

OBSTETRICS

The effect of CenteringPregnancy group prenatal care on preterm birth in a low-income population

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OBJECTIVE: The purpose of this study was to evaluate the impact of group prenatal care on rates of preterm birth.

STUDY DESIGN: We conducted a retrospective cohort study of 316 women in group prenatal care that was compared with 3767 women in traditional prenatal care. Women self-selected participation in group care.

RESULTS: Risk factors for preterm birth were similar for group prenatal care vs traditional prenatal care: smoking (16.9% vs 20%; $P = .17$), sexually transmitted diseases (15.8% vs 13.7%; $P = .29$), and previous preterm birth (3.2% vs 5.4%; $P = .08$). Preterm delivery (<37 weeks' gestation) was lower in group care than traditional care (7.9% vs

12.7%; $P = .01$), as was delivery at <32 weeks' gestation (1.3% vs 3.1%; $P = .03$). Adjusted odds ratio for preterm birth for participants in group care was 0.53 (95% confidence interval, 0.34–0.81). The racial disparity in preterm birth for black women, relative to white and Hispanic women, was diminished for the women in group care.

CONCLUSION: Among low-risk women, participation in group care improves the rate of preterm birth compared with traditional care, especially among black women. Randomized studies are needed to eliminate selection bias.

Key words: CenteringPregnancy, disparity, prenatal care, preterm birth

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Preterm birth is a serious, international public health issue. In the short term, preterm infants require more medical treatment than full-term infants; the treat-

★ EDITORS' CHOICE ★

ment ranges from antibiotics and phototherapy to mechanical ventilation and total parenteral nutrition. Other complications of prematurity, such as cerebral palsy and retinopathy, can lead to life-long handicap.^{1,2} The annual cost of treatment for these and other complications that arise from preterm birth has been estimated at >26 billion dollars in the United States alone.³

Risk factors for spontaneous preterm delivery are well described and include a history of previous preterm birth, multiple gestation, vaginal bleeding, low prepregnancy weight, systemic and genital tract infection, maternal smoking, and non-white race among others.^{4,5} Although prescription of 17 alpha-hydroxyprogesterone caproate has led to reductions in the rates of recurrent preterm delivery, there is no similarly effective means of primary prevention for women who are otherwise at low risk for preterm birth.⁶ Instead, clinicians focus on symptom-based screening and physical examination, and treatment is aimed at arresting the labor process after it has begun.⁷

South Carolina has one of the highest rates of preterm birth in the country; 14.3% of women deliver at <37 weeks'

gestation. There is also a tremendous racial/ethnic disparity in rates of prematurity; 19.7% of non-Hispanic black women deliver preterm compared with 12.7% of non-Hispanic white women and 13.0% of Hispanic women.⁸ The Greenville Hospital System Obstetrics Center, located in Greenville, SC, provides prenatal care primarily to medically underserved women. Given the vulnerability of the population that is served, historic rates of premature birth among women in this practice (16.4%) are markedly higher than both state and national averages.

In an effort to address this long-standing issue, the Greenville Hospital System Obstetrics Center began to offer CenteringPregnancy group prenatal care in March 2009. CenteringPregnancy is a national model of group prenatal care that has shown promise in reducing the rates of preterm birth.⁸⁻¹² The originators drew on basic adult learning theories that highlight the importance of group work and participatory processes to develop the model, although no single theory of health behavior was central to their design.

The Centering Healthcare Institute (Boston, MA) maintains the curriculum and evaluates and approves sites that offer this trademarked model of group prenatal

