



Group Prenatal Care Attendance and Women's Characteristics Associated with Low Attendance: Results from Centering and Racial Disparities (CRADLE Study)

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Abstract

Objectives Group prenatal care (GPC), an alternative to individual prenatal care (IPC), is becoming more prevalent. This study aimed to describe the attendance and reasons of low attendance among pregnant women who were randomly assigned to receive GPC or IPC and explore the maternal characteristics associated with low-attendance.

Methods This study was a descriptive study among Medically low risk pregnant women (N = 992) who were enrolled in an ongoing prospective study. Women were randomly assigned to receive CenteringPregnancy GPC (N = 498) or IPC (N = 994) in a single clinical site. The attendance frequency and reason for low-attendance (i.e. $\leq 5/10$ sessions in GPC or ≤ 5 visits in IPC) were described separately in GPC and IPC. Multivariable logistic regressions were performed to explore the associations between maternal characteristics and low-attendance.

Results On average, women in GPC attended 5.32 (3.50) sessions, with only 6.67% attending all 10 sessions. Low-attendance rate was 34.25% in GPC and 10.09% in IPC. The primary reasons for low-attendance were scheduling barriers (23.19%) and not liking GPC (16.43%) in GPC but leaving the practice (34.04%) in IPC. In multivariable analysis, lower perceived family support ($P = 0.01$) was positively associated with low-attendance in GPC, while smoking in early pregnancy was negatively associated low-attendance ($P = 0.02$) in IPC.

Conclusions for Practice Scheduling challenges and preference for non-group settings were the top reasons for low-attendance in GPC. Changes may need to be made to the current GPC model in order to add flexibility to accommodate women's schedules and ensure adequate participation.

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Keywords Prenatal care · Group prenatal care · Pregnant women · Low-attendance

Significance

Group prenatal care (GPC) is an alternative to the traditional individual prenatal care (IPC) that has gained popularity in past two decades. Evidence links prenatal care attendance rates with improved obstetric outcomes, but previous studies of GPC have consistently documented poor attendance

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at scheduled GPC sessions for women receiving this model of care despite high patient satisfaction with the GPC setting. The present study is unique in that it not only reported the frequency of GPC group session attendance and reasons for low attendance in both GPC and IPC, but also explored the associations of demographic, psychosocial, and lifestyle characteristics with prenatal care attendance in both models of prenatal care. A strength of current study is using data collected from a randomized controlled trial with women were allocated 1:1 to GPC or IPC. Because of this study design, women who assigned to GPC have similar demographic, psychosocial, and lifestyle characteristics to women who assigned to IPC. Therefore, differences in reasons for low attendance or factors associated with low attendance in GPC and IPC are likely due to the specifics of the prenatal care model. Understanding which women are likely to have low attendance in prenatal care is critical for implementing effective strategies to improve prenatal care attendance and may provide important feedback useful for revising elements of GPNC models to better accommodate women's needs and preferences.

Introduction

Prenatal care is a key component in achieving optimal health outcomes for both pregnant women and their children. Recently, models of group prenatal care (GPC) have been developed as an alternative to the traditional individual prenatal care (IPC). Several models of GPC have been developed, including Expect With Me (Cunningham et al. 2017), Supportive Pregnancy Care (DIMES 2018), and CenteringPregnancy (Rising 1998). In the United States CenteringPregnancy (CP) is the most well-known and widely implemented model of GPC and has been successfully implemented in hundreds of obstetric and gynecological practices since the description of the model was first published in 1999 (Centering Healthcare Institute 2018; Rising 1998). The CenteringPregnancy model of GPC was founded on a set of essential elements that place primacy on women taking ownership of their health, with the provider acting as a facilitator of group discussion and education. There are up to ten group sessions of 2 h each over the second and third trimesters, consisting of the same group of providers and patients in each session.

Growing evidence suggests that compared to IPC, GPC is associated with improved rates of breastfeeding initiation, increased attendance at post-partum and family planning visits, reduced rates of preterm birth, and significant cost savings from fewer admissions to the neonatal intensive care unit (Crockett et al. 2017; Gareau et al. 2016; Ickovics et al. 2007; Jafari et al. 2010; Klima 2003). Additionally, women report higher rates of satisfaction with GPC, improved social

support, improved knowledge about pregnancy and readiness for child birth (Novick et al. 2011; Rising et al. 2004). Although the GPC model is well received by women participating in groups and several studies reported improved pregnancy outcomes in this model of care, practices offering GPC report significant challenges recruiting and retaining women in GPC model (Phillippi and Myers 2013; Yorga and Sheeder 2015).

