


Improved Outcomes for Hispanic Women with Gestational Diabetes Using the Centering Pregnancy[®] Group Prenatal Care Model

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Abstract *Objective* To determine the impact of Centering Pregnancy[®]-based group prenatal care for Hispanic gravid diabetics on pregnancy outcomes and postpartum follow-up care compared to those receiving traditional prenatal care. *Methods* A cohort study was performed including 460 women diagnosed with gestational diabetes mellitus (GDM) who received traditional or Centering Pregnancy[®] prenatal care. The primary outcome measured was completion of postpartum glucose tolerance testing. Secondary outcomes included postpartum visit attendance, birth outcomes, breastfeeding, and initiation of a family planning method. *Results* 203 women received Centering Pregnancy[®] group prenatal care and 257 received traditional individual prenatal care. Women receiving Centering Pregnancy[®] prenatal care were more likely to complete postpartum glucose tolerance testing than those receiving traditional prenatal care, (83.6 vs. 60.7 %, respectively; $p < 0.001$), had a higher rate of breastfeeding initiation (91.0 vs. 69.4 %; $p < 0.001$), had higher rates of strictly breastfeeding at their postpartum visit (63.1 vs. 46.3 %; $p = 0.04$), were less likely to need medical drug therapy compared to traditional prenatal care (30.2 vs. 42.1 %; $p = 0.009$), and were less

likely to undergo inductions of labor (34.5 vs. 46.2 %; $p = 0.014$). When only Hispanic women were compared, women in the Centering group continued to have higher rates of breastfeeding and completion of postpartum diabetes screening. *Conclusion for Practice* Hispanic women with GDM who participate in Centering Pregnancy[®] group prenatal care may have improved outcomes.

Keywords Gestational diabetes · Group prenatal care · Centering pregnancy · Breastfeeding · Postpartum visit

Significance

What is already known on this subject? Centering pregnancy group prenatal care can improve outcomes and readiness for childbirth compared to traditional prenatal care.

What this study adds? Group care has not been reported for specific high-risk pregnancy conditions such as gestational diabetes. This retrospective cohort study describes and adapted Centering Pregnancy-based group prenatal care model used for Hispanic women diagnosed with gestational diabetes. It demonstrates that women in the group care had higher rates of breastfeeding and higher rates of postpartum diabetes screening compared to women with gestational diabetes who remained in traditional high-risk care. This suggests that for Hispanic women with gestational diabetes, group-based prenatal care is an option.

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Introduction

The increased prevalence of maternal obesity and diabetes mellitus is a major concern for providers of prenatal and obstetrical care. Likewise, the shift toward higher pre-

pregnancy weight and type II diabetes in pregnant women is reaching epidemic proportions (Barbour 2014; Wahabi et al. 2014). The reported prevalence of pregnancies complicated by gestational diabetes mellitus (GDM) in the United States ranges from 1–14 %, with 2–5 % being the most commonly cited numbers (ACOG Practice Bulletin 2001). Complications of obesity and diabetes during pregnancy include shoulder dystocia, birth trauma, neonatal hypoglycemia, and increased maternal and neonatal morbidity. Furthermore, offspring of mother's with GDM are at a higher risk of hypertensive disorders, obesity, glucose intolerance and childhood obesity (Metzger 2007). Women diagnosed with GDM have a 50 % lifetime risk of developing Type II diabetes, often within 4–5 years of their initial diagnosis of GDM (ACOG Practice Bulletin 2001).

At our Midwestern county hospital, 16 % of obstetrical patients have a diagnosis of either preexisting or pregnancy-related diabetes and 34 % are obese. These obstetrical patients from the inner city have limited access to medical care except when they are pregnant or within the 6-week postpartum window. Few are able to attend preconceptional counseling. Thus, the intensive attention to their medical problems given during standard prenatal care does not continue beyond pregnancy and the benefits of frequent surveillance and intervention soon dissipate.

Currently, we conduct both traditional prenatal care and Centering Pregnancy[®] group prenatal care for a self-selected segment of the low-risk population in satellite and main clinics. We also developed a modified Centering Pregnancy[®] model for Spanish-speaking women diagnosed with GDM.

