Though the findings are not statistically significant, they should be considered in light of the higher-risk profile of the women retained by the BIH Program (Tables 1–3). Additionally, though 99% of BIH women received some prenatal care, their prenatal care initiation profile showed that they began care later than the comparison group. BIH women were more likely to initiate prenatal care in the second or third trimester of pregnancy.

In this study, the African-American infant outcomes most responsive to the targeted BIH intervention were VLBW and very PTB. These results are similar to those of Norbeck,[38] Zimmer-Gembeck,[36] Korenbrot[32-33] and Moore.[40] They support the need for further study of the design and implementation of model interventions designed with an understanding of the African-American culture as it relates to health. More knowledge is needed about motivators of health behavior and about which strategies are most likely to effect change in the existing reproductive and infant health disparities. These would be interventions[46] that merge science (perinatal epidemiology, standardized validated intervention models, and data and information sciences), and cultural competence (African-

Table 5. Preterm Birth Outcomes in BIH Program Newborns and Medi-Cal Comparison Group Newborns

Preterm Delivery Categories	BIH[1] July 1996–Sept. 1998 (N=1,553)	Comparison Group[2] (N=11,633)	OR	95% CI	P
<32 weeks	3.5%	4.3%	0.81	0.50-1.30	0.36
32–37 weeks	14.4%	13.6%	1.07	0.82-1.39	0.61
<37 weeks	17.9%	17.9%	1.0	—	—

[1] BIH live birth infants born to clients with BIH entry before 32 weeks gestation, July 1996 through September 1998.
[2] Live births born to African-American women with a MediCal paid delivery in BIH targeted ZIP codes; 1997 Birth certificate data.

American values, beliefs, and motivations).[47] Furthermore, the importance of place—the community-based context for interventions targeted at African Americans—is a cross-cutting issue to be examined. Finally, the risk-screening tool developed especially for African-American women identifies some unique psychosocial risk factors, which need further study. Use of the tool in future studies will enhance the assessment of its validity among African Americans in other geographic locations and may lead to increased understanding of how they interact with reproductive outcomes.

The limitations of the study were: a differential drop-out rate for women with lower risk and the fact that BIH participants were not removed from the Medi-Cal comparison group data. Both of these limitations would tend to suppress the effect of the BIH intervention. In conclusion, the BIH Program retained high-risk women in care. Most importantly, in spite of that high-risk profile, the program participants show a trend towards better outcomes than women in the ZIP codes overall.

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