Attendance at prenatal care appointments, either IPC or GPC can be challenging. Inflexible work schedules, lack of reliable or affordable childcare, and limited access to transportation regularly limit access to medical care appointments (Heaman et al. 2014; Lia-Hoagberg et al. 1990). These barriers can pose a greater challenge for GPC attendance because of the format, length of the sessions, and fixed schedule (Berman et al. 2018). Currently, there is little quantitatively research describing the frequency of session attendance or factors associated with low attendance in GPC. Attending assigned group sessions in GPC may be more critical because over the course of the ten group sessions, not only the different content be delivered, but also the cohesion of the group develops. This group cohesion, an essential and unique attributor of the GPC model, develops over the course of 6 months and is based on building trust and relationships among the provider team, patients and their support people. This group cohesion is thought to be one of the factors that support the association of GPC with improved maternal health behaviors and birth outcomes (Earnshaw et al. 2016; Rising 1998) and is likely compromised when group members attend sporadically.

To fill the current research gap, the objectives of this study were to describe the frequency of attendance and the reasons for low-attendance in both GPC and IPC and to explore the associations between baseline characteristics and low-attendance among medically low risk women who were receiving prenatal care in a single clinical site and enrolled in a large, ongoing, prospective study: Reducing Disparities in Birth Outcomes: A Randomized Controlled Trial on CenteringPregnancy (Cradle Study).

Methods

Study Design and Population

The parent Cradle Study is a large randomized controlled trial (RCT) among medically low risk women were recruited, enrolled, and followed at a single site at the Greenville Health System (GHS) Obstetrics and Gynecology (OB/GYN) Center in Greenville, South Carolina. The GHS OB/GYN center has been providing GPC using the CenteringPregnancy model since 2008. In the last 10 years more than 4000 women have been enrolled in groups, which represents ~20% of the

low-risk pregnancy population at this site. The original objectives of the Cradle study were to compare maternal and birth outcomes as well as maternal behavioral and psychosocial measures, by race, among pregnant women who assigned to GPC to their counterparts in IPC and to investigate whether changes in women's behavioral and psychosocial measures would explain the potential benefits of GPC on maternal and/or birth outcomes. However, current study was descriptive and exploratory in nature and didn't intend to test any hypotheses or compare the any outcomes between GPC and IPC.

Further details of the practice and Cradle study design were published previously (Chen et al. 2017). In keeping with the CenteringPregnancy GPC model medically low risk pregnant women aged between 14 and 45 years and entered prenatal care before 20^{6/7} gestational weeks were eligible for the Cradle study. Study exclusion criteria include medical complications such as pre-gestational diabetes, severe chronic hypertension, active pulmonary tuberculosis, massive morbid obesity or severe psychiatric illness, as well as pregnancy complications such as multiple gestation or planned cervical cerclage. Eligible women who agreed to participate were randomized 1:1 into GPC or IPC prenatal care, stratified by race, and were followed from their enrollment to 12-weeks postpartum. At recruitment and prior to randomization, women were provided descriptions of both GPC and IPC. The study team makes every effort to ensure that women were familiar with both GPC and IPC before study consent. Women were informed that they can decline Cradle study participation if they want to choose either GPC or IPC, and that study participation was best for those women who were willing to participate in either form of prenatal care.

The sample size of the Cradle study (N = 3160) was calculated based on the primary outcome of preterm birth. The study could detect the reduction in risk difference of 1.4% on preterm birth rate between Black and White women in GPC vs. IPC with an alpha of 0.05 and a power of 90%, assuming 15% attrition rate. Study enrollment began in April 2016 and is expected to continue through June 2020. The current study includes a cohort of the first 992 women enrolled into the Cradle study with a due date prior to June 1st, 2018. Among them 498 were randomly assigned to receive CenteringPregnancy GPC and 494 were assigned to IPC. Written consent was obtained from all participants, and institutional Review Board approval was obtained from Clemson University and the Greenville Health System. This study was carried out following the rules of the Declaration of Helsinki.

CenteringPregnancy Group Prenatal Care (Intervention)

The CenteringPregnancy model of GPC was founded on a set of essential elements that place primacy on women

taking ownership of their health, with the provider acting as a facilitator of group discussion and education. Groups of 8–10 women meet for a series of 10 sessions over pregnancy (usually 6 months), consisting of the same group of providers, patients and their support person in each session. The content of each session includes discussions about pregnancy, childbirth, healthcare, and parenting. This format was designed to increase contact with the provider, improve women's health knowledge, and provide a unique opportunity for bonding with other women experiencing pregnancy (Rising 1998; Rising et al. 2004).

During the GPC sessions, women measure their own weight and blood pressure, and have a brief individual physical assessment with a credentialed health care provider (either a physician or a nurse practitioner/midwife) who co-facilitates the group. This type of GPC incorporates physical assessment and the other ACOG screening recommendations with facilitated group discussion that promotes relationships between group members and allows additional time for patient education and discussion (Centering Health-care Institute 2018).