The objective of this study was to determine the impact of an adapted program of Centering Pregnancy[®]-based group prenatal care for pregnant Hispanic women with diabetes on pregnancy outcomes and postpartum follow-up care compared to those receiving traditional prenatal GDM care.

Materials and Methods

This report aims to both describe the adapted Centering Pregnancy Program for Hispanic women with GDM and to compare the outcomes for this high-risk population to the standard of care for women with GDM in our system.

Participants

We care for approximately 2800 pregnant women a year and 16 % either have diabetes (type 2 diabetes mellitus or

GDM) or have a history of GDM in a prior pregnancy. Prior to the initiation of this study once a parturient was found to have preexisting type II or gestational diabetes mellitus, they were removed from their current healthcare provider or Centering Pregnancy[®] group and received subsequent care in a high-risk clinic. Although this approach facilitates access to specialized medical expertise and at least seemingly makes more efficient use of nutritionists and diabetic educators, continuity of care and the support from their prior Centering Pregnancy[®] care group was lost. Latinas represent more than one-third of our obstetric population and comprise over two-thirds of prenatal patients with diabetes and obesity in our population. The vast majority of these women do not have severe longstanding problems with diabetes that require individualized care of sub-specialists, but rather conditions that are amenable to assessment and management by caregivers aided by well-established algorithms and backed up by access as needed to specialty care. Therefore, in August of 2010 a group prenatal care program was initiated in the Obstetrics and Gynecology clinic based on the Centering Pregnancy[®] model and focusing on Hispanic women with GDM.

Screening for gestational diabetes was performed routinely for women at the end of their 2nd trimester or earlier if they had risk factors as recommended by The American Congress of Obstetricians and Gynecologists (ACOG) (ACOG Practice Bulletin 2001). Screening for GDM was performed clinically per the standard recommendations by ACOG. Prior to our study, once the diagnosis was made, the patient was referred to the high-risk obstetrics clinic to be evaluated by a Maternal-Fetal Medicine (MFM) specialist.

Beginning in August of 2010, Hispanic prenatal patients with GDM were offered traditional individual prenatal care or group prenatal care using the Centering Pregnancy[®] care model. In the group care model, the groups were conducted entirely in Spanish, thus were not offered to non-Hispanics at the time. After a brief description of each care model, the Hispanic women were able to self-select which model of care they desired for the remainder of their pregnancy. The Hispanic Centering[®] GDM Program was offered consistently in 3 different epochs during the study time, with some gaps between groups based on interest and funding for the program.

In the control group, women received focused high-risk antenatal care under the supervision of a high-risk specialist with one-on-one traditional care at the standard visit intervals per ACOG guidelines. Standard care included nutritional and exercise counseling. Women were included in the control group only if they were diagnosed with GDM while the Centering[®] Program was being offered.

Centering Pregnancy Group Prenatal Care Model Adaptation for this Program

We adapted the traditional Centering Pregnancy group antenatal care model into a 4-visit group session model, based on the goals and objectives of Centering in the 3rd trimester. This model of group prenatal care (hereafter referred to as the Program—Table 1) incorporated three major components of care: health assessment, education, and support. In this setting, patients learned care skills, participated in facilitated discussions, and developed a support network with other group members. Full details of the Centering Pregnancy model can be found on their website (centeringhealthcare.org). We developed the program in consultation with our providers already enrolling routine prenatal care women into Centering Pregnancy groups and with Centering Healthcare International (CHI); however, no financial support was received from CHI for the development or implementation of the Program. Participants electing the Program were assigned to a group of 8–10 women with the same estimated month of delivery. The group met every other week for four sessions in the early 3rd trimester. Starting at 36 weeks, each participant was seen individually at a weekly prenatal appointment

with the same provider and facilitator in the Program (Centering Healthcare Institute 2015). During weekly visits, they also were seen by the dietician who, in conjunction with the provider, managed their diabetes care during these visits. The foundation of the Centering Pregnancy[®] prenatal care model was utilized with the addition of a diabetic facilitated group discussion. ACOG standards for prenatal care were followed.

