Published in final edited form as:

Contraception. 2009 April ; 79(4): 290–296. doi:10.1016/j.contraception.2008.10.013.

How does gestational diabetes affect postpartum contraception in nondiabetic primiparous women?

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Abstract

Background: The aim of the study is to explore the effect of gestational diabetes mellitus (GDM) on postpartum contraception among nondiabetic primiparous women.

Study Design: Secondary analyses of 2004–2005 Pregnancy Risk Assessment Monitoring System data from Michigan and Oregon.

Methods: Analyses were performed on 2332 women, taking complex survey design into consideration. Crude and adjusted odds ratios (cOR; aOR) and their 95% confidence intervals (CI) were obtained using logistic regression analyses.

Results: Postpartum use of hormonal (aOR=1.12, 95% CI: 0.68–1.83) and nonhormonal (aOR=1.18, 95% CI: 0.73–1.92) contraception were not influenced by GDM after controlling for confounders. Female sterilization was more frequently adopted (cOR=4.99, 95% CI: 1.13–22.17) and depomedroxyprogesterone acetate (DMPA) (cOR=0.53, 95% CI: 0.23–1.18), diaphragm/cervical cap/sponge (cOR=0.13, 95% CI: 0.016–0.95) and cervical ring (cOR=0.13, 95% CI: 0.017–0.98) were less frequently adopted by women reporting GDM diagnosis.

Conclusion: With few exceptions, GDM does not appear to affect postpartum hormonal and nonhormonal contraception.

Keywords

Gestational diabetes; Contraception; Parity; Epidemiology; United States

1. Introduction

A wide range of hormonal and nonhormonal methods of contraception are available to women of reproductive age in the United States [1]. Numerous studies have, so far, examined the safety and effectiveness of contraception in healthy women [2]. Yet, studies that focus on health effects of contraception in women with co-existing medical problems, such as cardiovascular disease, obesity, hypertension, lipid disorders and diabetes mellitus (DM) are relatively scarce [3]. Hormonal contraception does not appear to precipitate the development of Type 2 diabetes in healthy women. In fact, two large cohort studies have consistently found no association

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between use of hormonal contraception and onset of Type 2 diabetes [4,5]. Furthermore, evidence linking hormonal contraception to metabolic changes in women who are already diagnosed with DM is at best inconclusive [6-8]. A limited number of studies of DM patients have implicated combined oral contraceptives (COCs) in vascular complications and other disorders of carbohydrate metabolism [9]. The effect of hormonal contraception on the risk of DM in nondiabetic women with a recent history of gestational diabetes mellitus (GDM) remains uncertain. GDM usually develops in mid pregnancy and typically affects 3–10% of all pregnant women [10]. Women who recently developed GDM may be at an increased risk for metabolic disorders that could lead to Type 2 diabetes onset [11]. In one cohort study [12], 30% of GDM women followed-up for an average of 6 years after the index pregnancy eventually developed Type 2 diabetes. Numerous studies of nondiabetic women with a history of GDM have evaluated the effects of specific hormonal contraceptives, including COCs, on metabolic changes associated with Type 2 diabetes [12-14]. However, most of these studies were observational in nature and many were limited in sample size. In addition, some of these studies were conducted in high-risk groups of Latina and Navajo women, making it difficult to extrapolate their findings to the general population of women in the United States. Current evidence suggests that low-dose COCs and nonhormonal contraceptives are safe in nondiabetic women with a history of GDM. However, effectiveness at preventing unwanted pregnancies is an important factor to be considered when choosing the most appropriate contraceptive method, especially after an episode of GDM. Women diagnosed with GDM are often managed by diet and other lifestyle changes. They may experience little psychological distress during the index pregnancy. However, the potentially increased risk of Type 2 diabetes with repeat pregnancies could influence a woman's postpartum use of various hormonal and nonhormonal methods of contraception. In women with prior GDM, repeat pregnancy poses a greater risk of subsequent Type 2 diabetes than low-dose COCs [15]. For these women, postpartum counseling often includes not only breastfeeding, diet, weight management and exercise but also planning of future pregnancies and method of contraception [13,16]. In the absence of clear recommendations for the subpopulation of nondiabetic women with a history of GDM, healthcare practitioners are often faced with the dilemma of choosing a safe and effective method of contraception that has little deleterious effects on weight, blood pressure, glucose and lipid metabolism and can reduce the likelihood of unwanted pregnancies [17].

