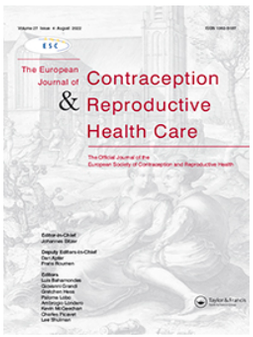

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RESEARCH ARTICLE

Contraception utilization in women with pregestational diabetes

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ABSTRACT

Objective: To compare contraception use between women with and without pregestational diabetes.

Methods: Cross-sectional data on women aged 18–44 years from 2011 to 2017 National Survey of Family Growth (NSFG) was analysed. Maternal diabetes was defined as the presence of pre-gestational type 1 or type 2 diabetes. Bivariate and multiple logistic regression analyses were run to evaluate the association between the use of contraception and by contraception type: permanent, long-acting reversible contraception (LARC), other hormonal method, other non-hormonal method, and none, and maternal diabetes status, controlling for relevant covariates.

Results: Among the total study sample of 28,454, 1344 (4.7%) had pregestational diabetes. Unadjusted analysis showed women with a history of pregestational diabetes were more likely to use permanent contraception following pregnancy (58.0% vs. 38.7%, $p < 0.001$) or no contraception (27.2% vs. 24.5%, $p < 0.001$), but less likely to use LARC (3.4% vs. 11.7%, $p < 0.001$), other hormonal contraception (4.1% vs. 8.9%, $p < 0.001$), or other non-hormonal contraception (7.2% vs. 16.4%, $p < 0.001$). In adjusted analyses, permanent (aOR 1.62, 95% CI 0.72–2.26) remained significant, however the differences were no longer statistically significant: LARC (aOR 0.34, 95% CI 0.12–1.00); other hormonal (aOR 0.61, 95% CI 0.27–1.35); other non-hormonal (aOR 0.59, 95% CI 0.25–1.43); and None (aOR 1.11, 95% CI 0.65–1.89).

Conclusion: In this analysis, we found that women with pregestational diabetes were more likely to use permanent contraception methods compared to women without pregestational diabetes; however over a quarter of women with pregestational diabetes did not use contraception between pregnancies.

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Contraceptive use; diabetes; pregnancy; gestational diabetes; women's health

Introduction

Women of reproductive age represent a growing population of concern due to increases in the prevalence of diabetes in pregnancy and the increasing prevalence of diabetes among women during reproductive years [1–4]. Pregestational diabetes increases risk of adverse maternal and foetal outcomes that include caesarean section and operative vaginal delivery, preeclampsia, preterm birth, congenital anomalies, macrosomia, large-for-gestational age, neonatal hypoglycaemia, and foetal death [5–8]. Additional long-term complications for the child include future risk of obesity, hypertension, and type 2 diabetes [1,9–11].

Effective contraception use and pregnancy planning until glycemic control is optimised is key in reducing the risk for most adverse outcomes with pregestational diabetes [11,12]. The American Diabetes Association (ADA) 2021 Standards of Care recommends that women of childbearing age with pregestational diabetes be counselled on contraception until optimal glycemic control is achieved at regular intervals [1]. Despite this increased risk of adverse pregnancy outcomes, few nationally representative studies have examined contraception use patterns in women with diabetes.

The objective of this study was to examine contraception use among women with pregestational diabetes during pregnancy compared to women without pregestational diabetes. We hypothesised that women with pregestational diabetes would have higher contraception use compared to women without diabetes.

Methods

Study design and population

This was a population-based, cross-sectional study conducted among women aged 18–44 years in the US participating in the NSFG survey between 2011 and 2017 as described elsewhere [13]. Women with only gestational diabetes were excluded from our analyses.

Data sources

We merged and analysed three cycles of datasets from the National Survey of Family Growth (NSFG) from 2011 to 2013, 2013 to 2015, and 2015 to 2017.