The group sessions lasted 2 h and were led by a health educator, diabetic educator and physician. Each session had a specific topic of focus: family planning, breast-feeding, what to expect during labor and delivery, and infant care (Centering Healthcare Institute 2015). Topics that focused on diabetes were included such as blood sugar monitoring, nutrition, and exercise. Facilitated group participation in discussions and physical assessment (e.g., blood pressure, weight measurement) were utilized per the Centering Pregnancy[®] essential elements. This education was intended to help empower women to make healthy lifestyle choices related not only to their pregnancy, but also beyond pregnancy and the postpartum period, when access to medical care may not be readily available. In addition, family members were encouraged to attend the Program with participants to aid

Table 1 Sessions and topics of the adapted Centering Pregnancy model for women with gestational diabetes

Session	Pregnancy topics	Materials	GDM topics	GDM materials	Notes
1	Introduction, discussion of group expectations Orientation to taking own weight, blood pressure Pregnancy concerns, discomforts, and strategies Family planning	Name tags, markers, “mom’s notebook”, Centering bags Family planning activity materials and handouts	Diabetes—explanation of risks and self-monitoring Food groups and portion control Food labels	Ping Pong balls Food models Food labels	
2	Breastfeeding Tips on getting started well and getting support	Breastfeeding handouts	Exercise	Pedometers (given to everyone)	Breastfeeding video
3	What to expect during labor and delivery Stress management	Make rice socks	Diabetes after pregnancy—what happens postpartum	Water bottles	Childbirth video
4	Infant care—car seats, safe sleep, feeding	Infant care handouts Safe sleep handouts Hope bracelets or yarn	Diabetes risk for offspring		Representative from Healthy Start Program Infant care and safe sleep video

Table represents the condensation of Centering Pregnancy topics into a smaller number of group sessions for the gestational diabetes (GDM) group sessions. The pregnancy topics and diabetes topics covered at the sessions are listed, along with special supplies and materials needed. Several of the sessions included informational videos to help stimulate learning and conversation. These four main education sessions occurred every 2 weeks in the early third trimester. They were followed by combined weekly visits with the same provider, dietician, and facilitator as well until the time of delivery

in empowering the family to make healthy lasting changes.

Study Design and Analysis

A retrospective cohort study was performed to compare women receiving traditional GDM prenatal care to those receiving Hispanic GDM Centering Pregnancy[®] group prenatal care Program. The university governing Institutional Review Board approved the study. Women were included in the study if they were age 18 years or older, diagnosed with GDM and received traditional high-risk clinic or Program group prenatal care at Wishard/Eskenazi Health clinics from August 2010 through February 2015. Women were excluded for multiple gestation, primary language other than English or Spanish, or major fetal anomalies. The primary outcome measured was completion of postpartum glucose tolerance testing. Secondary outcomes related to diabetes in pregnancy and traditionally collected birth and postpartum health included need for medical drug therapy, antenatal testing, induction of labor (for any indication), postpartum visit attendance, birth weight, APGAR scores, rate of Cesarean delivery, initiation of breastfeeding before hospital discharge, breastfeeding at the postpartum visit, and family planning method utilized. Data were abstracted from electronic medical records and analyzed using SPSS v23 (IBM, Armonk, NY). As a Program evaluation, an a priori sample size calculation was not performed. Dichotomous variables were compared using Chi-square testing and continuous variables were compared using student *t* test where appropriate.

Results

A total of 460 women met the study criteria. Of these, 203 women received Centering Pregnancy[®] group prenatal care and 257 received traditional prenatal care. The overall mean age of the population was 30.9 ± 5.6 years old with a mean gestational age at diagnosis of 26.7 ± 5.6 weeks. 320 women (70.0 %) were Hispanic and 33 (7.2 %) had a diagnosis of chronic hypertension. Ninety-seven women (21.1 %) had a diagnosis of GDM in a prior pregnancy. Table 2 contains a demographic comparison of the two study groups. There were no significant differences between groups for maternal age, parity, prior history of GDM or prior cesarean delivery. There was a significant difference in race with 100 % of women receiving group prenatal care being Hispanic compared to only 46.9 % of the traditional GDM care group being Hispanic ($p < 0.001$). This was expected as the Program was only offered to women with Spanish as their preferred language.