The purpose of the current study is to explore the effect of diagnosis with GDM on postpartum hormonal and nonhormonal contraceptive behaviors among nondiabetic primiparous women. We hypothesize that, in this target population, women who are diagnosed with GDM may report postpartum methods of contraception that are different from non-GDM women.

2. Materials and methods

2.1. Data source

Secondary analyses of data from the Centers for Disease Control and Prevention (CDC) Pregnancy Risk Assessment Monitoring System (PRAMS) was conducted [18]. The CDC PRAMS is a surveillance project in the United States that collects state-specific, population-based data on maternal attitudes and experiences before, during and shortly after pregnancy. Every month, each PRAMS state selects a stratified sample of 100–300 new mothers from eligible birth certificates. Thus, a PRAMS state may sample between 1200 and 3600 women per year. Participating PRAMS states have adopted standardized data collection procedures. Each selected mother receives a letter introducing the survey, followed by a 14-page questionnaire, 2–6 months postpartum. Those who do not respond receive a second mailed questionnaire and, in most states, a third. If there is no response to repeated mailings, women are contacted by telephone, and those who agree to participate are interviewed. PRAMS use a complex survey design, whereby women at high risk for poor pregnancy outcomes are

oversampled. Information from the birth certificate file is used to statistically weight the collected data for sample stratification, noncoverage and nonresponse [18,19]. In the current study, PRAMS 2004–2005 data from two states (Michigan and Oregon) were analyzed. We selected these two states because they were the only PRAMS states to have consistently phrased questions on key variables of interest. The response rates for the states of Michigan and Oregon were 72.5% and 75.6%, respectively. Demographic data from state birth certificate files were linked to the PRAMS questionnaire of survey participants, and all other variables were obtained from the PRAMS questionnaire. SAS Survey software (SAS Institute, Cary, NC, USA) was used to account for complex survey design. The research protocol was approved by the Institutional Review Board of Eastern Virginia Medical School.

2.2. Study population

The sample was restricted to primiparous women who had no history of DM. Primiparous women were identified as those who replied “no” to the following question: “Before you got pregnant with your new baby, did you ever have any other babies who were born alive?” Past history of DM was based on the following question: “Did you have any of these problems during your most recent pregnancy?” Women who replied “yes” to “High blood sugar (diabetes) that started *before* this pregnancy” were excluded. Accordingly, a total of 2710 nondiabetic primiparous women (Michigan: 1073 and Oregon: 1637) were eligible for inclusion in the analysis. After excluding survey participants with missing data on key variables of interest, a complete case analysis was conducted on 2332 (86.1%) women [Michigan: 939 (87.5%) and Oregon: 1393 (85.1%)].

2.3. Variable definitions

GDM status was defined based on a single question: “Did you have any of these problems during your most recent pregnancy?” Those who answered “yes” to “high blood sugar (diabetes) that started *during* this pregnancy” were classified as “GDM,” and “non-GDM,” otherwise. Out of 2332 women included in the current analyses, a total of 170 women were in the GDM group, and the remaining 2162 were in the non-GDM group. In a subsample of 2320 women, moderate agreement ($\kappa=0.57$) was observed between self-reported GDM status and data from the birth certificate files.

