Published in final edited form as:
Matern Child Health J. 2011 April ; 15(3): 401–409. doi:10.1007/s10995-010-0595-6.

Perinatal Depression and Birth Outcomes in a Healthy Start Project

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Abstract

Given the risk of adverse perinatal outcomes associated with a depressive disorder, the Health Resources and Services Administration's (HRSA) Maternal and Child Health Bureau (MCHB) from 2001–2005 devoted resources through the Federal Healthy Start Initiative to screen pregnant women for depression and link them with services. In this report, we present the evaluation of a program that screened for depression and provided services for women with depressive symptoms or psychiatric distress in pregnancy to assess whether the program was associated with a reduction in babies born low birth weight, small for gestational age, or preterm. The program impact was examined among 1,100 women in three cohorts enrolled from 2001–2005 that included: (1) subjects recruited prior to the inception of the Healthy Start Initiative; (2) subjects enrolled in the Healthy Start Initiative; and (3) a comparison group recruited during the project period but not enrolled in the Healthy Start Initiative. After adjustment for covariates, women with probable depression were over one and a half times more likely to give birth to a preterm baby than non depressed women. Neither adjusted nor unadjusted risks for delivery of preterm, low birth weight or small for gestational age infants were significantly lower for women enrolled in Healthy Start as compared to women not enrolled in Healthy Start. However, regardless of enrollment in Healthy Start, women who delivered babies after the Healthy Start program began were 85% less likely to deliver preterm babies than women giving birth before the program began. Depression status conferred increased risk of adverse birth outcomes, results that were not altered by participation in the Healthy Start program. We cannot exclude the possibility that the community

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activities of the Healthy Start program promoted increased attention to health issues among depressed women and hence enhance birth outcomes.

Keywords

Perinatal depression; Birth outcomes; Healthy start; Evaluation

Introduction

Up to 20% of women may develop a depressive disorder at some point during pregnancy [1, 2]. Some researchers [3–7], although not all [8–14], find maternal depressive symptoms are associated with adverse perinatal outcomes such as low birth weight (LBW), preterm delivery (PTD), and small for gestational age (SGA).

Given the putative risk to adverse perinatal outcomes associated with a depressive disorder, the Health Resources and Services Administration's (HRSA) Maternal and Child Health Bureau (MCHB) devoted resources through the Federal Healthy Start Initiative to screen women for depression and link them with services. In this report, we present the evaluation of a program that screened for depression and provided services for women with depressive symptoms or psychiatric distress in pregnancy. The specific questions that we address in this evaluation are: (1) Were women with as compared to those without depressive symptoms more likely to have low birth weight, small for gestational age, or preterm infants? (2) Did women with depressive symptoms who were enrolled in the Healthy Start Initiative (HSI) deliver fewer preterm, low birth weight and small for gestational age babies as compared to depressed women not enrolled in the HSI? and (3) Did the rate of preterm delivery, low birth weight, and small for gestational age decline among babies born to depressed women in cohorts served after, as compared to before, deployment of the HSI? Given the literature in this area, we hypothesized that depressive symptoms in pregnancy would be associated with an increased risk of deliveries that were preterm, low birth weight or small for gestational age. Additionally, we hypothesized that the community intervention activities offered in the form of prenatal program services would reduce feto-infant morbidity levels among service recipients both with and without depression and among depressed and non depressed women receiving prenatal care at sites where HSI enrollment occurred.

Materials and Methods

The Local Healthy Start Initiative Site

The evaluation was performed on a local Healthy Start Initiative (HSI) in a New England urban locale. The site was first funded from 1997 to 2001, with receipt of a second round of funding from 2001 to 2005, which included the perinatal depression component. The HSI is a community partnership coordinated by a non-profit foundation in conjunction with local hospitals, a local university, health centers, and the local health department.