In addition, women in the traditional GDM care were diagnosed with GDM at a slightly later gestational age and a higher proportion of them also had chronic hypertension or a substance abuse history. In many of these cases, the women were diagnosed with GDM after already having established a relationship with the high-risk clinic providers and were less likely to transfer to the Centering GDM group. In addition, women with these histories tended to not be Hispanic and thus would not have been offered the Program. When only Hispanic women in the control group were compared to the Centering GDM Program participants, there were no differences in these demographic variables with the exception of the gestational age at diagnosis (Table 2).

Women receiving Centering Pregnancy[®]-based group prenatal care were found to be more likely to complete postpartum glucose tolerance testing (83.6 %) than those receiving traditional prenatal care (60.7 %) ($p < 0.001$, Table 3). Interestingly, there was only a small difference in the postpartum visit attendance between the two groups (94.9 vs. 87.3 %, $p = 0.008$). Therefore, it appears that women presented for their postpartum visit, but the postpartum GTT was not completed for many women receiving traditional care.

During pregnancy, fewer women in the Centering GDM Program required drug therapy than those in the traditional care program ($p = 0.009$). Women receiving care in the Program were more compliant with antenatal appointments (appointment no-show rate of 6.7 vs. 13.9 % for traditional care, $p = 0.01$). Delivery outcomes were similar between the two groups with no differences in gestational age at delivery, preterm birth, cesarean delivery or most neonatal outcomes (Table 3). Women in the Centering GDM group Program needed labor induction less frequently than traditional care (34.5 vs. 45.3 %, $p = 0.02$), likely a result of some baseline group differences. While overall rates of NICU admissions were the same, the number of admissions for neonatal hypoglycemia was higher in the Centering group. When only Hispanic women with GDM were compared, no difference in the rate of neonatal hypoglycemia was seen.

Women in the Hispanic Centering GDM Program were more likely to choose a more reliable form of contraception postpartum. They chose either sterilization or a LARC method significantly more often than women in the traditional care group (57.1 vs. 43.1 %, $p = 0.003$), with most of the difference in the LARC category. Women receiving Centering GDM Program prenatal care had a higher rate of breastfeeding at hospital discharge than those receiving traditional prenatal care (91.0 vs. 69.4 %, $p < 0.001$). Women in the Program also had higher rates of strictly breastfeeding their baby at the postpartum visit (63.1 vs. 46.3 %, $p < 0.001$).

Table 2 Characteristics of the study population

Characteristic	Hispanic GDM Centering Pregnancy Program (n = 203)	Traditional GDM high-risk care (n = 257)	<i>p</i> value (Centering group vs. all traditional care)	Traditional GDM high-risk care, Hispanics only (n = 120)	<i>p</i> value (comparisons of Hispanic groups)
Maternal age (years)	31.2 (5.1)	30.7 (6.0)	0.32	30.7 (5.2)	0.48
Maternal race Hispanic (% yes)	203 (100 %)	120 (46.9 %)	<0.001	120 (100 %)	0.99
Parity	1.9 (1.2)	1.7 (1.5)	0.20	1.9 (1.3)	0.94
Gestational age at diagnosis (weeks)	25.9 (5.8)	27.4 (5.5)	0.005	27.6 (5.1)	0.008
1 h glucose challenge test results	179.7 (29.8)	179.3 (40.0)	0.90	177.5 (33.6)	0.58
Hemoglobin A1c at diagnosis	5.73 (0.39)	5.89 (0.92)	0.03	5.84 (0.80)	0.23
History of GDM	45 (22.2 %)	52 (20.2 %)	0.61	28 (23.3 %)	0.78
Chronic hypertension present	3 (1.5 %)	30 (11.7 %)	<0.001	5 (4.2 %)	0.14
Substance abuse history	1 (0.5 %)	25 (9.7 %)	<0.001	2 (1.7 %)	0.29
Prior cesarean delivery	33 (27.0 %)	43 (30.1 %)	0.59	15 (26.3 %)	0.96

Data presented as mean (\pm standard deviation) or as n (%) for categorical variables