Postpartum contraception was assessed with two inter-related questions. The first “yes” or “no” question was formulated as follows: “Are you or your husband doing anything *now* to keep from getting pregnant?” Women who responded “yes” were asked a follow-up question: “What kind of birth control are you or your husband or partner using *now* to keep from getting pregnant?” Possible responses include a list of *hormonal* [pill, shot every 1 month (Lunelle); shot every 3 months (Depo-Provera); contraceptive patch (OrthoEvra)] and *nonhormonal* [female sterilization; male sterilization; condoms; diaphragm/cervical cap/sponge; cervical ring (5 cm in diameter ring placed in vagina slowly releases estrogen and progesterone); copper intrauterine device (IUD); levonorgestrel-releasing intrauterine system [8]; rhythm method; withdrawal; abstinence; others] methods of contraception. Hormonal and nonhormonal methods of postpartum contraception were defined as “yes” or “no” variables.

Other variables were used to describe the study population and were tested as potential confounders for the associations of GDM with postpartum contraception. Sociodemographic variables include *age at delivery* (“<20”; “20–24”; “25–29”; “30–34”; “35+ years”), *race and ethnicity* (“White, non-Hispanic”; “White, Hispanic”; “Black”; “Asian”; “Others”), *marital status* (“Unmarried”; “Married”), *education* (“Not high school graduate”; “High school graduate”), *household income* (“<\$10,000”; “\$10,000–\$14,999”; “\$15,000–\$19,000”; “\$20,000–\$24,999”; “\$25,000–\$34,999”; “\$35,000–\$49,000”; “\$50,000+”) and *state* (“Michigan”; “Oregon”). Prepregnancy body mass index (BMI) was calculated by dividing

weight (in kilograms) by height (in meters) squared and was further categorized as follows: “underweight” (“ $<19.8 \text{ kg/m}^2$ ”); “normal weight” (“ $19.8\text{--}26.0 \text{ kg/m}^2$ ”); “overweight” (“ $26.1\text{--}29.0 \text{ kg/m}^2$ ”); and “obese” (“ $29.1+ \text{ kg/m}^2$ ”). Smoking status at the time of the survey was defined as “never smoker”, “ex-smoker” and “current smoker.” Prepregnancy contraceptive use was defined as a “yes” or “no” variable based on the following question: “When you got pregnant with your new baby, were you or your husband or partner doing anything to keep from getting pregnant?” Finally, the number of days elapsed between date of delivery and date of survey administration was defined as a continuous variable.

2.4. Statistical analysis

Univariate, bivariate and multivariate analyses were conducted using SURVEYFREQ, SURVEYMEANS and SURVEYLOGISTIC procedures in the Statistical Analysis System *version 9.2* (SAS Institute). Two-sided statistical tests were conducted at an α -level of .05, and weighted measures of frequency (percentages) and association (odds ratios) were reported. Bivariate associations were evaluated using the Rao-Scott chi-square test [20]. In addition, crude and adjusted odds ratios (cOR; aOR) and their 95% confidence intervals (CI) were computed using logistic regression analyses. Since participating women were interviewed 2–6 months after delivery, the number of days elapsed between delivery and survey administration was included as a covariate in all multivariate models. A potential confounder was defined as an extraneous variable associated with both GDM and contraceptive behaviors without being on the causal pathway between GDM and contraceptive behaviors. Stratified analyses and interaction terms within logistic regression models were used to establish confounding and identify whether a confounding variable was also an effect modifier. Finally, the associations of GDM status with postpartum hormonal and nonhormonal contraceptive behaviors were examined after controlling for confounders.

3. Results

The overall prevalence rate of GDM was 6.1% (4.8–7.5%). Table 1 presents the distribution of GDM and nonGDM women by age, race and ethnicity, marital status, education, household income, state, prepregnancy BMI and smoking status. Women who reported a GDM diagnosis were significantly older than non-GDM women. In particular, GDM women were more likely to be in the following age groups: 30–34 years (cOR=2.36, 95% CI: 1.00–5.53) and 35+ years (cOR=4.55, 95% CI: 1.83–11.33). A statistically nonsignificant trend was observed whereby GDM women were more likely to have completed high school education (cOR=1.21, 95% CI: 0.61–2.39). In addition, GDM women were more frequently overweight (cOR=2.91, 95% CI: 1.53–5.55) or obese (cOR=4.31, 95% CI: 2.49–7.44).

