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Contraceptive use among women with prediabetes and diabetes in a US national sample

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Abstract

Introduction: Although elevated blood glucose is associated with adverse obstetrical outcomes, evidence suggests that women with diabetes may not be receiving comprehensive reproductive healthcare, including family planning and preconception care. Using a population-based sample, we evaluated the relationship between contraceptive use and biomarker-identified diabetes.

Methods: This cross-sectional study used data from 5548 women in the nationally representative National Longitudinal Study of Adolescent to Adult Health (Add Health) from 2007–2009. Women were aged 24–32 years, sexually active with men, and not pregnant. Hemoglobin A1C identified prediabetes and diabetes from blood specimens. The primary outcome was most effective contraception used in the past year: more effective (sterilization, intrauterine device, implant, combined hormonal methods, or injectable), less effective (condoms, diaphragms, spermicides, natural family planning, or withdrawal), or none. Multinomial regression models were adjusted for race/ethnicity, education, insurance, healthcare access, and body mass index.

Results: Of the women with diabetes, 37.6% used more effective contraception, 33.6% less effective contraception, and 28.8% none. Women with diabetes had higher odds of using no contraception, rather than more effective contraception, than women with normoglycemia (adjusted odds ratio [aOR], 1.90; 95% confidence interval [CI], 1.25–2.87). Women with diabetes

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who were undiagnosed had greater odds of using less effective contraception, rather than more effective contraception, compared to those who were diagnosed (aOR 3.39; 95% CI, 1.44−7.96). Contraceptive use did not differ between women with prediabetes and normoglycemia.

Discussion: Less effective contraceptive methods were commonly used by women with diabetes. Certified nurse-midwives and other providers can support women with diabetes to reach their pregnancy goals by providing preconception care and family planning.

Precis

Women with diabetes are significantly less likely to use contraception than women who are normoglycemic.

INTRODUCTION

A growing population of women has diabetes during their reproductive years.[1] Approximately 35% of newly diagnosed cases of diabetes occur between the ages of 18 and 50, and an estimated 19% of reproductive age women are not normoglycemic.[2,3] They need the reproductive care, tailored to their childbearing goals, that minimizes the harmful impact of elevated blood glucose during pregnancy. During pregnancy, elevated blood glucose secondary to poorly managed diabetes can lead to fetal malformation, pregnancy loss, preterm birth, preeclampsia, macrosomia, and fetal programming that increases the infant's risk of obesity and diabetes later in life.[4–7] Currently, the American Diabetes Association (ADA) recommends that women with diabetes use contraception while engaging in preconception care to lower glycosylated hemoglobin (A1C) below 6.5% before pregnancy.[8] However, as a patient population, women with diagnosed diabetes inconsistently receive contraception counseling, use contraception, plan pregnancies, or obtain preconception care, a finding that may be confounded by socioeconomic status or body weight.[9–15]

Using contraception to time pregnancies during periods of better glycemic control can help women with diabetes achieve their childbearing goals while reducing adverse pregnancy outcomes. The patterns of contraceptive use among women whose diabetes is undiagnosed or poorly managed have not been described using nationally representative data. Thus, the objectives of this study were to estimate the relationship between contraceptive use and key measures of glucose dysregulation, including prediabetes, undiagnosed diabetes, diagnosed diabetes, and suboptimal preconception glycemic control, among women of reproductive age in a US national sample. We hypothesized that women with diabetes would be less likely to use contraception than their normoglycemic peers, controlling for demographic characteristics and body mass index (BMI).

MATERIALS AND METHODS

Data Set and Sample

We used data from the 2007–2009 Wave IV of the National Longitudinal Study of Adolescent to Adult Health (Add Health). Ninety-eight percent of participants were interviewed in 2008. Add Health used a stratified, school-based cluster sampling strategy and is representative of US adults who were seventh to twelfth grade students during the

1994–1995 school year.[16] Race/ethnicity was collected from in-home interviews at initial enrollment in 1994–1995. All other survey and biological data were collected from the same participants at follow-up home visits from 2007 to 2009. The informed consent process has been described elsewhere.[16]

All self-identified non-pregnant female respondents who reported sexual activity with a male partner in the past year were eligible for this analysis. Women were excluded for missing values, refusals, or uncertain responses for demographic characteristics (n = 40), BMI (n=100), contraceptive use (n = 20), or A1C (n = 457). The final, unweighted analytic sample contained 5548 women.