GDM gestational diabetes mellitus

To account for racial differences in the control group, we performed an analysis limiting the control group to only Hispanic women (Tables 2, 3). Comparing only Hispanic women in the two groups, the only baseline difference that remained was the gestational age at diagnosis, which was similar in the Hispanic control women as in the overall control group. The primary outcome of completing Type II diabetes screening with a postpartum glucose tolerance test was still higher in the Hispanic Centering Program participants compared to Hispanic women in traditional GDM care (83.6 vs. 72.5 %, $p = 0.01$). This was still significant even after adjusting for the EGA at diagnosis of GDM (adjusted OR 2.47, 95 % CI 1.36–4.49, $p = 0.003$). Rates of preterm birth in the Hispanic control women were the same as the overall control group also (11.0 %). Rates of breastfeeding at discharge (91.0 vs. 82.9 %, $p = 0.03$), any breastfeeding of their infant at the postpartum visit (4–6 weeks postpartum; 83.2 vs. 73.5 %, $p = 0.04$), and strictly breastfeeding at the postpartum visit (63.1 vs. 48.0 %, $p = 0.04$) were higher for Hispanic women going through the Centering Program than those utilizing traditional high-risk GDM care. Of note, during the study

period the majority of Hispanic women diagnosed with GDM chose the group care model (62.5 %).

Comments

Our study demonstrates that for pregnant Hispanic women with GDM, group prenatal care is a viable model. Improving the rates of screening for Type II diabetes for this particularly high risk group of women is important from a public health standpoint. Development of Type II diabetes for Hispanic women with GDM occurs faster and at a higher rate than other groups (Kim et al. 2002), thus catching it in the early postpartum period can allow time for healthy lifestyle changes and interventions well before a subsequent pregnancy. Controlling Type II diabetes and blood sugars before a subsequent pregnancy is important to reduce congenital anomalies and other pregnancy complications (ACOG Practice Bulletin 2001). Therefore, the improved rates of screening can improve interconception care for these high-risk women. In addition, because uncontrolled diabetes increases the risk of health problems

Table 3 Outcomes for the study population

Outcome	Hispanic GDM Centering Pregnancy Program care (n = 203)	Traditional GDM high-risk care (n = 257)	<i>p</i> value	Traditional GDM high-risk care, Hispanics only (n = 120)	<i>p</i> value (comparisons of Hispanic groups)
Needed drug therapy for GDM	60 (30.2 %)	104 (42.1 %)	0.009	43 (37.1 %)	0.20
Development of hypertensive disorder of pregnancy	19 (9.5 %)	21 (8.3 %)	0.67	8 (6.8 %)	0.39
Received antenatal fetal testing	84 (41.6 %)	94 (36.6 %)	0.27	44 (36.7 %)	0.37
Weight gain in pregnancy (kg)	9.3 (4.5)	10.2 (6.7)	0.21	10.3 (5.7)	0.26
Gestational age at delivery (weeks)	38.6 (2.2)	38.5 (1.9)	0.55	38.6 (1.4)	0.91
Preterm delivery <37 weeks	17 (8.4 %)	28 (11.0 %)	0.35	13 (11.0 %)	0.47
Induction of labor	69 (34.5 %)	115 (45.3 %)	0.02	47 (39.8 %)	0.39
Cesarean section for delivery	69 (34.0 %)	101 (39.8 %)	0.38	41 (34.7 %)	0.20
Postpartum hemorrhage	4 (2.0 %)	12 (4.7 %)	0.11	7 (5.9 %)	0.07
Chorioamnionitis diagnosed	8 (4.0 %)	16 (6.3 %)	0.27	7 (5.9 %)	0.44
3rd or 4th degree laceration at delivery	2 (1.0 %)	7 (2.8 %)	0.18	1 (0.8 %)	0.88
Cesarean wound infection	3 (1.5 %)	7 (2.8 %)	0.35	3 (2.5 %)	0.52
Sex of baby = male	107 (53.0 %)	144 (56.9 %)	0.45	66 (55.9 %)	0.37
Birth weight (g)	3472 (614)	3396 (724)	0.24	3434 (729)	0.63
Macrosomia (>4000 g)	33 (16.8 %)	43 (17.6 %)	0.81	23 (21.1 %)	0.38
5 min APGAR score <7	3 (1.5 %)	7 (2.9 %)	0.33	3 (2.7 %)	0.48
Shoulder dystocia	1 (0.5 %)	5 (2.0 %)	0.17	2 (1.7 %)	0.29
NICU admission	23 (11.3 %)	43 (16.8 %)	0.10	19 (16.0 %)	0.20
Neonatal hypoglycemia	12 (6.0 %)	5 (2.0 %)	0.03	2 (1.7 %)	0.07
Postpartum contraception initiation	185 (91.1 %)	218 (86.2 %)	0.10	108 (91.5 %)	0.99
Chose sterilization or LARC method for contraception	116 (57.1 %)	109 (43.1 %)	0.003	58 (49.2 %)	0.13
Breastfeeding at discharge	183 (91.0 %)	175 (69.4 %)	<0.001	97 (82.9 %)	0.03
Postpartum visit attendance	187 (94.9 %)	220 (87.3 %)	0.006	106 (91.4 %)	0.22
Any breastfeeding at postpartum visit	149 (83.2 %)	142 (61.5 %)	<0.001	75 (73.5 %)	0.04
Strictly breastfeeding at postpartum visit	113 (63.1 %)	107 (46.3 %)	<0.001	49 (48.0 %)	0.04
Completion of postpartum diabetes screening	168 (83.6 %)	156 (60.7 %)	<0.001	87 (72.5 %)	0.01