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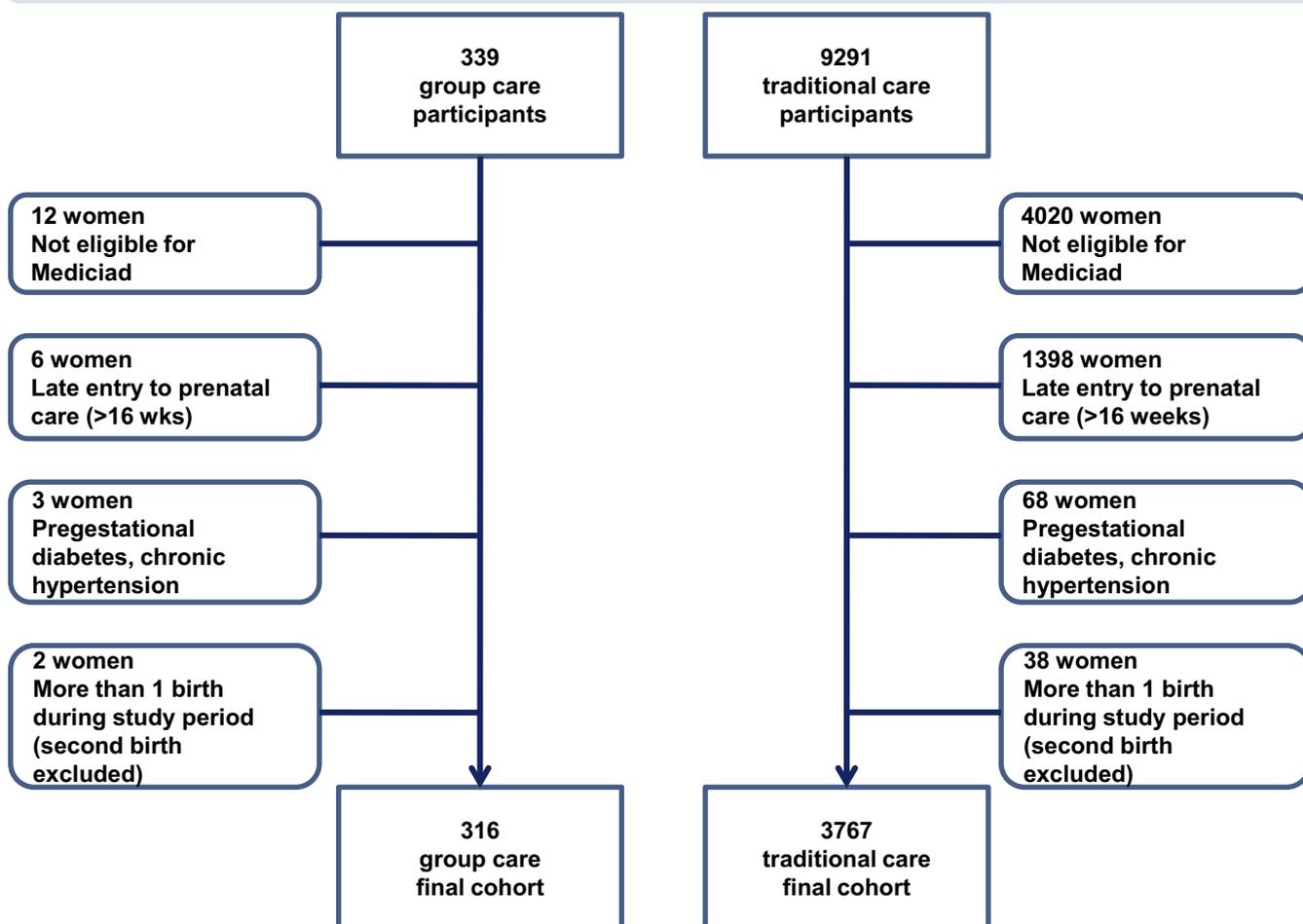
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FIGURE

Study population of all singleton live-births during the study period



Exclusions are noted.

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care. Participation typically is limited to low-risk women and excludes women with preexisting medical conditions or high-risk pregnancies, such as multiple gestations. Groups of up to 8-12 pregnant women at approximately the same gestational age are brought together 10 times over 6 months. Physical assessment by a credentialed medical care provider occurs within the group space, and women actively participate in their own medical care by taking responsibility for measuring their weight and blood pressure. Each 2-hour session follows an educational curriculum that includes information about health and nutrition, childbirth preparation, stress reduction, relationships, and parenting. Facilitated group discussion encourages active participation. There is an emphasis on relationship building that can

result in improved social support for the group members. In most settings, groups are led by certified nurse-midwives or nurse-practitioners.