Participants allocated to GPC were scheduled to attend group sessions once per month on a fixed day and time during the second trimester (sessions 1–4) and every two weeks during the third trimester (sessions 5–10). The session schedule was provided to the patient at the time of study enrollment. At GHS OB/GYN center, morning sessions are offered between 9 am and 12 pm and afternoon sessions are offered between 1 pm and 4 pm. This fixed and consistent schedule helps the group form a consistent cohort throughout the duration of pregnancy and provides an opportunity to build social support. Women who are unable to attend group due to last minute schedule changes are not able to “make up” a missed group, but rather are seen in an individual visit to substitute for the missed group visit.

Traditional Individual Care Model (IPC)

Participants allocated to IPC attended traditional individual prenatal care according to the schedule of visits and using the health screening tests recommended by ACOG (American College of Obstetricians and Gynecologists 2012). Women were able to schedule or reschedule these visits at any time during the regular work day (i.e. 7 am–5 pm Monday through Friday).

Data Collection

Timing of Data Collection

Pregnant women were enrolled between 8 and 20^{6/7} gestational week and were followed up to 12 weeks postpartum. At enrollment (Survey 1) and again in the third trimester

(Survey 2, between 30 and 40 gestational weeks), women completed surveys composed of demographic questions, as well as numerous psychosocial, lifestyle and behavioral measures using validated questionnaires. Women were also given incentives at two time-points to compensate for their time, the first (\$25) for completing the Survey 1 immediately after study enrollment, and the second (\$50) in the third trimester when administering the Survey 2, but only for women who completed at least five of their assigned prenatal care (GPC sessions or IPC visits). The timing of the administration of the second survey was meant to correspond with women's attendance of five prenatal care visits so that the incentive distribution and the administration of the second survey could take place concurrently.

Assessment of Attendance

Prenatal care attendance data were extracted from the electronic medical record (EPIC system) and scheduling database, and monitored by the study team monthly. In the Cradle study, we defined low-attendance as attending less than five group sessions for women who assigned to GPC and five prenatal visits for women who assigned to IPC. The threshold of five group sessions in GPC was selected because that dose was considering as an adequate exposure to CenteringPregnancy model and was widely used by previously published studies, including both RCT (Ickovics et al. 2016) and observational studies (Gareau et al. 2016; Tanner-Smith et al. 2013). Please note that this threshold does not seek to replace the concept of Adequacy of Prenatal Care, for which there are numerous indexes (Kotelchuck 1994; Research and Kessner 1973).

Assessment of Reasons for Low-Attendance

At 30–40 gestational weeks, Cradle study staff approached participants to distribute the Survey 2 and provide the incentive for completion of five group sessions in GPC and five prenatal care visits in IPC. If women were ineligible for the incentive due to low attendance, study staff still offered them the opportunity to complete the Survey 2. They also asked these women into take a brief interview for reasons behind their low attendance and recorded the answers as part of a quality improvement effort for the Cradle study. For women that did not return to the office during the window of 30–40 gestational weeks, study staff reviewed their medical records to see if reasons for low attendance could be identified (e.g. miscarriage/abortion, preterm birth, or transfer to another practice). Two research staff reviewed women's responses monthly and consensus coded all responses into categories.

Assessment of Participants' Demographics

Information on sociodemographic characteristics such as maternal age, race/ethnicity, annual household income, educational attainment, and employment status were collected at study enrollment through Survey 1 and medical records.

Assessment of Psychosocial, Behavioral, and Lifestyle Measures

A variety of psychosocial, behavioral, and lifestyle measures were collected at the study surveys. Measures of maternal stress, mood disorders, social support, resiliency and persistence, discrimination in everyday life, and pregnancy intention were examined in addition to lifestyle characteristics. Perceived stress was assessed by a validated 4-item scale (Cohen and Janicki-Deverts 2012; Cohen and Williamson 1988) measuring women's perceptions of control and confidence about their life circumstances. Prenatal distress was assessed using the Prenatal Distress Questionnaire (a 17-item scale) measuring how worried a woman feels about common stressors during pregnancy (Lobel 1996). Prenatal anxiety was assessed with the Pregnancy-Specific Anxiety Scale (PSAS) that assesses women's emotional state of anxiety arising from concerns about their pregnancy (Guardino and Schetter 2014). Depression was measured using the Center for Epidemiological Studies (CES-D) (Radloff 1977). Perceived family support was measured using a 7-item scale adapted from the Provisions of Social Relations Scale (Turner et al. 1983) with the addition of a financial assistance item. This scale assesses the extent to which the women feel they can depend on their family for emotional, problem-solving, and financial support (Hahn-Holbrook et al. 2013). Pregnancy Intention was addressed by one question from the Pregnancy Risk Assessment Monitoring System (PRAMS) questionnaire (Centers for Disease Control and Prevention 2014) to assess women's emotional response to discovering they were pregnant. "Shift and Persist" was measured using a validated 10-item scale that assessed resiliency when faced with adversity (Chen et al. 2015; Chen and Miller 2012), that represents greater resiliency and endurance to stressors. Everyday discrimination was assessed using a 11-item scale derived from the PRAMS (Centers for Disease Control and Prevention 2014) to assesses the degree to which women may or may not experience discrimination in everyday (Lewis et al. 2012; Williams et al. 1997). To assess lifestyle characteristics, participants completed the U.S. Household Food Security Survey Module—Short Form (Blumberg et al. 1999; Economic Research Service 2012), and were asked if they were drinking alcohol or smoking before and during early pregnancy. Four participants assigned to GPC, and four participants assigned to IPC did not complete the

enrollment survey, and thus were excluded from any analysis of psychosocial measures or lifestyle characteristic.