The overall prevalence rate of any postpartum contraception was 82.4% (95% CI: 80.1–84.7%). In addition, 45.5% (95% CI: 42.6–48.5%) and 55.7% (52.9–58.6%) of women adopted hormonal and nonhormonal methods of postpartum contraception, respectively. Table 2 displays associations between GDM status and contraceptive behaviors, including specific methods of contraception adopted postpartum. GDM was not significantly associated with postpartum use of hormonal (cOR=0.83, 95% CI: 0.51–1.35) or nonhormonal (cOR=0.84, 95% CI: 0.52–1.35) contraception. With few exceptions, most postpartum methods of contraception were as frequently adopted by GDM women as they were by non-GDM women. Female sterilization was more frequently adopted (cOR=4.99, 95% CI: 1.13–22.17) and depomedroxyprogesterone acetate (DMPA) (cOR=0.53, 95% CI: 0.23–1.18), diaphragm/cervical cap/sponge (cOR=0.13, 95% CI: 0.016–0.95) and cervical ring (cOR=0.13, 95% CI: 0.017–0.98) were less frequently adopted by women reporting a GDM diagnosis.

Table 3 presents multivariate logistic regression analyses for the associations of GDM status with hormonal (Model I) and nonhormonal (Model II) contraception. Although significantly

related to GDM, BMI was not associated with either hormonal or nonhormonal method of contraception. By contrast, age at delivery and level of education were identified as potential confounders. We also adjusted for prepregnancy contraception and number of days elapsed between date of delivery and date of survey administration. Accordingly, analyses were based on a subsample of 2275 women with no missing data on all covariates included in the logistic models. Results indicated that postpartum hormonal (aOR=1.11, 95% CI: 0.68–1.83) and nonhormonal (aOR=1.18, 95% CI: 0.73–1.92) contraceptive use was not significantly affected by GDM status, after adjustment for confounding variables.

4. Discussion

Our study findings suggest that, with few exceptions, a GDM diagnosis does not influence postpartum contraceptive behaviors. Overall, hormonal and nonhormonal methods of contraception were not influenced by GDM diagnosis except for decreased use of DMPA and increased use of sterilization. In addition, the relationship of GDM with postpartum hormonal and nonhormonal contraceptive behaviors was confounded by age at delivery and education. In particular, GDM women were found to be older than non-GDM women, and older women were less likely to be postpartum users of hormonal and nonhormonal contraception. Furthermore, educated women were less likely to be diagnosed with GDM and to use various methods of contraception after the index pregnancy.

To our knowledge, this is the first study to explore differences in use of postpartum contraception among nondiabetic primiparous women by recent history of GDM. Nondiabetic primiparous women who are diagnosed for the first time with GDM are likely to seek postpartum care from a health professional and to receive advice with regard to contraception. Therefore, exploring contraceptive behaviors in these women may provide insight as to whether scientific evidence is being applied in clinical practice. Based on current evidence and consistent with our study findings, a diagnosis of GDM should not influence the decision of women and their health providers to use hormonal versus nonhormonal methods of contraception. By contrast, identifying an effective method of contraception after a pregnancy complicated with GDM is a key issue for avoiding unwanted pregnancies that could increase the future risk of Type 2 diabetes [15]. Although rarely used in the overall study population, female sterilization was more frequently reported in women diagnosed with GDM. By contrast, methods of contraception that are known to be less reliable than low-dose COCs, including the diaphragm, cervical cap, sponge and cervical ring, were less frequently reported among GDM versus non-GDM women.