Dependent variable

Our dependent variable was contraception use measured as a composite categorical variable. Each contraceptive

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category, namely permanent, long-acting reversible contraception (LARC), other hormonal methods, other non-hormonal methods, and no contraception use, were treated as five separate outcome variables. These were categorical variables reported as yes/no. Questions about contraception use asked whether and what type of contraceptive method was used in the month before the interview. Permanent contraceptives were a composite categorical variable measured as self-reports of using sterilisation/bilateral tubal ligation and/or vasectomy. LARC was also a composite categorical variable measured as use of intra-uterine devices (IUDs and/or implants). Other hormonal contraceptive was a composite categorical variable measured as use of any shots, pills, patch, and/or vaginal ring. Other non-hormonal contraception was a composite categorical variable measured as use of any female or male condoms, vaginal pouch, diaphragm, withdrawal, natural family planning including calendar rhythm method, and/or spermicide in the month before the interview. No contraception use was a categorical variable measured as not using any contraceptive method.

Key independent variable

The primary independent variable was maternal diabetes mellitus which was a categorical variable defined as women who self-reported having a diagnoses of pregestational diabetes. We excluded women who were classified as having borderline diabetes, pre-diabetes, or gestational diabetes.

Covariates

Maternal age, body mass index (BMI), and parity were continuous variables. Race and ethnicity were categorised as Hispanic, non-Hispanic Black, non-Hispanic White, and non-Hispanic other. Marital status was categorised as single, married, or divorced/separated/widowed. Educational level was categorised as college or more, high school, or less than high school. Insurance type was grouped as private, government, or none. Poverty category groups were defined as a percentage of the U.S. federal poverty level and were $\geq$200%, 100–199%, and $<$100%. We excluded pregnancy intervals greater than six years. A previous diagnosis of hypertension was treated as a binary (yes/no) variable.

Statistical analysis

Descriptive statistics were run for all variables using frequencies and their corresponding percentages for categorical variables and means with corresponding standard deviation (SD) for continuous variables. In bivariate analyses, chi-square tests were run to test for differences between categorical variables and history of diabetes during pregnancy (yes/no). For unadjusted analyses, we tested associates between all variables and each contraception type used. For adjusted analyses, we ran five separate models testing the independent association between history of diabetes during pregnancy and contraception type used. Covariates included maternal age, BMI, parity, race/ethnicity, marital status, education level, insurance type, and hypertension. Statistical significance was set at p-value <0.05 and all analyses were weighted with appropriate survey weights to yield nationally representative estimates. Stata v 15.1 was used for statistical analyses [14].

Results

Maternal characteristics of the study population by history of pregestational diabetes are displayed in Table 1. Out of 28,454 participants included in the study, 1344 (4.7%) had pregestational diabetes. Women with pregestational diabetes were older (41 years (0.8) vs. 37 years (0.2), $p < 0.001$), had a higher BMI (33.8 kg/m^2 ±0.7 vs. 28.2 kg/m^2 ± 0.3, $p < 0.001$), had a poverty category of $\geq$200% (31.9% vs. 24.9%, $p < 0.001$) and have hypertension (39.8% vs. 16.6%, $p < 0.001$) compared to women without pregestational diabetes. Women with pregestational diabetes were less likely to have a college degree (49.3% vs. 60.1%, p 0.002) and have private insurance (48.0% vs. 60.3%, p 0.015) compared to women no pregestational diabetes.

Table 2 displays the contraception type used with history of pregestational diabetes. Women with pregestational diabetes were more likely to use a permanent contraception method (58.0% vs. 38.7%, $p < 0.001$) and were more likely not to use contraception (27.2% vs. 24.5%, $p < 0.001$) compared with women with no history of pregestational diabetes. They were also less likely to use LARC (3.4% vs. 11.7%, $p < 0.001$), other hormonal contraception (4.1% vs. 8.9%, $p < 0.001$), and other non-hormonal contraception (7.2% vs. 16.4%, $p < 0.001$).

Unadjusted and adjusted analyses for the association between pregestational diabetes and contraception type are depicted in Table 3. In unadjusted analyses, women with pregestational diabetes were less likely to utilise LARC (OR 0.27, 95% CI 0.10–0.69), other hormonal (0.44, 95% CI 0.21–0.94), and other non-hormonal (0.40, 95% CI 0.15–1.04) and more likely to use permanent contraception (OR 2.20, 95% CI 1.49–3.23) or not to use any contraception method (OR 1.15, 95% CI 0.77–1.72) compared to women without pregestational diabetes. In the fully adjusted models, that also included adjustment for parity and religion, the only difference in the use of contraception between women with and without pregestational diabetes was the use of permanent sterilisation, which was higher among women with pregestational diabetes (aOR 1.62, 95% CI 1.02–2.55).