Statistical Analysis

The primary analyses in current study were descriptive and exploratory in nature (i.e. no comparisons of any outcomes between GPC and IPC). Because direct comparisons of attendance frequency and reasons for low-attendance between prenatal care models may not be appropriate given the structural differences, all analyses were separated by prenatal care model, excepting women's baseline characteristics presented in Table 1 (we wanted to examine whether balance was achieved between GPC and IPC in Table 1). All statistical analyses were performed with SAS statistical software (version 9.4 SAS Institute Inc, Cary, NC).

Women's baseline characteristics of all 992 women were presented as percentage (frequency) for categorical variables and mean (standard deviation, SD) for continuous variables. Because we wanted to examine whether women who assigned to GPC had the similar characteristics as to women who assigned to IPC, we performed Chi square tests for categorical variables and *t* test for continuous variables.

Self-reported reasons for low-attendance and percentages were reported among women who attended less than 5 group sessions in GPC (*N* = 207) and 5 prenatal care visits in IPC (*N* = 94).

For calculating the low-attendance rate, we excluded women (*N* = 115; 60 in GPC; 55 in IPC) who left the practice (*N* = 22; 11 in GPC and 11 in IPC), moved out of the practice area (*N* = 60; 28 in GPC and 32 in IPC), had an abortion or miscarriage before 20 gestational weeks (*N* = 26; 14 in GPC and 12 in IPC), or developed pregnancy/medical complications that do not allow them to continue receiving GPC (*N* = 7 in GPC). We believed these reasons are not modifiable and cannot be controlled either by the providers or by women themselves. Then the low-attendance rate for each prenatal care model was calculated as the number of participants who attended less than 5 sessions/visits divided by the number of participants in each prenatal care model.

Our exploratory analysis for the associations of participant's demographic, psychosocial, and lifestyle characteristics with low attendance was conducted using multivariable logistical regression models. For some psychosocial measures and lifestyle characteristics, we treated the responses of "don't know/not applicable (NA)" as a separate category for categorical variables, or by imputing the mean score by participants' attendance status and stratified by prenatal care model in the multiple regressions. We also conducted complete data analysis as sensitivity analyses. For above analyses, we also excluded women (*N* = 115) who left the practice, moved out of the practice area, had an abortion or miscarriage before 20 gestational weeks, or developed pregnancy/medical complications that do not allow them to

Table 1 Characteristics of Cradle study participants at baseline (*N* = 992)

	Full sample	Prenatal care model		<i>P</i> ^a
		Group (GPC)	Individual (IPC)	
Characteristics [% (<i>N</i>)]		<i>N</i> = 498	<i>N</i> = 494	
Age in years [mean (SD)]	24.98 (5.07)	25.1 (5.19)	24.9 (4.94)	0.44
Race (randomized) [% (<i>N</i>)]	992	498	494	
Black	39.21 (389)	39.16 (195)	39.27 (194)	
White	38.81 (385)	38.76 (193)	38.87 (192)	
Hispanic	16.23 (161)	16.27 (81)	16.19 (80)	
Other	5.75 (57)	5.82 (29)	5.67 (28)	0.10
Annual household income [% (<i>N</i>)]	702	361	341	
< \$10,000	31.20 (219)	32.69 (118)	29.62 (101)	
\$10,000–19,999	29.91 (210)	31.02 (112)	28.74 (98)	
≥ \$20,000	38.89 (273)	36.29 (131)	41.64 (142)	0.35
Education [% (<i>N</i>)]	941	470	471	
Less than high school	23.70 (223)	23.83 (112)	23.57 (111)	
High school	56.75 (534)	56.17 (264)	57.31 (270)	
Above high school	19.55 (184)	20.00 (94)	19.11 (90)	0.92
Employment [% (<i>N</i>)]	930	461	469	
Working full time	32.04 (298)	31.67 (146)	32.41 (152)	
Working part-time	20.43 (190)	19.51 (90)	21.32 (100)	
Unemployed	47.53 (442)	48.81 (225)	46.27 (217)	0.57

^aTests of significance compare differences in participant characteristics at baseline. For continuous variables *t* tests were used and Chi squared tests for categorical variables

continue receiving GPC, and women who did not complete the Survey 1 ($N=7$).