Data presented as mean ± standard deviation or as n (%) for categorical variables

GDM gestational diabetes mellitus, *LARC* long-acting reversible contraception, defined as an intrauterine device or implantable contraceptive; *NICU* neonatal intensive care unit

and death, early diagnosis and intervention are crucial (Zoungas et al. 2014; Monesi et al. 2014).

Group prenatal care such as the Centering Pregnancy[®] Care model is a growing trend that has been shown to provide clinical and psychosocial advantages when compared to traditional individual care (Ickovics et al. 2003). Additional research has demonstrated that Centering Pregnancy antenatal care has reduced rates of preterm birth and improved breastfeeding rates (Ickovics et al. 2007). Studies have shown that group prenatal care has led to improved perinatal outcomes as well as improved maternal education and readiness for labor, delivery and parenthood for several groups of pregnant women (Ickovics et al. 2003, 2007; Kennedy et al. 2009; Robertson et al. 2009). Additionally, when compared to standard prenatal care, group prenatal care was shown to reduce the risk of preterm birth by 33 % in a study of over 1000 low-risk women (Kershaw et al. 2009). Centering Pregnancy group prenatal care has been successfully implemented in different populations including Hispanics, adolescents, and military women (Ickovics et al. 2003, 2007; Kennedy et al. 2009; Robertson et al. 2009; Summers 2014; Tandon et al. 2012; Trudnak et al. 2013). Our current findings are particularly important because they suggest that interventions for a specific high-risk medical complication of pregnancy such as GDM can be incorporated into a group prenatal care program.

We performed a systematic review to find any studies specifically applying the Centering Pregnancy[®] group prenatal care model to women with gestational diabetes. Utilizing terms “diabetes”, “group prenatal care”, or “Centering” yielded no relevant studies comparing traditional care to group prenatal care specifically for women with gestational diabetes. Centering Pregnancy has been utilized successfully in Hispanic women (Robertson et al. 2009; Summers 2014; Tandon et al. 2012; Trudnak et al. 2013), but not specifically for Hispanic women with GDM. Our study demonstrates that women with GDM receiving an adapted Centering Pregnancy[®]-based group prenatal care were more likely to complete postpartum glucose tolerance testing (GTT) than those receiving traditional individual prenatal care. This is important because persistent glucose intolerance can only be diagnosed and treated if it is recognized. Unfortunately, not all women who presented for a postpartum visit in the traditional care model received a postpartum GTT. In many settings, including our traditional model, women often do not present for their postpartum visit in a fasting state (despite being instructed to do so) and thus are not able to perform the 2-h GTT testing at the postpartum visit, but rather have to return for a second visit. Due to logistical issues with a new baby, many women do not return to get the GTT testing. While we are unaware of studies to this effect, we

are skeptical that such women get routine glucose screening subsequently either, thus subsequent pregnancies are at risk for complications of untreated diabetes. Women in the Program were scheduled for their postpartum visit in the early morning and instructed to come in a fasting state to try and accomplish the GTT at that visit. The provider continuity in the postpartum setting may have also played a role in the adherence to postpartum screening recommendations coupled with the diabetes-focused facilitated discussions that reinforced the lifetime risk of developing diabetes and the importance of the postpartum glucose tolerance testing.