To date, only one large randomized controlled trial that evaluated pregnancy outcomes for women who were enrolled in group prenatal care has been conducted.¹³ The authors found that the rate of preterm birth among women in group care was 33% lower than the rate of preterm birth for women in the traditional prenatal care control group (9.8% vs 14.8%). The subsample of black women demonstrated a 41% difference in the rate of preterm delivery (10.1% in group care vs 15.9% in traditional care). Reductions in the rates of prematurity and low birthweight have been inconsistent in smaller matched cohort studies.^{9,14,15}

The purpose of this study was to conduct a retrospective cohort study to determine the impact of the CenteringPregnancy model of group prenatal care on rates of preterm birth for women who are enrolled in group care compared with women who receive care in traditional prenatal care. This study will contribute the literature by examining the effectiveness of this evidence-based model outside of a highly structured clinical trial setting, with a large enough sample to document any observed changes in birth outcomes.

METHODS

During the implementation of group prenatal care in our practice, we developed guidelines that limited eligibility for group participation to low-risk patients and that

was consistent with both the scope of practice of the nurse-practitioners and nurse-midwives who were providing care in the groups and the CenteringPregnancy model design. Exclusion criteria for participation in group care included, but were not limited to, pregestational diabetes mellitus, chronic hypertension, multiple gestation, obesity (defined by body mass index $>45 \text{ kg/m}^2$), severe psychiatric disease, untreated drug or alcohol addiction, and other medical complications of pregnancy that require higher levels of surveillance, such as HIV infection and maternal cardiac or renal disease. Beginning in March 2009, all women with low-risk pregnancies seeking prenatal care in the first trimester were given the option of receiving care in the group prenatal care model. Patients were recruited for groups at the time of their first prenatal care visit by either a nurse-practitioner or a nurse-midwife, and the final determination regarding eligibility was made by the provider.

All groups were conducted according to the trademarked CenteringPregnancy curriculum, which has been described in previous publications.^{9,11-13} Participation in group care was not randomized, but rather left to the discretion of the individual patient. Patients in group care had the option of accessing additional visits in a traditional individual care setting as needed if health problems arose.

Typical monthly enrollment in group care ranged between 30–45 patients. A log of all participants was maintained to track the outcomes of these patients for ongoing quality control. *Participation* was defined as attendance at even 1 group session, and the total number of groups attended was recorded for each participant. Women were permitted to withdraw from group care and continue with traditional care if desired; this was also recorded for each participant. Medical care in groups was provided by nurse-midwives and nurse-practitioners. After the first 8 months of implementation, many groups also included a medical student, a resident physician in obstetrics and gynecology, or a resident physician in family medicine.

In December 2010, institutional review board approval was granted by the

TABLE 1

Demographic characteristics of women in group care compared with women in traditional care

Characteristic	Entire cohort		P value ^a
	Group care (n = 316)	Traditional care (n = 3767)	
Maternal age, y ^b	23.1 ± 4.6	25.1 ± 5.6	< .001
Maternal race/ethnicity, n (%)			< .001
White	107 (33.9)	1725 (45.8)	
Black	107 (33.9)	961 (25.5)	
Hispanic	55 (17.4)	835 (22.2)	
Other	47 (14.9)	246 (6.5)	
Marital status, n (%)			< .001
Married	75 (23.7)	1314 (34.9)	
Unmarried, Father not named	99 (31.3)	1000 (26.6)	
Unmarried, Father named	141 (44.6)	1433 (38.0)	
Unknown	1 (0.3)	20 (0.5)	
Education, n (%)			.266
<High school	114 (36.1)	1532 (40.7)	
High school diploma/GED	105 (33.2)	1176 (31.3)	
>High school	97 (30.7)	1055 (28.0)	
Month prenatal care began, n (%)			< .001
0-2 mo	181 (57.3)	1288 (34.2)	
3-4 mo	135 (42.7)	2479 (65.8)	
Kotelchuck Index, n (%)			< .001
Inadequate	16 (5.1)	182 (4.8)	
Intermediate	17 (5.4)	380 (10.1)	
Adequate	114 (36.1)	1786 (47.4)	
Adequate +	169 (53.5)	1419 (37.7)	
Tobacco use during pregnancy, n (%)			.166
No	263 (83.2)	3012 (80.0)	
Yes	53 (16.8)	753 (20.0)	
Sexually transmitted disease infection, n (%) ^c			.287
No	266 (84.2)	3252 (86.3)	
Yes	50 (15.8)	515 (13.7)	
Parity, n (%)			< .001
0	199 (63.0)	1549 (41.1)	
≥1	117 (37.0)	2218 (58.9)	
Previous preterm birth, n (%)			.082
No	306 (96.8)	3562 (94.6)	
Yes	10 (3.2)	205 (5.4)	