From 2001–2005 the HSI provided a comprehensive framework of case finding, case management, care coordination, and health education and training to pregnant and parenting women and their infants (aged 0–2). This service consisted of placing Healthy Start workers onsite at hospital obstetrical clinics, community-health centers and the Medicaid enrollment sites at the local Health Department. The Healthy Start workers delivered care coordination services consisting of four core functions: (1) initial contact or outreach; (2) intake; (3) assessment, care planning, and referrals; and (4) ongoing contact and tracking. Additionally, the HSI funding provided enhancements to a wide range of clinical services most often in the form of funding to clinical providers to enhance existing clinical and outreach services.

Healthy Start Initiative Procedures for Participants

Women were eligible to participate in the HSI if they: (1) lived in the target city or one of 8 surrounding towns, (2) were currently pregnant or had a child age two or younger, (3) received healthcare at one of two publicly-funded hospital clinics, community health centers, a local health department, or (4) were referred to the program through a community outreach worker. There were no age or language restrictions. All women who participated in the program signed informed consent. Women were enrolled in the HSI in one of four ways: (1) they were approached by workers at healthcare appointments; (2) they called an HSI worker as a response to a program advertisement on TV or in print; (3) they were referred to an HSI worker by a health care or social service provider, and (4) they were contacted via outreach conducted by a HSI worker at targeted locations such as housing projects and health departments. Anyone who requested services was provided with them.

Upon enrollment, participants were administered a standardized risk assessment by case managers. Information was also collected about general medical and obstetrical problems; psychiatric distress; basic needs; and social service needs. Women were referred to appropriate health and social services based on results of their risk assessment and followed periodically for the duration of their program enrollment.

Healthy Start Initiative Procedures for Mental Health Issues

Women were referred to an established “MOMsline” for further psychiatric assessment, referral and care coordination if, on the risk assessment, they met any of the following: (1) scored at least probable for a depressive disorder based upon the Primary Care Evaluation of Mental Disorders (PRIME-MD) Brief Patient Health Questionnaire [15]; (2) endorsed suicidal feelings; (3) reported a traumatic event and re-experienced that event with “intense fear, helplessness, or horror;” (4) or responded affirmatively to a question that they would “like help with a mental health problem.” Participants deemed in need of additional general healthcare or social services were given appropriate referrals that were documented on a risk assessment form and in the participant’s medical chart if appropriate. Results of the risk assessment were also entered into the program’s Management Information System. This system documented the number of participant’s served, participant demographics, results of risk assessment, and treatment referrals and services received.

Evaluation Procedures

Since women in the HSI were not randomized to receive or not receive services, two comparison groups were used to estimate the effects of the program. The comparison groups shared eligibility characteristics of the women enrolled in the HSI and were drawn from the same reproductive health settings. Trained research assistants (social workers with education ranging from BA to MSW) who were part of the evaluation team obtained written informed consent from women and administered a structured questionnaire. This questionnaire was designed to capture information relevant to the evaluation of the Healthy Start Depression Initiative (see Yonkers et. al. [16]) and included demographic (race/ethnicity, age, parity, education), interpersonal violence and substance use information. For this report, we used the demographic data as well as information about interpersonal violence and substance use. The PRIME-MD Brief Patient Health Questionnaire (BHQ) was used to determine if women had a probable depressive disorder.

The first comparison group included women who received reproductive health services before the 2001 HSI began. Because education of clinic workers and providers could contribute to a cohort effect, we also included a second comparison group. This group was comprised of women who received reproductive health care at the same time as women enrolled in the HSI but who were not enrolled in the program. Women did not enroll for a

variety of reasons including lack of interest, worker judgment that the woman did not need the HSI services and unavailability of an HSI worker at the time of the woman's health visit. The evaluation of all three cohorts, the pre-Initiative cohort (Group 1), post-Initiative cohort enrolled in the HSI (Group 2), and post-Initiative not enrolled in the HSI (Group 3) was conducted by an independent evaluation team that did not include the clinicians who enrolled or provided reproductive health services to women. Institutional Review Board (IRB) approval for the evaluation was obtained from the university at which the lead authors had faculty appointments and the IRB of each participating site.