Additionally, women that received prenatal care using the Program were less likely to require medical drug therapy for glycemic control or undergo induction of labor. A standard algorithm for when to begin drug therapy in women with GDM was followed in both the traditional care plan and the Program. All women with GDM were encouraged to walk 30 min per day five days a week to help them achieve long term glycemic control. However, we did not collect objective exercise data. Women who avoided medical drug therapy for glycemic control had lower rates of labor induction ($p < 0.001$, data not shown). This is likely due to the tendency to induce labor earlier for women with GDM who require drug therapy. None of the participants developed pregnancy complications that required transfer to the traditional high-risk tertiary clinic for management of their GDM. Additionally, we lost no women in the Program to traditional prenatal care or from attrition. We also noted improved attendance rates to antenatal group appointments compared to traditional GDM care. Anecdotally, the providers and clinic staff noted efficiencies and standardization of services during the Centering Pregnancy[®] care that were not always seen in the traditional model of care. These will be the subject of a future study.

These data show no significant difference in birth outcomes for Hispanic women with GDM including gestational age at delivery, birth weight, macrosomia, Cesarean delivery, or NICU admission. Thus, removing women with GDM from the traditional high-risk clinic care and placing them in group-based Program care did not result in adverse outcomes. The increased rate of neonatal hypoglycemia noted in the Program participants was unexpected and was not seen when comparing Hispanic women alone in the two groups.

Women enrolled in Centering Pregnancy[®]-based care Program were more likely to breastfeed, confirming prior studies showing improved initiation of breastfeeding for women in Centering Pregnancy (Ickovics et al. 2007). This was seen not only at hospital discharge but also with improved rates of strictly breastfeeding at the postpartum visit, even with limiting the analysis to only Hispanic

women. Given the maternal and infant benefits of breastfeeding, this is an important outcome (ACOG Committee Opinion No. 361 2007). Additionally, women in the Program were more likely to choose a more reliable method of contraception. These benefits are likely directly related to the increased education time spent on those topics in the adapted Program.

Potential limitations to this study include the heterogeneous control population. Women were able to choose the Program and those who chose group care may have been more motivated to implement changes in their health behaviors. We did not capture how many women were already participating in a traditional Centering group before being diagnosed with GDM. This may not have been significant as the randomized trial completed by Ickovics found that benefits persisted for group care when randomizing women into the model (Ickovics et al. 2007). In a future study, we plan to randomize GDM women to group versus traditional care and to stratify the randomization into different language groups to truly assess the impact of ethnicity on outcomes from group prenatal GDM care. There were fewer Hispanic women in the control group because the majority of eligible women chose to participate in the Program. However, when the analysis was limited to Hispanic women only, women participating in the Program remained more likely to receive postpartum diabetes screening and breastfeed. Another limitation is that the Program was designed specifically for our inner-city Hispanic population, potentially decreasing the generalizability of these results. Additionally, the entire group care session was given in Spanish to simplify care and reach our most prevalent population of GDM women, thus all participants were Spanish-speaking, which may further limit generalizability. We did not measure acculturation as a potential influence on outcomes. A cost analysis was not performed. Future studies will perform a cost-benefit analysis of the Program.

In summary, our adapted Centering Pregnancy[®] group prenatal care Program demonstrated improved outcomes for pregnant Hispanic women with GDM. These benefits may lead to important public health gains by facilitating earlier diagnosis and intervention for Type II diabetes. Additionally, women in the Program showed improved rates of breastfeeding, effective contraception use, and better glycemic control during pregnancy, all important indicators of effective education and implementation. Overall, the benefits above, combined with the lack of adverse pregnancy outcomes in the group setting, make an adapted Centering Pregnancy[®] group prenatal care an option for pregnant Hispanic women with GDM. Expanding the Centering Pregnancy[®] model to women with other select high-risk conditions in a study setting may reveal

even more benefits of group prenatal care for women and their developing babies.

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Compliance with Ethical Standards

Conflict of interest The authors report “no conflicts of interest.”

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