GED, general equivalency degree.

^a Maternal age comparison was made with *t* test; the comparison of the remainder was made with χ^2 . ^b Data are given as mean ± SD;

^c *Nisseria gonorrhoea*, *Chlamydia trachomatis*, *Herpes simplex*.

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TABLE 2

Birth outcomes for women in group care compared with women in traditional care

Characteristic	Entire cohort, n (%)		P value ^a
	Group care (n = 316)	Traditional care (n = 3767)	
Gestational age at delivery, wk			.034
<32	4 (1.3)	118 (3.1)	
32-36	21 (6.7)	359 (9.5)	
≥37	291 (92.1)	3290 (87.3)	
Birthweight, g			.265
<1500	5 (1.6)	112 (3.0)	
1500-2400	23 (7.3)	318 (8.4)	
≥2500	288 (91.1)	3337 (88.6)	
Admission to neonatal intensive care unit			.082
No	294 (93.0)	3391 (90.0)	
Yes	22 (7.0)	376 (10.0)	
Breastfed			.099
No	111 (35.1)	1501 (39.9)	
Yes	205 (64.9)	2266 (60.1)	

^a χ^2 test.Picklesimer. Group prenatal care and preterm birth. *Am J Obstet Gynecol* 2012.

Greenville Hospital System University Medical Center for a retrospective cohort study to evaluate program outcomes. Demographic information and pregnancy outcomes were obtained from the electronic birth certificate database that is maintained by the hospital. Preterm birth was considered as any delivery at <37 weeks' gestational age by the best obstetric estimate of gestational age at delivery, which was collected in accordance with the Centers for Disease Control and Prevention's National Center for Health Statistics Handbook and the 2003 revision of the US Standard Certificate of Live Birth.¹⁶⁻¹⁸

Adequacy of prenatal care was determined with standard scoring on the Kotelchuck Adequacy of Prenatal Care Utilization index, which is also included in the 2003 revision of the US Standard Certificate of Live Birth.¹⁹ This index is based on the American College of Obstetricians and Gynecologists prenatal care standards for uncomplicated pregnancies and characterizes care into 1 of 4 categories according to the timing of initiation of care, the total number of prenatal care visits received, and the gestational

age at delivery. Women are categorized as receiving "inadequate" care if they enter prenatal care after the month 4 of pregnancy (16 weeks' gestational age) or receive <50% of the expected visits. All other categories require entry to care in months 1-4. The "intermediate" category requires attendance at 50-79% of the expected visits; the "adequate" category requires attendance at 80-109% of the expected visits; and the "adequate +" category requires attendance at >110% of the expected visits.

The study cohort consisted of women who delivered live-born singleton infants between March 2009 and December 2010, who received Medicaid coverage at the time of delivery, who entered prenatal care within the first 16 weeks of pregnancy, and who had no pregestational diabetes mellitus or hypertension. If women had >1 birth during the study period, only the first delivery was included to maintain independence.

Bivariate group comparisons between women who received group care and those in the control group who received traditional care were made with the use

of χ^2 analysis for categorical data and the Student *t* test for continuous data. Multiple logistic regression analysis was used to obtain adjusted odds ratios for preterm birth for patients who were enrolled in group care vs the control group of women who participated in traditional prenatal care; adjustment was made for known risk factors and group differences. Significance level was set at the probability level of .05. All statistical analyses were performed with SAS statistical software (version 9.2; SAS Institute Inc, Cary, NC).