Outcome Measures

The primary outcome was the most effective contraceptive method used in the prior 12 months. Participants were asked to indicate all types of contraceptive use in the prior 12 months, and categorized as using no contraception, less effective contraception, or more effective contraception (Table 1). Categorization reflects the widely used World Health Organization's Model of Tiered Contraceptive Effectiveness.[17] Using the wording from the survey, we defined more effective methods include tubal ligation/sterilization; vasectomy; IUD (intrauterine device), coil, loop; emergency IUD insertion; Norplant; birth control pills; Patch (Ortho Evra); ring (NuvaRing); and shot (Depo-Provera). Less effective methods included condoms (rubbers); female condom; diaphragm, cap or shield; natural family planning (safe periods by temperature, cervical mucus test); rhythm or safe period by calendar; emergency contraception or "morning after" pill; withdrawal (pulling out); vaginal sponge; contraceptive film; and spermicide foam, jelly, creme, suppositories). For our analyses, women were categorized by the most effective method reported (ie, a pill and condom user would be categorized as more effective method user). We conducted a sensitivity analysis about the categorization of ten women who indicated they used other methods.

Diabetes Status

Diabetes status was the primary predictor. Capillary whole blood was collected from a finger stick and analyzed to determine A1C; the high reliability and validity of this measure have been documented elsewhere.[18,19] Women were categorized as having diabetes if they had 1) an A1C greater than or equal to 6.5%, 2) self-reported diabetes diagnosis (an affirmative answer when asked if she had a "history of being told by a doctor or health care professional that you have diabetes (if female, outside of pregnancy)"), or 3) documentation of anti-hyperglycemic medication use in a prescription inventory of the previous four weeks. Women were categorized as having prediabetes if their A1C was between 5.7% and 6.4% without a history of a diabetes diagnosis or anti-hyperglycemic medication use. Women were categorized as normoglycemic if they had no evidence of prediabetes or diabetes. These criteria reflected ADA clinical practice guidelines and are described elsewhere.[19] Type 1 diabetes mellitus and type 2 diabetes mellitus were not distinguishable in this survey.

Additionally, all women with diabetes were categorized by diagnosis status and glycemic control. First, women with diabetes were categorized as diagnosed if they had a self-reported

diabetes diagnosis or took anti-hyperglycemic medications, and undiagnosed if they had neither. Second, women with diabetes were categorized as having suboptimal preconception glycemic control or not. Suboptimal preconception glycemic control was operationalized as A1C greater than or equal to 6.5% based on the ADA's recommended glycemic targets before pregnancy. Although the ADA considers 7% to be an appropriate goal for many adults who are not pregnant, we use the ADA's more conservative criterion for the preconception period.[8] By this definition, all undiagnosed women in the sample have A1C greater than or equal to 6.5%. Some women with diagnosed diabetes had an A1C greater than or equal to 6.5%, whereas some had A1C less than 6.5%, likely because of treatment and lifestyle changes.

Covariates

Analytic models controlled for characteristics which have been linked to diabetes risk and contraceptive behavior: demographic characteristics (race/ethnicity, insurance type, limited access to healthcare in the prior 12 months, and educational attainment) and BMI, with height and weight measured by field interviewers.[12,20–23] Educational attainment was a proxy for socioeconomic position relevant to health status because, in this age range, educational attainment is typically more stable than income.[24] We also conducted a sensitivity analysis in which we included age in the model.