The evaluation team assessed Group 1 within the six-month period before the HSI began (November 2001). Independent assessment of Groups 2 and 3 were concurrent (April 2002 to April 2005) and began after the 2001 HSI was put in place.

Medical Record Review Procedures

After delivery, the evaluation team systematically, and without knowledge of the participant's enrollment status, reviewed medical records to abstract the following data: birth weight and gestational age at delivery, complications of pregnancy or delivery, newborn medical problems, medical history, documented use of substances, and medications taken during pregnancy and used during delivery. Gestational age at delivery was calculated according to an algorithm that relied on results of a first trimester ultrasound, or if this was not obtained, completed days from first day of last menstrual period (LMP). If neither were available, we used the doctor's estimated age based upon delivery characteristics. Preterm delivery was defined as delivery before 37 completed weeks of pregnancy. Small for gestational age was defined as below the tenth percentile of birth weight for gestational age, according to an external standard of birth weight for gestational age accounting for infant's gender and race/ethnicity developed by colleagues at Yale from all 1999 singleton births in the United States [17]. For the purposes of this study, low birth weight was defined as less than 2,500 g. Birth weights were obtained within 24 h of delivery. We excluded women from this analysis if they had an abortion, miscarriage, or ectopic pregnancy or did not have a live birth ($n = 104$), or if they gave birth to multiples ($n = 14$). Therefore, we analyzed a total of 1,110 births.

Statistical Analysis

All analyses were performed in 2008. We used the chi-square statistic to test for differences in the distribution of socio-demographic and clinical characteristics between depressed and non-depressed groups and recipients of the HSI services and non-recipients. The association between key outcome measures (low birth weight, small for gestational age and preterm delivery) depression status and program participation was quantified by means of odds ratios generated from logistic regression models that were adjusted for possible confounding variables. We constructed the regression models and assessed goodness of fit using the −2 log likelihood ratio test. We estimated the significance of main effects by means of Wald test. All tests of hypotheses were two-tailed with a type I error rate fixed at 5%. SAS version 9.1 was used to perform all analyses.

Since women were not randomized to any of the aforementioned groups, the observed covariates, such as those listed in Tables 1 and 2, were not balanced across the compared groups. Thus, we constructed regression models that adjusted for covariates significant at a 0.10 level or those defined apriori as likely to modify the dependent variables (smoking, drug, and alcohol use in pregnancy). If the estimated correlation of the group was negative and statistically significant at an alpha of 0.05, we concluded that women in the post-HSI period had greater improvement in birth outcomes than those in the pre-HSI period. In the logistic models for the evaluation of depressed women in the HSI, the group indicator was

for Group 2 (enrolled in HSI) vs. Group 3 (after program initiation but not enrolled in HSI). If the estimated correlation of group was negative and statistically significant at alpha of 0.05, this signified that depressed women enrolled in the HSI (Group 2) or women overall (depressed and non depressed) had greater improvement in birth outcomes than women not enrolled in the HSI (Group 3).

Results

Participant Characteristics by Depression and Group Status

Baseline characteristics of the women by depression status are presented in Table 1. Black, non-Hispanic women as compared to white Non-Hispanic women were significantly more likely to be depressed ($P = 0.014$). The percentage of depressed women in the pre-Healthy Start group (36%) was significantly higher than in the post Healthy Start group (28%) ($P = 0.045$). There were no significant differences in depression status between women enrolled and not enrolled in Healthy Start ($P = 0.512$).

Baseline characteristics of the women by group status are presented in Table 2. Unadjusted comparisons between Group 2 and Group 3 indicated significant differences in race/ethnicity ($P < 0.001$) and parity ($P = 0.029$). Results from chi-square statistics (not shown) concluded that more Hispanic women were enrolled in the Initiative as compared to non enrollees ($P < 0.001$).