Previously conducted studies have found that low-dose COCs and nonhormonal contraception are generally safe in the aftermath of GDM diagnosis and do not increase risk of developing DM [13,21–23]. A retrospective cohort study of 904 Latinas examined the effect of contraceptives on Type 2 diabetes risk in women with recent GDM [11]. At their initial postpartum visit, 443 women selected a nonhormonal contraception (NHC), 383 received low-dose COCs, and 78 breastfeeding women received a progestin-only oral contraceptive (OC). When breast-feeding ended, patients initially taking progestin-only OCs were switched to low-dose COCs. Patients were followed-up periodically with oral glucose tolerance tests for up to 7.5 years. The unadjusted average annual incidence rates of Type 2 diabetes were 8.7%, 10.4% and 26.5%, respectively, for patients using NHC, low-dose COCs and progestin-only OCs. Cumulative incidence rates were virtually identical for patients with uninterrupted use of low-dose COCs and NHC, but patients using progestin-only OC developed Type 2 diabetes more rapidly during the first 2 years of use. A recent prospective cohort study of 526 Hispanic women with a history of GDM compared the impact of two methods of contraception, namely, DMPA ($n=96$) and low-dose COCs ($n=430$), on the risk of DM [14]. Annual DM incidence rates were 19% in the DMPA group and 12% in the low-dose COCs group with an unadjusted hazard

ratio of 1.58 (95% CI: 1.00–2.50; $p=.05$) for DMPA group versus the low-dose COCs group. In another prospective cohort study, 972 nondiabetic, normotensive, Latino women with a history of GDM received NHC ($n=448$), low-dose COCs ($n=430$), or DMPA ($n=94$) [23]. They were subsequently followed-up and compared on multiple metabolic indicators including weight, fasting serum low-density lipoprotein (LDL) and high-density lipoprotein (HDL) cholesterol, triglycerides, systolic (SBP) and diastolic (DBP) blood pressures. The DMPA users gained significantly more weight compared with NHC and low-dose COC users. Patterns of change in LDL cholesterol, triglycerides, and DBP were not significantly different among groups. HDL cholesterol change differed only between low-dose COCs and NHC groups. SBP change differed only between COCs and DMPA users. Our study suggests that DMPA was less frequently adopted postpartum by nondiabetic women who experienced GDM in the index pregnancy. This finding is in line with current evidence that points to low-dose COCs as being a safer alternative method of hormonal contraception. It is also plausible that physicians are familiar with research work that has suggested increased health risks with use of DMPA after a pregnancy complicated by GDM. [23].

To our knowledge, this is the first study to examine differences in contraceptive behaviors by recent diagnosis with GDM, using a population-based sample of non-Hispanic nulliparous women. Our results should, nevertheless, be interpreted with caution. First, the cross-sectional study design may have limited our ability to infer causal relationships between GDM and postpartum contraceptive use. Second, the current analyses were based on CDC PRAMS data only from the states of Michigan and Oregon. Therefore, our results could not be readily generalized to the overall population of the United States. Since GDM is most prevalent among Latino women, our results may not generalize to states having a high proportion of Hispanics. Third, specific methods of postpartum contraception, such as COCs and progestin-only OCs, could not be discerned using CDC PRAMS data. Fourth, retrospective self-reporting of data may have resulted in nondifferential misclassification of key variables under study, including GDM. Finally, residual confounding may partly explain the observed associations between GDM status and various contraceptive behaviors. In addition to personal preferences and physician recommendation, breastfeeding behaviors may also influence postpartum choice of contraception. Although evidence remains equivocal, a limited number of studies have suggested that breast-feeding can improve glucose tolerance after a GDM-complicated pregnancy [24]. Thus, the practice of breast-feeding may have delayed the use or influenced the choice of contraceptives, especially among nondiabetic GDM women.

In conclusion, among nondiabetic primiparous women, those who are diagnosed with GDM report postpartum contraceptive behaviors that are mostly similar to those of their non-GDM counterparts except for increased sterilization and decreased DMPA use. In addition, the effect of GDM on postpartum contraceptive use appears to be confounded by age at delivery and level of education. Further in-depth analyses are needed for a better understanding of the observed relationships. In addition, more advanced study designs are required for establishing a temporal relationship between GDM diagnosis and various postpartum contraceptive behaviors.