Data Analysis

We used STATA version 14.1 (StataCorp LLC, College Station, TX) with SVY and SUBPOP commands to conduct design-based analyses that accounted for stratification, clustering, and unequal probability of selection.[25] Application of the survey weights produced unbiased weighted population estimates of diabetes prevalence and contraceptive use. We used Taylor Series Linearization to perform design-based standard error computations. Associations were tested with the second order Rao-Scott design-adjusted F test, with the null hypotheses of independence. We modeled diabetes status as a predictor of contraceptive use with pseudo maximum-likelihood multinomial logit regression. We exponentiated beta coefficients to produce adjusted odds ratios (aORs) with 95% confidence intervals (95% CI). The overall significance of each predictor was examined with an adjusted Wald test. In order to model diagnosis status and suboptimal preconception glycemic control as predictors of contraceptive use, we conducted an additional unconditional domain analysis of women with diabetes. All models adjusted for demographic characteristics and BMI. All tests were two-tailed, with a 0.05 significance level. Institutional review board approval was obtained from the [institutional review board name redacted for anonymity].

RESULTS

Diabetes Status and Contraceptive Use

Most sexually active, non-pregnant women aged 24–32 years used birth control in the prior year (Table 2). The effectiveness of contraception used had significant bivariate associations with demographic variables, BMI, and diabetes status (all $P < .001$). We estimated that 20.8% of the population had prediabetes, and 5.9% had diabetes. More women with diabetes

used less effective contraception (33.6% vs 25.2%) or no contraception (28.8% vs 16.4%) than their normoglycemic peers ($P < .001$).

In the multinomial analysis, compared to women with normoglycemia, women with diabetes had greater adjusted odds of using no contraception (adjusted odds ratio [aOR], 1.90; 95% confidence interval [CI], 1.25–2.87) than more effective contraception (Table 3). There were not significant differences between use of less effective and more effective methods by women with diabetes compared to women with normoglycemia. Contraceptive use did not differ between women with prediabetes and normoglycemia.

Demographic characteristics and BMI were significant predictors (Table 3). Using no contraception was less likely among non-Hispanic black women but more likely among women with less education or who were obese than their respective referents. Use of less effective contraceptive, rather than more effective contraception, was more likely among non-Hispanic black women, Hispanic women, less educated women, women without insurance, and women without access to healthcare than their respective referents.

Sensitivity Analyses

We conducted a sensitivity analysis, categorizing the women who used “other methods” as more effective, less effective, or excluded from the analysis. We saw minor changes in coefficients and no changes in statistical significance. We report the analysis excluding those who reported other methods. We also examined the addition of age as a covariate; age did not change the statistical significance of other variables or the estimates in any meaningful way.

Variation in Contraceptive Use among Women with Diabetes

Among the 381 women with diabetes, 60.6% were diagnosed (n = 213), and 56.0% had suboptimal preconception glycemic control indicated by A1C greater than or equal to 6.5% (n = 241). Among women with diabetes whose A1C was greater than or equal to 6.5%, 70.4% were undiagnosed and 29.6% were diagnosed.

Contraceptive use was significantly associated with diagnosis status ($P < .001$) (Table 4). Over half of undiagnosed women used less effective contraception (51.1%); using no contraception and more effective contraception were both more common among diagnosed than undiagnosed women with diabetes. In an adjusted multinomial model (Table 5), the association remained, indicating that undiagnosed women had greater odds of using less effective contraceptive, rather than more effective contraception, compared to diagnosed women (aOR 3.39, 95% CI, 1.44−7.96).

Table 4 also indicates a similar significant association between suboptimal preconception glycemic control and contraceptive use among women with diabetes ($P < .001$). Nearly half of the women with A1C greater than or equal to 6.5% used less effective contraception (45.4%). In the adjusted model (Table 6), the association between glycemic control and contraceptive use remained significant because women with A1C greater than or equal to 6.5% had significantly lower odds of using no contraception than less effective contraception compared to women with A1C below 6.5% (aOR 0.31; 95% CI, 0.13−0.74; p = .009; not

shown). The step-down tests comparing no or less effective to more effective contraception were not significant.

As seen in Tables 5 and 6, Hispanic women with diabetes were more likely to use less effective contraception and less likely to use no contraception than non-Hispanic white women with diabetes. Obese women with diabetes were more likely to use no contraception than normal or underweight women with diabetes.