Results

Characteristics of the Cradle Study Population

The baseline characteristics of the women were presented in Table 1. Of the 992 women included in this study (498 in GPC; 494 in IPC), 39.21% were non-Hispanic black, 38.81% were non-Hispanic white, 16.23% were Hispanic, and 5.75% were “Other” race/ethnicity. The majority of women reported having only a high school degree (56.75%) and annual household income less than \$20,000 (61.11%). Roughly half the participants were unemployed (47.53%). There were no differences in baseline demographics between women assigned to GPC and IPC (all P s > 0.05). The characteristics of the Cradle study participants are similar to the low-risk pregnancies population served in this clinic (data not shown).

Reasons for Low Attendance by Prenatal Care Model

The reasons for not attending at least 5 group sessions in GPC or 5 prenatal care visits in IPC were reported in Table 2. Among women attended less than 5 group sessions in GPC ($N=207$), “scheduling” was the most frequent reason (23.19%) for not attending, followed by “did not like GPC; returned to IPC” (16.43%), and “left the practice” (13.53%). Among women attended less than 5 prenatal care visits in IPC ($N=94$), the most frequent reason was “left the practice” (34.04%), followed by “abortion/miscarriage” (12.77%), and “moved out of the area” (11.70%).

Low Attendance by Prenatal Care Model

When women who moved out of the area, left the practice, had abortion/miscarriage before 20 gestational weeks, or developed pregnancy/medical complications that do not allow them to continue receiving GPC were excluded, the low-attendance rate was 34.25% in GPC ($N=438$) and 10.02% in IPC ($N=439$). There were no racial/ethnic differences in low-attendance rates in GPC (all P s > 0.05). In IPC, however, black ($P=0.02$) had a lower low-attendance rate and “Other” race/ethnicity ($P=0.02$) women had a higher low-attendance compared to white women (Fig. 1).

On average, women assigned to GPC completed 5.32 (3.53) sessions, with 20.69% not attending any GPC sessions and 16.09, 13.79, and 6.67% attending eight, nine, or ten sessions, respectively (Fig. 2). Among women attended at least one session ($N=346$), the mean number of attended sessions was 6.71 (2.46).

Table 2 Reasons for low-attendance by prenatal care model ($N=301$)

Reasons for low-attendance	GPC $N=207$	IPC $N=94$
Scheduling ^a	23.19 (48)	2.06 (2)
Did not like GPC; returned to IPC	16.43 (34)	–
Entered GPC	–	6.38 (6)
Left the practice	13.53 (28)	34.04 (32)
Abortion/miscarriage < 20 GW	6.76 (14)	12.77 (12)
Did not come to any prenatal care	5.80 (12)	8.51 (8)
Delivered preterm	5.31 (11)	10.64 (10)
Moved out of the area	5.31 (11)	11.70 (11)
Transportation challenges	4.83 (10)	1.06 (1)
Women who developed pregnancy/medical complications that made them ineligible for GPC	3.38 (7)	–
Personal circumstances ^b	3.38 (7)	1.06 (1)
No excuse	2.42 (5)	4.26 (4)
Other ^c —missing	0.97 (2)	0.00 (0)
Withdrew from study	0.48 (1)	0.00 (0)
No data ^d	8.21 (17)	7.45 (7)

^aScheduling includes women that were unable to attend their scheduled group time due to unforeseen circumstances such as work or school

^bPersonal circumstances in GPC reasons included financial issues ($n=3$), legal issues ($n=2$), sudden death of baby’s father ($n=1$) and childcare issues ($n=1$); in IPC, patient reported loss of house to fire

^cWomen who were marked “other” without citing a specific reason

^dFor these participants research nurses/study staff were not able to determine the reason for low-attendance

Characteristics Associated with Low-Attendance

In multivariable analysis, lower perceived family support ($P=0.01$) was positively associated with low-attendance in GPC (Table 3), while smoking during early pregnancy ($P=0.02$) was negatively associated with low-attendance in IPC (Supplement Table 1). In the sensitivity analysis that only included women with complete data on all variables the results were not changed (data not shown).

Discussion

In current study among a population of medically low risk pregnant women, we found that attendance to GPC group sessions was low. Women assigned to GPC completed a mean of 5.32 (3.53) sessions, with 20.06% of them not attending any GPC sessions and 34.52% attending less than five of the ten group sessions during their prenatal period. The primary reasons reported for low-attendance was scheduling barriers and not liking GPC in GPC but leaving the practice in IPC. We found that women who reported lower perceived family support were more likely to have

Fig. 1 Low-attendance rates by prenatal care model and racial and ethnic subgroups: GPC (N = 435), white (N = 165), black (N = 172) and Hispanic (N = 71), and “Other” (N = 27); IPC (N = 436), white (N = 169), black (N = 167) and Hispanic (N = 73), and “Other” (N = 27). Within each prenatal care model, there were no statistical differences in attendance rates by race (white = reference group). Women who moved out of the practice area, had an abortion or miscarriage, or developed a pregnancy/medical complication that prevented further GPC attendance (N = 115), did not have Survey 1 data (N = 7) were excluded from this analysis