RESULTS

During the study period, there were 9630 singleton live-born deliveries at Greenville Memorial Hospital; 339 of these women participated in group prenatal care. After exclusions, the final study population consisted of 4083 women: 316 women in group care and 3767 women in traditional care (Figure). Women in the group care cohort attended a median of 7 (interquartile range, 5-8) sessions of the 10 scheduled group sessions. Forty-eight women (15%) withdrew from the group care program after a median of 1 (range, 1-5) sessions, but their pregnancy outcomes were evaluated with the group care cohort in an intent-to-treat analysis.

Maternal demographic characteristics were significantly different between groups (Table 1). Women who enrolled in group prenatal care were younger, more likely to be a minority, and nulliparous, and to have entered prenatal care earlier in comparison with women in traditional care. Risk factors for preterm birth such as the presence of sexually transmitted infections, tobacco use during pregnancy, and history of previous preterm birth were similar for both groups.

The mean gestational age at delivery was 38.8 ± 2.2 (SD) weeks for women in group prenatal care, which was greater than for women in traditional care who demonstrated a mean gestational age at delivery of 38.3 ± 2.7 weeks ($P < .001$). Similarly, mean birthweight was 3245 ± 579 g for women in group care compared with 3178 ± 654 g for women in traditional care ($P = .05$). Previous preterm

birth, maternal race, marital status, and adequacy of prenatal care were associated with preterm delivery at <37 weeks' gestation ($P < .001$ for all). Bivariate comparisons of birth outcomes for all women in group care compared with all women in traditional care are available in Table 2.

The rate of preterm delivery at <37 weeks' gestation was 7.9% for women in group care and 12.7% for women in traditional care ($P = .01$). Rates of preterm delivery at <32 weeks' gestation were also lower, with a rate of 1.3% for women in group care and 3.1% for women in traditional care ($P = .03$). There was no difference in rates of low infant birthweight <2500 g (8.9% group care vs 11.4% traditional care; $P = .20$) or neonatal intensive care unit admission (7.0% group care vs 10.0% traditional care; $P = .08$). Multivariate regression analysis that included maternal age, race, marital status, nulliparity, early entry to prenatal care, adequacy of prenatal care, and history of previous preterm delivery demonstrated that participation in group prenatal care was highly protective for preterm delivery (odds ratio [OR], 0.53; 95% confidence interval [CI], 0.34–0.81; Table 3).

To eliminate the potential confounding effect of previous preterm birth, subgroup analysis was performed only with nulliparous patients. There were persistent demographic differences between the 2 cohorts in the nulliparous subgroup. We continued to see a higher percentage of minority women participate in group prenatal care compared with traditional care. Of the 199 nulliparous women in group care, 33.2% were non-Hispanic white women; 33.2% were non-Hispanic black women; 16.6% were Hispanic women, and 17.1% of the women were self-reported as other race/ethnicity. The 1549 nulliparous women who received traditional care were 49.8% non-Hispanic white, 25.8% non-Hispanic black, and 18% Hispanic; 6.4% women reported to be other race/ethnicity ($P < .001$). Other demographic characteristics, including age, marital status, and educational level were not different between these 2 groups.

TABLE 3

Multivariate logistic regression for risk of preterm delivery <37 weeks

Characteristic	Adjusted odds ratio (95% CI)	P value
Maternal age	1.01 (0.99–1.03)	.398
Maternal race/ethnicity		
White	Referent	—
Black	1.20 (0.95–1.50)	.122
Hispanic	0.51 (0.38–0.69)	< .001
Other	0.87 (0.59–1.28)	.472
Marital status		
Married	Referent	—
Unmarried	1.09 (0.87–1.37)	.449
Kotelchuck Index		
Inadequate/intermediate	1.12 (0.86–1.45)	.405
Adequate/adequate +	Referent	—
Month prenatal care began		
0-2	0.69 (0.57–0.84)	< .001
3-4	Referent	—
Parity, n		
0	Referent	—
≥1	0.86 (0.69–1.07)	.169
Previous preterm birth		
No	Referent	—
Yes	2.54 (1.80–3.58)	< .001
Participation in group care		
No	Referent	—
Yes	0.53 (0.34–0.81)	.004

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Nulliparous women in group care enrolled in prenatal care earlier than nulliparous women in traditional care; 58.8% entered care at <2 months' gestation compared with 33.7% in the traditional cohort ($P < .001$). Nulliparous women in group care were also less likely to receive inadequate or intermediate prenatal care and more likely to demonstrate more adequate and adequate+ prenatal care, as measured by the Kotelchuck Index ($P = .011$).