Discussion

Findings and interpretations

In this nationally representative study, after controlling for relevant covariates, women with pregestational diabetes had higher odds of using permanent sterilisation compared to women without pregestational diabetes, and having no difference in any hormonal contraception types, including LARC. We also found that 27.2% of women with pregestational diabetes did not use any contraception between pregnancies.

These findings support our hypothesis that women with a history of diabetes would have higher contraception use compared with women with no history of diabetes based

Table 1. Sample characteristics.

Variables	History of DM during pregnancy ($N = 1344$)	No history of DM during pregnancy ($N = 27,110$)	p-Value
Age (in years)	41.2 ± 0.8	37.2 ± 0.2	<0.001***
Body mass index (BMI) (kg/m^2)	33.8 ± 0.7	28.2 ± 0.3	<0.001***
Race/Ethnicity			0.796
Non-Hispanic White	58.9%	54.6%	
Hispanic	17.3%	21.6%	
Non-Hispanic Black	16.4%	17.6%	
Non-Hispanic other	7.4%	6.2%	
Marital status			0.008**
Single	17.2%	22.4%	
Divorced/Separated/Widowed	33%	22.0%	
Married	49.8%	55.6%	
Education			0.002**
College or more	49.3%	60.1%	
High school	27.8%	31.4%	
Less than high school	22.8%	8.5%	
Insurance type			0.015*
Private	48.0%	60.3%	
Government	42.7%	26.3%	
None	9.3%	13.4%	
Poverty category[a]			<0.001***
≥200%	31.9%	24.9%	
100–199%	34.0%	23.6%	
<100%	34.2%	51.6%	
Parity			0.394
0 Pregnancies	3.2%	6.0%	
1 Pregnancy	11.1%	15.4%	
2–3 Pregnancies	62.6%	60.6%	
>3 Pregnancies	23.2%	18.1%	
Religion			0.453
No religion	14.2%	18.4%	
Catholic	24.4%	19.5%	
Protestant	47.3%	53.3%	
Other religion	14.2%	8.9%	
Hypertension			<0.001**
Yes	39.8%	16.6%	

Significance at ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.
[a]Poverty category groups were defined as a percentage of the U.S. federal poverty level.

Table 2. Contraception use by history of diabetes during pregnancy.

Variable	History of DM during pregnancy ($N = 1344$) (%)	No history of DM during pregnancy ($N = 27,110$) (%)	p-Value
Contraception type			<0.001***
Permanent	58.0	38.7	
LARC	3.4	11.7	
Other hormonal	4.1	8.9	
Other non-hormonal	7.2	16.4	
None	27.2	24.5	

LARC: Long-acting reversible contraception. Other hormonal contraceptive was defined as use of any shots, pills, patch, and/or vaginal ring. Other non-hormonal contraceptives was defined as use of any female or male condoms, vaginal pouch, diaphragm, withdrawal, natural family planning including calendar rhythm method, and/or spermicide in the month before the interview.

Table 3. Unadjusted and adjusted logistic regression for the association between history of diabetes during pregnancy and contraception type.

Contraception type	Unadjusted Odds ratio (95% confidence interval)	Adjusted Odds ratio (95% confidence interval)
Permanent	2.20 (1.49–3.23)	1.62 (1.02–2.55)
LARC	0.27 (0.10–0.69)	0.35 (0.12–1.00)
Other hormonal	0.44 (0.21–0.94)	0.61 (0.28–1.35)
Other non-hormonal	0.40 (0.15–1.04)	0.60 (0.25–1.43)
None	1.15 (0.77–1.72)	1.11 (0.65–1.89)

LARC: Long-acting reversible contraception. Model 2 adjusted for: Covariates included maternal age, body mass index, parity, race and ethnicity, marital status, education, health insurance coverage, poverty category, religion, previous hypertension diagnosis.

on ADA standards of care. The ADA Standards of Care recommends that women with diabetes engage in regular family planning discussions with their provider to reduce the risk of unintended pregnancy [1]. Indeed, 58.0% of women with pregestational diabetes in our cohort used permanent sterilisation and additional 3.4% used LARC, with both of these methods being more frequently utilised by women with diabetes compared to controls ($p < 0.001$). However, 27.2% of women with pregestational diabetes reported not using any contraception in between pregnancies and thus our study identifies possible window of opportunities to optimise inter-conceptional care in women with pregestational diabetes.