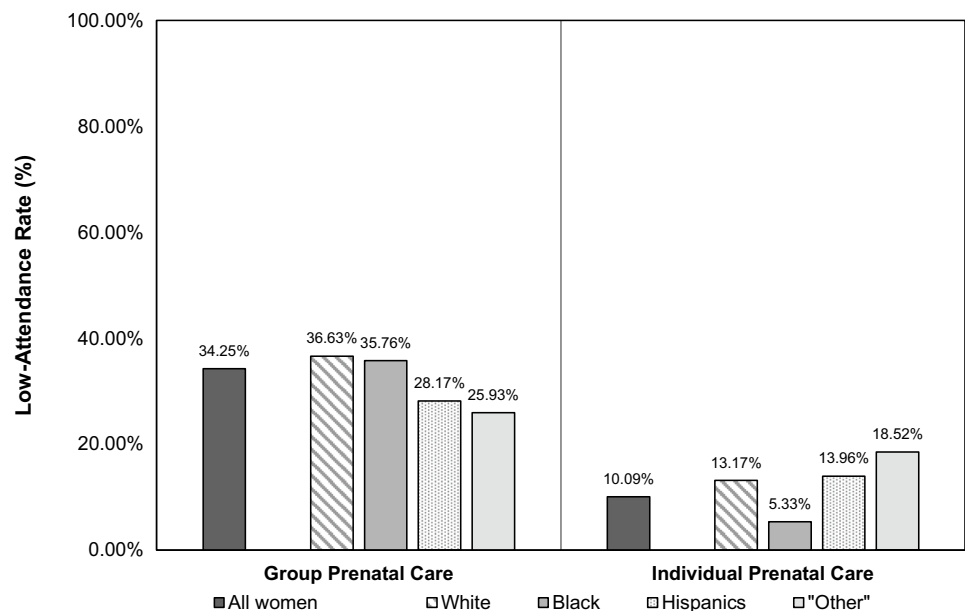
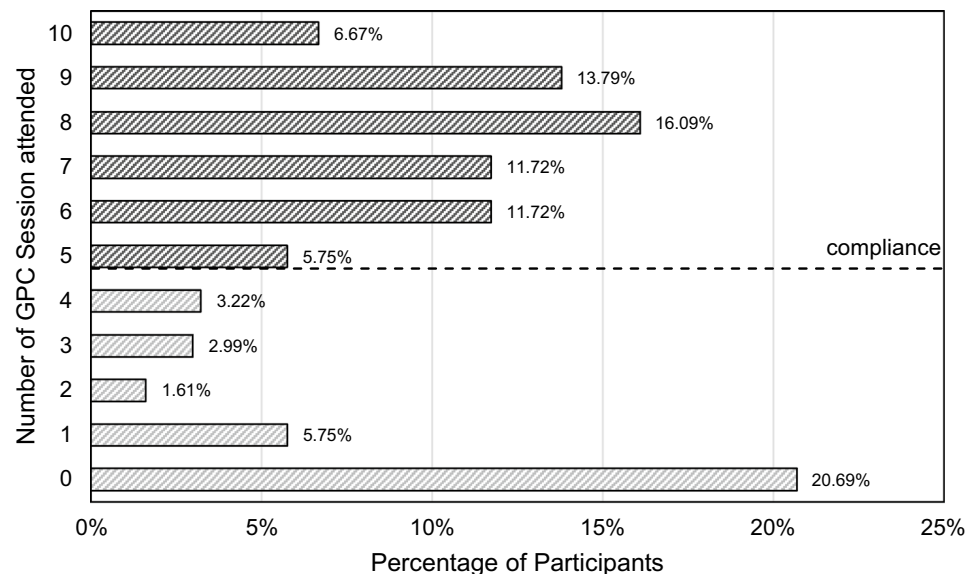


Fig. 2 The percentage of number of GPC sessions attended in the GPC model among 435 women who assigned to GPC. Women who moved out of the practice area, had an abortion or miscarriage, or developed a pregnancy/medical complication that prevented further GPC attendance (N = 60) were excluded from this analysis



low-attendance in GPC, but women who reported smoking during early during pregnancy were less likely to have low-attendance in IPC.