Nulliparous women in group care were less likely to use tobacco during pregnancy, with only 12.6% of the women reporting any tobacco use during pregnancy compared with 19.3% of the nulliparous women in traditional care ($P = .022$). The incidence of sexually transmitted infec-

tions was not different between the 2 groups (13.1% in group care vs 14.1% in traditional care; $P = .699$).

Pregnancy outcomes for this subgroup were similar to those of the larger cohort. The mean gestational age at delivery for nulliparous women was 38.8 ± 2.3 weeks for women in group prenatal care compared with women in traditional care who demonstrated a mean gestational age at delivery of 38.4 ± 2.9 weeks ($P = .01$). Similarly, mean birthweight was 3238 ± 588 g for women in group care compared with 3131 ± 669 g for women in traditional care ($P = .02$).

The differences in rates of preterm delivery were persistent in this subgroup; 8.0% of the nulliparous patients in group

TABLE 4
Comparisons for preterm delivery at <37 weeks' gestation by race/ethnicity within groups

Mother's race/ ethnicity	Group care			Traditional care		
	Subjects, n	Preterm delivery, n (%)	<i>P</i> value ^a	Subjects, n	Preterm delivery, n (%)	<i>P</i> value ^a
White	107	7 (6.5)	.63	1725	236 (13.7)	< .01
Black	107	8 (7.5)		961	155 (16.1)	
Hispanic	55	4 (7.3)		835	58 (7.0)	
Other	47	6 (12.8)		246	28 (11.4)	

^a χ^2 test.
 Picklesimer. Group prenatal care and preterm birth. *Am J Obstet Gynecol* 2012.

care and 12.9% of the nulliparous patients in traditional care delivered at <37 weeks' gestation ($P = .05$). Differences in the rate of preterm delivery at <32 weeks' gestation did not reach statistical significance: 1.5% for women ($n = 3$) in group care compared with 3.8% for women ($n = 59$) in the control group ($P = .14$). There was also no difference in a low infant birthweight of <2500 g (8.5% group care vs 11.4% traditional; $P = .10$) or neonatal intensive care unit admission (7.5% group care vs 11.2% traditional care; $P = .12$). Multivariate logistic regression modeling that controlled for maternal race, marital status, tobacco use during pregnancy, early entry to prenatal care, and adequacy of prenatal care confirmed the protective effect of participation in group care for reducing the risk of preterm delivery at <37 weeks' gestation for nulliparous women (OR, 0.54; 95% CI, 0.31–0.93).

Because there was a higher percentage of minority women in group care and because non-Hispanic black race is associated with increased rates of preterm delivery, we sought more information about the influence of race in the cohort. Logistic regression modeling that controlled for maternal age, marital status, nulliparity, early entry to prenatal care, adequacy of prenatal care, and participation in group care showed similar risks for preterm delivery for black and white women, with Hispanic women relatively protected from preterm delivery (OR, 0.51; 95% CI, 0.38–0.69). When we performed unadjusted within-group com-

parisons with χ^2 testing, we saw a significant difference in the rates of preterm delivery at <37 weeks' gestation by race/ethnicity for women in traditional care ($P < .01$). For women in group care, this disparity in rates of preterm delivery at <37 weeks' gestation by maternal race/ethnicity was no longer significant ($P = .63$; Table 4).

COMMENT

The 47% reduction in preterm birth for low-risk women in group care is consistent with the previously published prospective randomized study of group prenatal care, and confirms that this model has the potential to deliver beneficial outcomes outside of the clinical trial setting.^{9,13} This finding persisted in the subanalysis of nulliparous women. Furthermore, the racial/ethnic disparity in rates of preterm birth seemed to diminish for the women who participated in group care when compared with the control group of women in traditional care. When considered as a "bench to bedside" translational research project, we can see that replication of group care according to the guidelines that were established by the Centering Healthcare Institute delivers positive patient outcomes that are consistent with previously published prospective clinical trials.