Acknowledgments

We thank Denise D'Angelo, MPH, and the states of Michigan (Violanda Grigorescu, MD, MSPH) and Oregon (Ken Rosenberg, MD, MPH) for their guidance and provision of 2004–2005 PRAMS data. There was no funding provided for this study. This research was supported in part by the intramural research program of the NIH, National Institute on Aging.

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Table 1

Sociodemographic, lifestyle and health characteristics of nondiabetic primiparous women by gestational diabetes mellitus status—CDC PRAMS, 2004–2005 (N=2332)

Total	n ^a	All women (N=2332)	GDM (n=170)		Non-GDM (n=2162)		cOR (95% CI)
			% ^c		% ^c		
			% ^b				
	2332						-
		100	6.14		93.86		
Age (years)							
<20	382	16.93	3.44		96.56	1.00	
20–24	681	29.71	5.60		94.39	1.67(0.72–3.87)	
25–29	599	26.11	4.78		95.22	1.41(0.61–3.27)	
30–34	443	18.66	7.74		92.26	2.36(1.00–5.53)	
35+	227	8.59	13.94		86.06	4.55 (1.83–11.33)	
Race/Ethnicity							
White, non-Hispanic	1367	78.34	5.84		94.17	1.00	
White, Hispanic	216	6.72	4.50		95.49	0.76 (0.33–1.76)	
Black	294	9.94	7.69		92.30	1.34 (0.58–3.11)	
Asian	281	4.04	6.83		93.17	1.18 (0.60–2.32)	
Other	174	0.96	22.40		77.59	4.65 (1.20–18.0)	
Marital status							
Unmarried	928	41.05	5.21		94.79	1.00	
Married	1404	58.94	6.78		93.22	1.33 (0.82–2.15)	
Education							
Not HS graduate	314	13.16	5.23		94.77	1.00	
HS graduate	2018	86.84	6.27		93.73	1.21 (0.61–2.39)	
Household annual income							
<\$10,000	515	20.91	6.69		93.31	1.00	
\$10,000–\$14,999	223	8.69	6.23		93.77	0.93 (0.38–2.27)	
\$15,000–\$19,000	150	7.15	5.19		94.81	0.76 (0.19–2.94)	
\$20,000–\$24,999	171	6.57	5.06		94.94	0.74 (0.27–2.06)	
\$25,000–\$34,999	223	9.68	8.22		91.78	1.25 (0.55–2.85)	
\$35,000–\$49,000	255	10.53	3.96		96.04	0.58 (0.25–1.35)	
\$50,000+	794	36.48	6.25		93.75	0.93 (0.49–1.76)	

Total	n ^a	All women (N=2332)	GDM (n=170)	Non-GDM (n=2162)	eOR (95% CI)
	2332	% ^b	% ^c	% ^c	-
		100	6.14	93.86	
State					
Michigan	939	71.15	6.37	93.63	1.16 (0.73–1.84)
Oregon	1393	28.85	5.56	94.44	1.00
Prepregnancy body mass index (kg/m ²)					
Underweight (<19.8)	333	11.84	3.14	96.86	0.95 (0.37–2.41)
Normal (19.8–26.0)	1258	52.65	3.29	96.70	1.00
Overweight (26.1–29.0)	282	13.82	9.04	90.96	2.91 (1.53–5.55)
Obese (29.1+)	459	21.69	12.81	87.19	4.31 (2.49–7.44)
Smoking status					
Never smoker	1729	70.92	6.69	93.31	1.00
Ex-smoker	190	7.65	6.34	93.66	0.94 (0.37–2.43)
Current smoker	413	21.44	4.22	95.78	0.62 (0.33–1.13)

All measures of frequency and association are weighted to account for complex survey design. HS, high school.

^aUnweighted total.

^bColumn percent.

^cRow percent.