Birth Outcomes by Depression Status

Table 3 presents unadjusted and adjusted birth outcomes by depression status. As can be seen, 9% of depressed women had babies that were born low birth weight, as compared to 6% of non-depressed women. Ten percent of depressed women had babies born small for gestational age as compared to 11% of non depressed women, although these differences were not significant. There was a significant difference in both adjusted and unadjusted rates of preterm delivery for depressed as compared to non depressed women, with depressed women being over one and a half times more likely to give birth to a preterm baby than non depressed women (OR = 1.83, 95% CI, 1.17, 2.86).

Effect of Participation in the Healthy Start Initiative on Birth Outcomes among Depressed and Non-Depressed Women

The goal of this analysis was to determine if, among pregnant women cared for at participating prenatal centers after the inception of the HSI, enrollment in the program was associated with improved birth outcomes. We conducted an analysis examining the main effect of enrollment in Healthy Start (Group 2 vs. Group 3) on birth outcomes adjusting for depression (yes/no), parity, age, race/ethnicity, interpersonal violence, smoking, drug, or alcohol use in pregnancy, and late registration for prenatal care. After adjusting for parity, age, race/ethnicity, interpersonal violence, smoking, drug, or alcohol use in pregnancy, and late registration for prenatal care, there were no significant differences in the likelihood of delivering a preterm, low birth weight, or small for gestational age baby between depressed women enrolled in the HSI and those not enrolled in the Initiative (Group 2 vs. Group 3).

An analysis examining the impact of enrollment time in the HSI (in months) and birth outcomes was conducted for all enrollees. Time in program was not significantly associated with preterm delivery ($P = 0.51$), delivery of a low birth weight ($P = 0.25$) or small for gestational age baby ($P = 0.77$), even after adjusting for the significant covariates listed in Table 1. Additionally, we examined if there was an interaction between depression status and Healthy Start enrollment on birth outcomes. No significant interaction effect was detected.

Initiation of the Healthy Start Initiative and Birth Outcomes among Depressed and Non-Depressed Women

The goal of this analysis was to determine whether the activities of the HSI performed by the HSI workers (education, screening, care coordination, and referral) had an impact on adverse birth outcomes among depressed and non-depressed women who were provided care at the participating prenatal centers. We conducted an analysis examining the main effect of Healthy Start program initiation on birth outcomes adjusting for depression (yes/no), for parity, age, race/ethnicity, smoking, drug, or alcohol use during pregnancy, interpersonal violence, and late registration in prenatal care. After adjustment, there was no difference in the preterm or low birth weight delivery rates between depressed women who delivered before the beginning of the HSI and those who delivered after the program was put into place. Adjusted analyses show that women in the post Healthy Start group (Groups 2 and 3) were 85% less likely to have preterm deliveries ($P < 0.0001$) as compared to women in the pre Healthy Start cohort (Group 1). Additionally, we examined the interaction between depression status and the initiation of the Healthy Start program and no significant effect was detected.

Discussion

In the first set of analyses we examined whether depressive symptoms in pregnancy were associated with adverse birth outcomes. After adjustment for covariates, women with probable depression were over one and a half times more likely to give birth to a preterm baby than non depressed women. In the second set of analyses, we examined whether actual participation in the HSI led to a decrease in adverse birth outcomes among depressed women. Results showed that after adjustment for covariates, rates of babies born low birth weight, preterm and small for gestational age were not significantly different among those depressed women who did or did not participate in the Initiative. This lack of difference held even when we controlled for length of time a woman was enrolled in the initiative. Although we could not reliably measure the amount of services each woman enrolled in the HSI received, if length of time is related to amount of services received, our results suggest they may not be correlated.

In the third set of analyses, we examined whether there was a cohort effect that resulted from community-wide education and dissemination of information and attention that resulted from the Healthy Start Initiative. The use of a comparison group within the same local but at a previous time interval was designed to control for confounding characteristics imposed by the environment (e.g., socioeconomic status, access to care, changes in health insurance). As expected, the rates of preterm delivery were reduced for women giving birth after as compared to before the initiation of the HSI. This suggests a cohort effect as compared to an effect restricted to women who enrolled in HSI.