The principal strength of our study is the racial diversity of the study population. The 2 largest studies of group care published by Ickovics et al^{9,13} included a study population of 80% black women

in both the matched cohort and the randomized controlled trial. Other authors have published smaller studies on racially and ethnically homogeneous populations that included black and Hispanic women.^{10,15} Authors with more diverse study populations have been limited by small sample sizes.^{14,20} Because of the diverse population in our practice, we were able to evaluate the impact of group care across racial and ethnic groups; our finding of an apparent decrease in the racial/ethnic disparities in preterm birth is novel.

This apparent decrease in racial disparities in preterm birth must be interpreted with caution. Racial identity in this study was self-reported on the mother's worksheet for the birth certificate; approximately 15% of the women in group care were self-identified as "other." Based on our familiarity with these women, we know that the majority are non-Hispanic and biracial, white and black. Baseline rates of prematurity are not available for this group. The lower rates of preterm birth for Hispanic women in this study population are evidence of the "Hispanic paradox," which is a well-described phenomenon that seeks to explain the relatively positive health outcomes of recent Hispanic immigrants, a group with high rates of poverty and limited access to medical care that may otherwise seem to be at risk for poor health outcomes.²¹ Finally, although the current study sample is among the largest and most diverse that has been reported, it is still relatively small, and the racial differences in pregnancy outcome may diminish when the number of patients who participate in group care is larger.

Other study limitations are those inherent to all retrospective cohort studies; the most significant is the potential for selection bias. Indeed, in bivariate analysis, we do see a number of differences between women who elected to participate in group care compared with those who elected traditional prenatal care. Many of the characteristics that are seen more frequently in group care patients, however, would seem to confer an increased risk for preterm delivery, such as a higher percentage of non-Hispanic black women, younger maternal age, and a higher number of unmarried women.

Finally, data collected from the electronic birth certificate database may be less accurate and is less comprehensive than data that could have collected from a review of the medical records or in patient interviews. The birth certificate worksheets include only a very limited number of risk factors in pregnancy (presence of diabetes mellitus, hypertension, previous preterm birth, and "other poor pregnancy outcome"). The worksheets do not include information about the presence or absence of many of the high-risk conditions that would have excluded women from participation in our group prenatal care program, such as maternal cardiac or renal disease. Reliance on this database also precluded our assessment of other potential confounders, such as short cervical length, positive fetal fibronectin testing, or the administration of 17-alpha hydroxyprogesterone caproate. We are also limited in our ability to draw conclusions about rare outcomes, such as preterm delivery at <32 weeks' gestation, by the relatively small numbers of women who participated in group care.

The findings of our study are important because implementation of group care in a medical practice is a significant commitment that requires changes to nearly every process in the office. There are obvious differences in the provider-patient interaction, but changes are also required for registration, laboratory, assessment of vital signs, physical configuration of patient care areas, and discharge processes. Patients are also required to make changes: a longer appointment time, a loss of flexibility in scheduling group appointments, and a prohibition against bringing small children to group. The data presented here show that offering group care to even a portion of self-selected patients can make a difference in pregnancy outcome. This may embolden providers and practice managers to pursue the system redesign that is required to bring group care into their office.

The possibility that group prenatal care could represent a form of primary prevention for preterm birth, particularly for nulliparous women, is intriguing. The mechanism that may explain the improved outcomes for participants in group care is unclear. It may be that the enhanced education that is provided during group sessions empowers women to seek medical attention earlier when they are experiencing problems, and the improved relationship between patient and provider may ensure better compliance with treatment recommendations. Relationships among patients that develop in the context of the group provide enhanced levels of social support, which may help relatively low-resource women with their levels of stress and coping. Stress reduction, in turn, may decrease the inflammatory mediators that contribute to the cascade of preterm labor. All of these theories are untested and will be the source of future research in our practice. ■

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