DISCUSSION

To our knowledge, this is the first study to use a population-based sample to describe contraceptive use among women with biomarker-identified diabetes. While the majority of women with normoglycemia used more effective contraception, most women with diabetes were using either less effective contraception or no contraception. Our data supported the hypothesis that women with diabetes had higher odds of using no method, rather than a more effective method, in comparison to women with normoglycemia.

Our findings add to the available evidence about contraceptive use by women with diabetes, which has largely described only women who are diagnosed. Two previous studies found no differences in the odds of contraception non-use by women with diagnosed diabetes compared to normoglycemic women.[12,13] In contrast, we found that women with diabetes had significantly greater adjusted odds of not using contraception when we aggregated women with diagnosed diabetes and undiagnosed diabetes.

Clinical Implications

Certified nurse-midwives and other providers should be prepared to provide patient-centered care to sexually active women with diabetes who are not using contraception. Patients who could become pregnant deserve clear information about the possibility of complications and means to reduce risks from providers who respect their reproductive autonomy. Concerns about the inadequate provision of diabetes-specific preconception care have been voiced,[9,26,27] and are lent weight by our finding that nearly 20% of women with an A1C greater than or equal to 6.5% were using no contraception.

Since many women in this age cohort are unaware of their diabetes status or glycemic control,[1] our findings support structuring preconception care to be universal and routine in primary care, including midwifery practice.[27–29] High rates of undiagnosed diabetes among young adult women drive home the importance of adhering to the ADA's diabetes screening criteria for providers serving this patient population.[1] Because achieving and then sustaining glycemic control requires constant maintenance, preventing unintended pregnancies while A1C is greater than or equal to 6.5% also requires undisrupted access to primary care without financial or institutional barriers. Policies should support access to quality care that to addresses both family planning and diabetes management needs.

According to the Centers for Disease Control and Prevention's Medical Eligibility Criteria for Contraceptive Use, women with diabetes may typically use the contraceptive method of their choice (with the exception that women who have had diabetes for more than 20 years

or have vascular damage may be contraindicated from using Depo-Provera or combined hormonal contraceptives).[30] In Add Health, most women with diabetes used less effective contraception, which may be preferable to women who desire methods which are generally less expensive, available without a prescription or healthcare interaction, non-hormonal, or prevent transmission of sexually transmitted infections.[31] Respecting women's preferences about contraception features is essential for preventing reproductive coercion. It is also critical for providers and researchers to identify and dismantle barriers encountered by women with diabetes who are using less effective contraception but desire more effective methods.

Our findings offer population estimates of women who need diabetes-specific reproductive healthcare, including both care that prevents and prepares for pregnancy in the context of diabetes management. In our discussion, we highlight the women who are using no contraception or less effective methods as they more likely to become pregnant than women who are using more effective methods.[32] However, we do not quantify unmet contraceptive need because Add Health only queries women's pregnancy intentions retrospectively after pregnancies are reported. Prospective pregnancy attitudes at the time of data collection were not collected. In the general population, 4.5% of women ages 15–44 are not using contraception because they were seeking pregnancy, so it is reasonable to assume an unknown proportion of contraception non-users in this sample are as well.[33] In the future, the unmet contraceptive need could be discerned by data collection that includes concurrent determination of pregnancy intentions, current contraceptive use and A1C.

Having the full spectrum of reproductive health services available may be particularly important for women with diabetes since data suggests diabetes can complicate pregnancy intentions. Some women with diabetes report feeling ambivalence about childbearing because they both felt desire for pregnancy and fear of diabetes-associated risks.[34] Women reported that guilt about diabetes harming their offspring delayed their plans for pregnancy[35] or made it hard for them to think about planning.[36] Women may perceive diabetes to reduce their fertility, which some women find distressing and can make preconception care, including contraception, seem irrelevant.[37–39] Additionally, women with diabetes have reported great happiness about unintended pregnancies.[38] More research is needed to understand how women want family planning and preconception care incorporated into diabetes management. Future research should continue to build on the emerging evidence that the postpartum period may be a particularly promising time for innovations in family planning service delivery.[40]

We noted two other trends in our data. In every model, obese women were more likely to use no contraception rather than more effective contraception, and Hispanic women were more likely to use less effective rather than more effective contraception. Women from the groups most affected should be invited to be collaborators, providing insight about how they understand the myriad factors that influence their contraceptive choices and input about the acceptability of interventions to address any unmet contraceptive need.