The issue examined by this evaluation is whether a comprehensive set of services such as that of the HSI which included care coordination and education, can reverse the risk that depression confers on adverse birth outcomes. Our evaluation suggests that there is little immediate benefit derived from participation in the HSI. The risks associated with depressive symptoms and depression in pregnancy may not be reversible for the index pregnancy examined in this evaluation. However, it is possible that increased services may lead to the prevention of adverse birth outcomes in subsequent pregnancies. Our findings may be limited by low power since few subjects in the three cohorts had elevated depressive symptoms.

We did find that the presence of the HSI significantly altered the preterm birth rate of women overall. The fact that women did better in the post HSI cohort could be related to

characteristics of women who were enrolled (i.e. healthier people) or to the community awareness that was promoted by the HSI.

Although we found a non-significant effect on birth outcomes for depressed women in Healthy Start, our findings pertain to one Healthy Start program during a specified time period, and are not representative of the other Healthy Start communities nationwide. Our inability to find a programmatic effect for babies born small for gestational age is similar to results reported in an evaluation of the Florida Healthy Start program [18], although the evaluation did not report specifically on depressed women and reported a robust programmatic effect on birth weight and preterm delivery.

A national evaluation (2000) of 15 Healthy Start programs [19] found that only 27% of the programs had a statistically significant effect on lowering rates of preterm delivery and only 3 or 20% of the 15 project areas saw reductions in low birth weight and very low birth weight in enrollees as compared to non enrollees. The lack of a uniform programmatic effect found by this national evaluation on birth outcomes could represent the etiological heterogeneity between preterm delivery, small for gestational age and low birth weight. If this was the case, it would suggest that there may be particular programmatic services that differentially influence the dimensions of infant morbidity. Although this national evaluation could not determine a causal relationship between program components and observable outcomes, characteristics of programs that were successful in reducing infant morbidity were most often related to strength in program administration, formation or enhancement of linkages between Healthy Start programs and clinical services, and employment of community members as Healthy Start educators, care managers, or peer counselors. Future evaluative efforts should focus on elucidating the specific mechanisms and program components whereby Healthy Start impacts maternal and child health in general and specifically for depressed women in order to improve the potency of the Healthy Start program and replicability of successful practices nationwide.

Our findings on program effectiveness may have been hampered by a number of issues. First, there were substantial differences in the three groups at baseline. Women enrolled in the HSI were less likely to be white and more likely to be Hispanic and pregnant for the first time than women not enrolled. Women enrolled in the HSI were also less likely to smoke, or use drugs or alcohol in pregnancy (18, 12 and 16%, in Groups 1, 2 and 3 respectively), suggesting a ceiling effect for poor birth outcomes.

Second, we utilized the PRIME-MD BHQ to measure a probable depressive disorder. This instrument measures depressive symptoms rather than an actual depressive disorder. The advantages of screening questionnaires are that they are short, easy to administer and can provide a measure of the severity of symptoms. The disadvantage is that they are not able to diagnose depression specifically but are elevated by general emotional distress, concurrent psychiatric illness or general medical conditions. The BHQ has been used in obstetric-gynecologic settings and correlates highly with the Structured Clinical Interview for DSM-III-R (SCID). The overall reliability between the BHQ and the SCID for major depressive disorder was 92 percent and 89 percent for minor depression [15].

Third, rather, than lack of control for confounding it may be that we over controlled for some covariates in our models. For example, if Healthy Start workers referred women to smoking cessation programs and women ceased smoking, but we included smoking in our models, than the program may have had an effect we were unable to detect. However, we do not believe this occurred for smoking, drug, or alcohol use since our unadjusted models pertaining to birth outcomes were non-significant even though smoking and other covariates remained significant.