Group Prenatal Care

Significant barriers to participation in GPC are evident in our study. In our review of 66 studies on GPC, we found only 11 have reported the overall prenatal care visits and only three studies reported attendance of group sessions of GPC (Supplemental Table 2), and only two studies have a comparison group (Ickovics et al. 2016; Picklesimer et al. 2012). One of these two studies was a retrospective cohort conducted at the Greenville and

reported the median number of group session attendance was 7 (interquartile range 5–8) (Picklesimer et al. 2012) among women who attended at least one group session. The other study is a clustered RCT (randomization at the clinic level) conducted in New York and reported the mean number of group session attendance was 5.3 (2.5) (Ickovics et al. 2016), also among women who attended at least one group session. In current study, the mean number of group session attendance was 6.71 (2.46) when calculated among women who attended at least one session, which is similar to the previous two studies. In addition, the RCT study reported that 22% of women did not attend any GPC sessions, which is similar to the finding in current study (20.06%). Although studies in this area are limited, the

Table 3 Multivariable associations of women's baseline characteristics with low-attendance in group prenatal care

	OR (95% CI)	P
Characteristics	N = 434	
Age in years [‡]	0.97 (0.93, 1.02)	0.24
Race [% (n)]		
White	1.00	
Black	1.09 (0.65, 1.83)	0.74
Latina	0.77 (0.39, 1.54)	0.46
Other	0.58 (0.21, 1.58)	0.29
Annual household income [% (n)]		
< \$10,000	1.58 (0.81, 3.08)	0.18
\$10,000–19,999	1.61 (0.84, 3.06)	0.15
≥ \$20,000	1.00	
Education [% (n)]		
Less than high school	0.64 (0.38, 1.1)	0.11
High school	0.62 (0.3, 1.29)	0.20
Above high school	1.00	
Employment [% (n)]		
Working full time	2.15 (0.84, 5.47)	0.11
Working part-time	1.06 (0.4, 2.85)	0.91
Unemployed	1.00	
Prenatal distress score	0.79 (0.46, 1.37)	0.40
Prenatal anxiety score	0.85 (0.62, 1.17)	0.31
CES-depression score	1.02 (0.98, 1.07)	0.36
Perceived stress during pregnancy score	1.05 (0.96, 1.16)	0.29
Perceived family support score	0.93 (0.88, 0.98)	0.01
Shift and persist	1.04 (0.97, 1.1)	0.28
Everyday discrimination score	1 (0.95, 1.05)	0.96
Feeling about pregnancy [% (n)]		
Unhappy	1.1 (0.52, 2.31)	0.81
Happy	1.00	
Not sure	0.7 (0.43, 1.15)	0.16
Food insecurity		
Food secure	1.00	
Marginal or insecure	1.03 (0.64, 1.67)	0.90
Drinking alcohol during early pregnancy [% (n)]	0.94 (0.33, 2.71)	0.92
Smoking during pregnancy [% (n)]	1.73 (0.95, 3.17)	0.07

Multivariable logistic regression odds ratios (OR) and 95% confidence intervals (CI) represent the odds ratio of having low-attendance while holding all other characteristics constant. Low-attendance is defined as completing < 5 GPC sessions. Excludes women who moved out of the practice area, had an abortion or miscarriage, or developed a pregnancy/medical complication that prevented further GPC attendance (N = 55) and who missed survey data (N = 3)

consistence of our results with previous studies suggests that low attendance in GPC is likely to be common.

Further, the barriers to GPC attendance reported in current study are similar those previously reported such as lack of transportation and childcare, time constraints, and resistance to group settings (Hill et al. 2018). In current

study, we provided free childcare during GPC sessions to limit the impact that childcare responsibilities could have on low attendance. Despite this, scheduling barriers were still the most frequent reason reported for low-attendance. Scheduling conflicts have previously been reported as a reason that women decline to participate in GPC model (Phillippi and Myers 2013; Yorga and Sheeder 2015). In current study, scheduling conflicts (25.26%) were the most frequent reasons for women not attending 5 CP sessions. The rigid scheduling of group sessions poses another challenge. To ensure continuity, the fostering of interpersonal relationship, and the building of social support; the CenteringPregnancy GPC model requires a fixed schedule (a morning or an afternoon session on selected days of the week), with a limited chance for make-up group sessions. Each GPC appointment is typically 2 h, compared to a typical prenatal visit lasting 10–20 min, which may make the model less appealing for women who want to limit the time they need to take away from work or other commitments. Therefore, it is not unexpected that GPC becomes a structural barrier for women with unanticipated changes to their schedule.

The provision of medical care in a group setting is a novel approach, which some women may be hesitant to try or may not enjoy. In current study, of the women who had low-attendance in GPC, 16.34% reported they did not like the group sessions and crossed over to IPC. In a previous qualitative study that examined reasons for why women who decline GPC, some women reported having a fear of emotional or physical exposure in a group setting (Phillippi and Myers 2013). Many women also cited distrust of disclosing private information with other women. In the current study it is worth noting that for women who reported not liking GPC (N = 34), 76.47% did not attend any group sessions, suggesting there may be an alternative reason for not attending group sessions. In future studies, it would be beneficial to evaluate if strategies for encouraging women to try one or two sessions alters their preconception of GPC.