Postpartum contraceptive use among nondiabetic primiparous women by gestational diabetes mellitus status—CDC PRAMS, 2004–2005
(N=2332)

GDM status						
	All women (n=2332)	GDM (N=170)	Non-GDM (N=2162)	cOR (95% CI)	<i>P</i> ^a	
Hormonal contraception:	% ^b	% ^b	% ^b			
No	54.46	58.72	54.17	1.00		
Yes	45.54	41.28	45.83	0.83 (0.51–1.35)	.45	
Nonhormonal contraception:	% ^b	% ^b	% ^b			
No	44.25	48.3	43.99	1.00		
Yes	55.75	51.70	56.01	0.84 (0.52–1.35)	.47	
Specific hormonal contraceptives (yes/no):	% Yes	% Yes	% Yes			
Pill	33.19	30.78	33.35	0.99 (0.57–1.74)	.66	
Shot every 1 month (Lunelle)	0.86	1.88	0.79	2.60 (0.31–22.03)	.41	
Shot every 3 months (Depo-Provera)	7.53	3.96	7.77	0.53 (0.23–1.18)	.074	
Contraceptive patch (OrthoEvra)	4.16	4.66	4.13	1.23 (0.43–3.59)	.81	
Specific nonhormonal contraceptives (yes/no):	% Yes	% Yes	% Yes			
Female sterilization	0.80	2.98	0.66	4.99 (1.13–22.17)	.027	
Male sterilization	0.29	1.00	0.24	4.59 (0.54–39.37)	.15	
Condoms	35.44	30.63	35.75	0.88 (0.51–1.51)	.37	
Diaphragm/cervical cap/sponge	0.53	0.065	0.56	0.13 (0.016–0.95)	.012	
Cervical ring	0.56	0.071	0.59	0.13 (0.017–0.98)	.014	
IUD	3.33	2.60	3.37	0.83 (0.22–3.10)	.69	
Rhythm method	4.36	6.22	4.24	1.64 (0.63–4.22)	.39	
Withdrawal	17.02	13.09	17.28	0.78 (0.40–1.56)	.32	
Abstinence	8.48	11.99	8.25	1.67 (0.79–3.51)	.26	
Other	2.35	1.29	2.42	0.57 (0.11–2.95)	.44	

All measures of frequency and association are weighted to account for complex survey design.

^aP values were calculated using Rao–Scott chi-square test.

^bColumn percent.

Table 3

Multivariate logistic regression models for the association of GDM status with postpartum hormonal and nonhormonal contraception—CDC PRAMS, 2004-2005 ($N=2275$)

	Model I: hormonal contraception (yes vs. no)		Model II: nonhormonal contraception (yes vs. no)	
	β (S.E.)	aOR (95% CI)	β (S.E.)	aOR (95% CI)
GDM status:				
GDM	0.054 (0.13)	1.12 (0.68–1.83)	0.17 (0.25)	1.18 (0.73–1.92)
Non-GDM	—	1.00	—	1.00
Age (years):				
<20	—	1.00	—	1.00
20–24	0.43 (0.12)	0.51 (0.33–0.78)	–0.024 (0.11)	0.76 (0.49–1.16)
25–29	–0.045 (0.12)	0.32 (0.21–0.49)	–0.14 (0.12)	0.68 (0.43–1.06)
30–34	–0.37 (0.14)	0.23 (0.14–0.37)	0.012 (0.13)	0.78 (0.49–1.27)
35+	–1.10 (0.21)	0.11 (0.059–0.21)	–0.11 (0.17)	0.69 (0.39–1.22)
Education:				
None-HS graduate	—	1.00	—	1.00
HS graduate	0.11 (0.11)	1.25 (0.81–1.92)	0.16 (0.11)	1.37 (0.88–2.13)
Prepregnancy contraceptive use:				
Yes	0.16 (0.08)	1.36 (1.00–1.86)	0.16 (0.08)	1.37 (1.00–1.86)
No	—	1.00	—	1.00
No. of days elapsed between delivery and survey administration	–0.0024 (0.0017)	0.99 (0.99–1.00)	–0.0027 (0.0017)	0.99 (0.99–1.00)

All measures of association are weighted to account for complex survey design; β =effect estimate of logistic regression model.