Fourth the lack of effect of the HSI may also have been due to limited power to examine very preterm, very low birth weight, and small for gestational age in women overall and in a subgroup of depressed women. For example, assuming a type 1 and type 2 error rate of 5 and 20%, respectively, and an adjusted odds ratio of 0.94 for SGA in a Healthy Start vs. non-Healthy Start population, we would require a total sample of 119,904 to detect the differences in SGA between the Healthy Start and non-Healthy Start groups. However, the trend we observed in the reduction of small for gestational age babies after the Healthy Start Initiative is of similar magnitude to the rate observed in both the evaluation of Florida Healthy Start [18] site and the 15 demonstration sites examined in the National Healthy Start Evaluation [19]. Moreover, typical risk factors for adverse birth outcomes (race/ethnicity, smoking, age) were consistent in our cohort with the literature [20, 21] (Table 3).

Fifth, because external controls in comparable communities were not available, macro-level factors such as global changes in socio-economic status and health insurance and changes in clinical practice and quality of care could have also been responsible for decreases in adverse outcomes. However, the use of the cohort comprised of women who received reproductive health care at the same time as women enrolled in the HSI but who were not enrolled in the program aimed to minimize this possibility.

Finally, it is also possible that the follow up period was not of sufficient duration and/or other potential covariates and mediating variables such as rapid repeat pregnancies, previous preterm deliveries, and utilization of prenatal care were not reliably assessed as part of this evaluation. The evaluation of the overall Healthy Start program conducted by Mathematica did demonstrate an increase in utilization of prenatal care among Healthy Start recipients as compared to non recipients in 8 out of the 15 project areas evaluated [19]. However, the demonstrated effects of pre-natal care on improvement in birth outcomes are mixed [22]. Moreover, it may have been that the time during which the evaluation was conducted was too short to detect changes in women's depression status or pregnancy outcomes. Therefore, the program impact of HSI on birth outcomes of depressed women may not be observed in the pregnancy assessed for this review, but rather the impact may be detected in subsequent pregnancies. Future evaluative efforts should follow Healthy Start enrollees for durations long enough to determine the interrelationship between perinatal depression, pregnancy interval, and birth outcomes in women with subsequent pregnancies.

In 2007, Congress appropriated over $100 million dollars to the Healthy Start Initiative through the Public Health Service Act. This funding has been disbursed by the MCHB to 97 communities nationwide to implement or continue Healthy Start programs. Given the scope, economic investment, and potential for replicability of successful practices, the evaluation of Healthy Start programs across the country provide important mechanisms to demonstrate effectiveness and suggest future directions in maternal and child health programming and for perinatal depression.

Acknowledgments

This study was supported by NIMH grant #MH-01908-04 and grant 1H78MC00028-01 from the Health Resources and Services Administration.

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Table 1

Participant characteristics by depression

Characteristics	**Depressed (MinD/MDD = 1, *N* = 200)**	**Not Depressed (MinD/MDD = 0, *N* = 910)**	***P*-value**
	$\mu \pm$ SD	**$\mu \pm$ SD**	
Gestational weeks at screening	24.3 ± 10.3	27.4 ± 11.7	0.013
Parity	1.4 ± 1.6	1.2 ± 1.4	0.055
Baseline BHQ Score	11.0 ± 5.2	4.1 ± 3.3	< 0.001
	N (%)	*N* (%)	
Age group			
< 20	32 (16)	201 (22)	0.171
20–35	156 (78)	652 (72)	
> 35	12 (6)	57 (6)	0.883
Race			
White, Non Hispanic	13 (6)	130 (14)	
Black, Non Hispanic	83 (42)	296 (33)	0.014
Hispanic	101 (51)	456 (50)	0.248
Other	3 (1)	28 (3)	0.672
Interpersonal violence	50 (25)	140 (15)	0.001
Tobacco/drug/alcohol use during pregnancy	35 (20)	143 (16)	0.242
Late registration	44 (29)	153 (22)	0.069
Group			
Pre-Healthystart[a]	72 (36)	258 (28)	0.039
Healthystart enrollee[b]	50 (25)	294 (32)	
Healthystart not-enrolled	78 (39)	385 (39)	0.685