Limitations

We note several limitations. Our analysis being cross-sectional, we do not suggest that diabetes motivates contraceptive use; rather, we are describing the observable patterns of contraceptive use among women with diabetes. Unfortunately, our description cannot distinguish type 1 diabetes mellitus and type 2 diabetes mellitus, but our findings are still meaningful because elevated blood glucose endangers pregnancies of women with both kinds of pre-pregnancy diabetes.[8] Generalizability of our findings is limited because some contraceptive methods listed in Add Health are no longer on the market in the United States, and new forms of the contraceptive implant (eg, Implanon, Nexplanon) have become available since data were collected. Add Health did not contain data about how long participants used each method, whether multiple methods were used concurrently or consecutively, or satisfaction with the method; those dimensions should be explored in future research.

Since these data were collected 2007–2009, guidelines around the long-acting reversible contraceptives (LARC, which includes IUDs and implants) have changed, and the Patient Protection and Affordable Care Act (ACA) significantly reduced out-of-pocket contraceptive expenses.[41] Unsurprisingly, LARC use has increased significantly between 2008–2014,[42] so Add Health would not be an ideal dataset for answering questions about current LARC use and thus we did not focus our inquiry on those methods. An analysis of the 2008–2014 NSFG demonstrates most of the significant changes between 2008 and 2014 occurred within the more effective method category: use of sterilization decreased by 8.4 percentage point, use of LARC increased by 8.3 percentage points, and use of combined hormonal methods did not significantly change.[42] We felt comfortable using Add Health data from 2007–2009 because the significant changes in the less effective method category between 2008 and 2014 were smaller (2.9 percentage point increase in use of withdrawal and 1.0 percentage point increase in use of natural family planning) and no changes were seen in the percentage of women at risk of unintended pregnancy who used no method, despite the ACA ostensibly making all prescription contraceptives more accessible.[42]

Despite its limitations, we determined that Add Health is more suitable for addressing our hypotheses than other population datasets. In particular, the NSFG could not be used to address our hypotheses because diabetes status is not determined by biomarker. The National Health and Nutrition Examination Survey (NHANES), the population-based sample frequently used to generate population estimates about biomarker-identified diabetes, has few contraceptive questions and a smaller number of young adults than Add Health. Since diabetes is increasingly common among women of reproductive age, data should be collected to update these findings. Until then, this is the best estimate that is available of family planning behaviors of young adult women with diagnosed and undiagnosed diabetes in the United States.

Women with diabetes in young adulthood are using more effective contraception less than their normoglycemic peers. Evaluating and improving family planning for women with current or potential glucose dysregulation is critical for helping women achieve reproductive goals while minimizing the risks associated with elevated blood glucose during pregnancy.

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Quick Points (3–5 bullet points with practice implications)

- Pre-pregnancy diabetes increases the risk of adverse obstetrical outcomes and is increasingly common in women during their reproductive years.
- Women with diabetes are more likely to use no contraception, rather than more effective contraception, than women who are normoglycemic.
- Family planning coupled with preconception care to lower blood glucose levels before pregnancy can help women with diabetes achieve their childbearing goals.

TABLE 1.

Categorization of contraceptive methods by effectiveness

More effective contraception[a]
tubal ligation/sterilization
vasectomy
IUD (intrauterine device), coil, loop
emergency IUD insertion
Norplant
birth control pills
Patch (Ortho Evra)
ring (NuvaRing)
shot (Depo-Provera)
Less Effective Contraception[a]
condoms (rubbers)
female condom
diaphragm, cap or shield
natural family planning (safe periods by temperature, cervical mucus test)
rhythm or safe period by calendar;
emergency contraception or “morning after” pill
withdrawal (pulling out)
vaginal sponge
contraceptive film
spermicide foam, jelly, creme, suppositories

[a]wording is as used on the survey

Table 2.