Our finding that low perceived family support was independently associated with a likelihood of having low-attendance in GPC is novel and has not been previously reported. A unique component of the GPC model is allowing a family member or partner to attend sessions. As such, women who do not believe they have a supportive family member to participate their sessions might be less likely to enjoy the group model and attend fewer sessions. Alternatively, women who have low perceived family support may not have the transportation, child care, or financial assistance that often make it possible for women to attend GPC sessions.

Individual Prenatal Care

Although the current study did not examine adequacy of care, attendance to prenatal care is a component in adequate

prenatal care and is a good proxy for the women in the current study with attendance at fewer than 5 IPC visits. Previous quantitative studies have shown that in an IPC model, being a younger mother, minority race or ethnicity, low education and unemployment was associated with inadequate prenatal care (Lia-Hoagberg et al. 1990; Partridge et al. 2012). Despite the underlying link of attending prenatal care appointments, we did not find that sociodemographic characteristics were associated with low attendance.

Interestingly, we found women who smoked during early pregnancy were less likely to have low-attendance. Among previous study conducted either outside of the US or within the US, smoking during early pregnancy were found to be either positively associated with lower IPC attendance or inadequacy of prenatal care (Raatikainen et al. 2007; Ribeiro et al. 2009) or no association (Masho et al. 2014). Multiple factors should be considered when comparing the results from current study to previous studies. It is worth noting that our analyses are exploratory in nature and this association might be observed by chance. It is also possible that women who smoked during the early pregnancy worried the potential adverse impact and attended more IPC visits to ensure their pregnancies can be actively monitored. Future studies are warranted to confirmed this finding.

Strengths and Limitations

The large sample size, the racial diversity of the population, and the randomized study design of the parent study are strengths of the current study. Since women were randomly assigned to their prenatal care model, the difference in reasons observed between the models should be only attributed to the model itself, and not women's particular characteristics (Frew et al. 2014). Additionally, each woman's prenatal care attendance, particularly in the GPC model, was monitored closely by the research team to ensure eligibility for study incentives. In addition, multiple psychosocial, behavioral and lifestyle factors were assessed using structured and validated instruments for pregnant women.

This study had a few limitations. The reason for low-attendance was not collected from all women due to lack of availability. However, we did have self-reported reasons for 88.50% of the women who had low-attendance. Women enrolled in our study were limited to reporting only one reason for low-attendance. Under certain circumstances, the reasons could be complex and multifaceted; therefore, our singular reasons may not fully capture why women could not meet their assigned group sessions. Our team is conducting a follow-up qualitative study using in-depth interviews with women who did not attend any GPC sessions, who crossed over from GPC to IPC, and those who had low-attendance in both GPC and IPC models. Although using the cutoff of

five or less group session as a measure of low-attendance was based on previous studies (Ickovics et al. 2016; Gareau et al. 2016; Tanner-Smith et al. 2013) with an assumption that women will be benefited from the CenteringPregnancy model if they attend five or more group sessions. However, evidence to support this assumption, which should from rigorous analyses of the dose–effect relationship, is still lacking. Since we also offered incentives for participants who completed 5 group sessions (in GPC) or visits (in IPC), our results may not be generalizable to clinics who do not incentives attendance. Despite this, the amount of incentive was approved by the IRB and determined not to impact women's decision making for prenatal care attendance. Lastly, there were some missing data for certain psychosocial measures. To maximize the study power and minimize potential bias, we treated missing data as a separate category for categorical variables and imputed mean values for continuous variables in our multivariable regression models. We also conducted a sensitive analysis only including women with complete data for all variables and the results were unchanged.

Conclusions

In this large study among medically low-risk pregnant women, we found that the attendance in the GPC model was low. Scheduling challenges and women's preference for non-group settings were identified as primary reasons for the low attendance in GPC. It is important to note that the data collected from the Cradle randomized controlled trial showed that demographic characteristics were balanced at study enrollment. The characteristics we found to be associated with low-attendance to GPC are therefore not biased by self-selection and indicate that a group model of prenatal care may not be preferred or appropriate for all low-risk pregnant women. Changes may need to be made to the current model of GPNC in order to add flexibility to accommodate women's schedules and ensure adequate participation. Understanding what factors are associated with low attendance, particularly for GCP models, is critical for the modification and creation of new strategies to increase group session attendance in this novel prenatal care model. Future studies are warranted to confirm the findings from the current study and in different populations. It is likely worthwhile for researchers and clinical providers of GPC to develop strategies to address these primary barriers of attending group sessions so that women can receive the optimal benefits of this prenatal care model.

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Authors' Contributions EF: study conception and design, obtain data and statistical analysis, drafting the manuscript, major editing; MBJ: study conception and design, obtain data and analysis, drafting the manuscript, major editing; BW: obtain data and statistical analysis, editing; AC: major editing; SCK: major editing; SG: major editing; XS: major editing; LC: study conception and design, data obtain and statistical analysis, major editing; All authors: data collection. All authors read and approved the final manuscript.

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Compliance with Ethical Standards

Competing interests The authors declare that we have no competing interests.

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