Table 2

Participant characteristics by group

Characteristics	Pre NHHS		*P*-value[a]	Post NHHS (*n* = 780)				*P*-value[b]
	Group 1 ($\mu \pm$ SD	(*n* = 330) Range		Group 2 ($\mu \pm$ SD	(*n* = 344) Range	Group 3 ($\mu \pm$ SD	(*n* = 436) Range	
Mean Gestational Weeks	39.1 ± 1.8	(27,42)	0.319	39.0 ± 2.1	(22,42)	39.0 ± 2.1	(24,44)	0.930
Parity	1.2 ± 1.3	(0,7)	0.788	1.1 ± 1.5	(0,13)	1.3 ± 1.4	(0,7)	0.029
	N	%		*N*	%	*N*	%	
Baseline BHQ score			0.718					0.048
0–9	278	84		297	86	351	81	
10–14	34	10		30	9	63	14	
≥15	18	6		17	5	22	5	
Age group			0.031					0.596
< 20	64	19		71	21	98	22	
20–35	236	72		258	75	314	72	
> 35	30	9		15	4	24	5	
Race			0.017					< 0.001
White	46	14		35	10	62	14	
Black	126	38		95	28	158	36	
Hispanic	144	44		210	61	203	47	
Other	14	4		4	1	13	3	
Interpersonal violence	67	20	0.067	59	17	64	15	0.347
Smoking or using drug/alcohol during pregnancy	60	18	0.251	40	12	69	16	0.106
Preterm delivery	20	6	0.243	27	8	36	8	0.836
Low birth weight	25	8	0.289	19	6	18	4	0.246
Small for gestational age	42	13	0.046	21	6	34	8	0.522
Prenatal care (late registration = 1)	91	28	< 0.001	43	13	58	13	0.954

Group 1: women assessed prior to the beginning of the NHHS Depression Initiative; Group 2: women assessed after beginning of the NHHS Depression Initiative and enrolled in NHHS; Group 3: women assessed after beginning of NHHS but not enrolled in NHHS

[a] *P*-value of Pre- vs. Post-NHHS;

[b] P-value of Group 2 vs. Group 3

Table 3

Birth outcomes by depression

Characteristics	Depressed	Not depressed	Unadjusted odds ratio[a]	Adjusted odds ratio
Total group				
Preterm delivery **	36 (21)	104 (13)	1.71 (1.12, 2.60)	1.83 (1.17, 2.86)
Low birth weight	16 (9)	46 (6)	1.62 (0.90, 2.94)	1.69 (0.89, 3.22)
Small for gestational age	14 (10)	76 (11)	0.89 (0.49, 1.62)	0.95 (0.50, 1.79)
Pre-healthystart (group 1)				
Preterm delivery *	26 (37)	70 (28)	1.55 (0.89, 2.70)	1.83 (1.00, 3.32)
Low birth weight	7 (10)	18 (7)	1.45 (0.58, 3.63)	1.70 (0.51, 5.65)
Small for gestational age[b]	7 (15)	27 (14)	1.11 (0.45, 2.73)	1.10 (0.48, 2.50)
Healthystart enrollee (group 2)				
Preterm delivery	5 (13)	15 (7)	1.98 (0.68, 5.80)	2.33 (0.68, 8.00)
Low birth weight *	6 (15)	13 (6)	2.85 (1.02, 8.01)	3.13 (0.97, 10.14)
Small for gestational age	4 (10)	19 (9)	1.23 (0.39, 3.82)	1.80 (0.52, 6.24)
Healthystart not-enrolled (group 3)				
Preterm delivery	5 (8)	19 (6)	1.29 (0.46, 3.59)	1.66 (0.42, 6.50)
Low birth weight	3 (5)	15 (5)	0.96 (0.27, 3.42)	0.93 (0.18, 4.90)
Small for gestational age	3 (5)	30 (10)	0.46 (0.14, 1.55)	0.57 (0.16, 1.98)

* $P < 0.05$,

** $P < 0.01$,

*** $P < 0.001$