Similarities and differences in relation to other studies

In contrast to our study, Horwitz et al. did not find a difference in contraception use based on women's diabetes status. [15]. Perritt et al. found postpartum contraceptive use varied by the presence of maternal diabetes, with women with diabetes being less likely to use postpartum contraception compared to women without diabetes [16]. However, that analysis was limited in their ability to adjust for potentially confounding factors including relevant sociodemographic characteristics and parity. Similarly, Schwarz et al. observed differences in contraception use and postpartum care by the presence of diabetes using California Medicaid data [17]. However, using data from California Medicaid population limited their external validity and their

ability to adjust for relevant confounding factors such as sociodemographic characteristics and parity, which were included in our analysis [17].

There are several factors associated with contraception use among women with pregestational diabetes. One factor is patient education by providers about the risks associated with unplanned pregnancies and using contraception and family planning [18]. In an audit of 100 women with diabetes from the United Kingdom, only 35% reported recollection of discussing contraception or pregnancy with their provider and less than one-quarter of the sample reported knowledge of potential risks associated with poor glycemic control in pregnancy [18]. Of note, the study found that only 15% of the sample knew to contact their diabetes care team when pregnant. The same audit found that condoms and oral contraceptives were the most frequently used methods of contraception. Additional factors associated with contraception use and family planning among women with diabetes are patient attitudes towards contraception and partner support in contraception use, internal locus of control, and provider trust [19]. Higher household income, higher levels of education, private health insurance at the time of delivery, and being happily married were all associated with planned pregnancies in women with diabetes. [20]. Women who reported pregnancy planning were also more likely to report positive interactions with their healthcare provider, underscoring the importance of provider trust and patient education [20].

Strengths and weaknesses

Our study has several strengths. First, we had a robust sample size to adequately power our bivariate and univariate analyses. Second, we explored a wide range of contraception options available within the dataset. Third, our use of a nationally representative dataset increases the generalisability of our findings. Despite the importance of our results, they should be considered in light of several limitations. First, our study is cross-sectional in nature which limits our ability to speak to any causal relationship between the history of diabetes in pregnancy and contraception use. Second, we were limited in our ability to distinguish between type 1 and type 2 diabetes mellitus or review the extent of glycemic control in each study participant. Finally, we were also limited in our ability to adjust for pregnancy intention in our analyses. However, our findings are still relevant due to increased risk of adverse pregnancy outcomes in women with pregestational diabetes.

Open questions and future research

Given the results of this study, it is important to investigate contraception use and preference in women of child-bearing age with diabetes as unplanned pregnancies in this population could carry detrimental effects on the health of the mother and her offspring [1,21,22]. The ADA Standards of Care identify pregnancy planning as a critical aspect of patient care among women with diabetes of childbearing age, even to those without a stated pregnancy intention, that should be assessed regularly, with LARC being identified as the most ideal option for women with diabetes [1]. Therefore, identifying barriers to effective contraception use is a public health interest and should be a focus for future research. Future research should explore barriers and facilitators to LARC contraceptives among women with diabetes, both at the individual, provider and healthcare system levels. Also, additional work is needed to explore the role of pregnancy planning and pregnancy wellbeing, which we were unable to evaluate due to limitations in the dataset. Patient education in the clinical setting is needed to ensure adequate patient understanding of health risks associated with poor glycemic control in pregnancy and the role of contraception in preventing them.

In conclusion, we found that women with pregestational diabetes were more likely to use permanent contraception methods compared to women without pregestational diabetes and more than a quarter of women with pregestational diabetes did not use any contraceptive method., This is an important finding as it identifies areas for patient and provider education to improve use of effective contraception utilisation among women with diabetes in order to optimise health prior to pregnancy and reduce adverse pregnancy outcomes associated with maternal diabetes.

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Disclosure statement

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