Demographic characteristics of sexually active, non-pregnant women ages 24–32 in Add Health, Wave IV, 2007–2009 (N=5548)

	More effective contraception[a,b]	Less effective contraception[a,c]	No contraception[a]	Total	*P*[d]
Total, n (%)	3031 (55.3)	1580 (26.7)	937 (18.1)	5548	
Race/ethnicity, n (%)					< .001
Non-Hispanic white	1862 (58.5)	679 (22.8)	563 (18.7)	3104	
Non-Hispanic black	577 (45.1)	510 (39.5)	192 (15.4)	1279	
Hispanic	415 (51.1)	277 (30.2)	133 (18.7)	825	
Native American	17 (50.0)	*e*	*e*	37	
Asian	160 (54.0)	97 (27.8)	46 (18.2)	303	
Education, n (%)					< .001
College graduate or more	1274 (66.1)	492 (23.2)	191 (10.7)	1957	
Some college or vocational school	1311 (53.5)	731 (27.8)	472 (18.7)	2514	
High school graduate	313 (43.2)	237 (29.8)	184 (27.0)	734	
Less than high school	133 (39.6)	120 (29.7)	90 (30.7)	343	
Insurance, n (%)					< .001
Private insurance	2327 (59.3)	1,033 (24.3)	594 (16.4)	3954	
Medicaid	264 (48.2)	190 (31.3)	123 (20.5)	577	
No insurance	440 (44.8)	357 (32.6)	220 (22.6)	1017	
Access to Care, n (%)					< .001
Had access	2369 (57.8)	1139 (25.3)	649 (16.9)	4,157	
Lacked access	662 (47.8)	441 (30.8)	288 (21.3)	1,391	
Body Mass Index (BMI), n (%)					< .001
Normal/underweight	1288 (61.7)	570 (25.7)	263 (12.5)	2,121	
Overweight	797 (58.5)	389 (25.7)	207 (15.8)	1,393	
Obese	946 (46.1)	621 (28.4)	467 (25.5)	2,034	
Diabetes Status, n (%)					< .001
Normoglycemia	2242 (58.4)	1045 (25.2)	602 (16.4)	3,889	
Prediabetes	625 (49.2)	412 (30.0)	241 (20.8)	1,278	
Diabetes	164 (37.6)	123 (33.6)	94 (28.8)	381	

[a] Unweighted n reported with weighted row percentages.

[b] More effective contraceptive methods are tubal ligation/sterilization; vasectomy; IUD (intrauterine device), coil, loop; emergency IUD insertion; Norplant; birth control pills; Patch (Ortho Evra); ring (NuvaRing); and shot (Depo-Provera).

[c] Less effective methods are condoms (rubbers); female condom; diaphragm, cap or shield; natural family planning (safe periods by temperature, cervical mucus test); rhythm or safe period by calendar; emergency contraception or “morning after” pill; withdrawal (pulling out); vaginal sponge; contraceptive film; and spermicide foam, jelly, creme, suppositories.

[d] Rao-Scott design-adjusted F test conducted.

[e] Cell counts too small to report per Add Health guidelines.

Table 3.

Odds of less effective or no contraception use, instead of more effective contraception use, by sexually active, non-pregnant women ages 24–32 in Add Health, Wave IV, 2007–2009 (N=5548)

	Less effective contraception[a,b]	No contraception[a]	*P*[c]
	aOR (95% CI)	aOR (95% CI)	
Diabetes status			.03
Normoglycemia	Ref	Ref	
Prediabetes	1.13 (0.91−1.40)	1.17 (0.87−1.57)	
Diabetes	1.45 (1.00−2.11)	1.90 (1.25−2.87)	
Race/ethnicity			< .001
Non-Hispanic white	Ref	Ref	
Non-Hispanic black	1.92 (1.51−2.45)	0.75 (0.58−0.96)	
Hispanic	1.39 (1.02−1.90)	0.91 (0.67−1.23)	
Native American	1.92 (0.67−5.48)	0.40 (0.08−2.15)	
Asian	1.39 (0.87−2.22)	1.32 (0.64−2.72)	
Education			< .001
College graduate or more	Ref	Ref	
Some college or vocational school	1.22 (0.98−1.52)	1.81 (1.41−2.32)	
High school graduate	1.53 (1.10−2.13)	3.01 (2.12−4.27)	
Less than high school	1.58 (1.05−2.38)	3.91 (2.57−5.95)	
Insurance			.02
Private insurance	Ref	Ref	
Medicaid	1.18 (0.85−1.64)	0.92 (0.66−1.26)	
No insurance	1.46 (1.16−1.84)	1.25 (0.96−1.65)	
Access to Care			.048
Had access	Ref	Ref	
Lacked access	1.25 (1.04−1.50)	1.22 (0.96−1.55)	
Body Mass Index (BMI)			< .001
Normal or underweight	Ref	Ref	
Overweight	0.97 (0.79−1.18)	1.23 (0.94−1.59)	
Obese	1.14 (0.92−1.42)	2.18 (1.66−2.85)	

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval

[a]The base outcome is more effective contraception use. More effective contraceptive methods are tubal ligation/sterilization; vasectomy; IUD (intrauterine device), coil, loop; emergency IUD insertion; Norplant; birth control pills; Patch (Ortho Evra); ring (NuvaRing); and shot (Depo-Provera). Outcome modeled with multinomial logit regression.

[b]Less effective methods are condoms (rubbers); female condom; diaphragm, cap or shield; natural family planning (safe periods by temperature, cervical mucus test); rhythm or safe period by calendar; emergency contraception or “morning after” pill; withdrawal (pulling out); vaginal sponge; contraceptive film; and spermicide foam, jelly, creme, suppositories.

[c]Adjusted Wald Test conducted.

Table 4.

Contraception methods used by sexually active, non-pregnant women with diabetes ages 24–32 in Add Health, Wave IV, 2007–2009 (N=381)

	More effective contraception[a,b]	Less effective contraception[a,c]	No contraception[a]	*P*[d]
Diagnosis status[e], n (%)				< .001
Diagnosed	98 (43.3)	51 (22.2)	64 (34.5)	
Undiagnosed	66 (28.8)	72 (51.1)	30 (20.1)	
Glycemic control, n (%)				< .001
A1C < 6.5%	65 (41.3)	31 (18.6)	44 (40.2)	
A1C > 6.5%	99 (34.7)	92 (45.4)	50 (19.9)	

[a] Unweighted n reported with weighted row percentages.

[b] More effective contraceptive methods are tubal ligation/sterilization; vasectomy; IUD (intrauterine device), coil, loop; emergency IUD insertion; Norplant; birth control pills; Patch (Ortho Evra); ring (NuvaRing); and shot (Depo-Provera).

[c] Less effective methods are condoms (rubbers); female condom; diaphragm, cap or shield; natural family planning (safe periods by temperature, cervical mucus test); rhythm or safe period by calendar; emergency contraception or “morning after” pill; withdrawal (pulling out); vaginal sponge; contraceptive film; and spermicide foam, jelly, creme, suppositories.

[d] Rao-Scott design-adjusted F test conducted.

[e] Diagnosis status based on self-report or use of anti-hyperglycemic medications.

Table 5.

Adjusted odds of less effective or no contraceptive use, instead of more effective contraceptive use, by diagnosis status of women with diabetes ages 24–32 in Add Health, Wave IV, 2007–2009 (N=381)

	Less effective contraception[a,b]	No contraception[a]	P[c]
	aOR (95% CI)	aOR (95% CI)	
Diagnosis Status[d]			.02
Diagnosed	Ref	Ref	
Undiagnosed	3.39 (1.44−7.96)	1.46 (0.54−3.94)	
Race/ethnicity			< .001
Non-Hispanic white	Ref	Ref	
Non-Hispanic black	1.21 (0.45−3.25)	0.48 (0.18−1.23)	
Hispanic	2.70 (1.01−7.19)	0.20 (0.05−0.72)	
Native American	*e*	*e*	
Asian	*e*	*e*	
Education			.60
College graduate or more	Ref	Ref	
Some college or vocational school	0.65 (0.26−1.65)	1.45 (0.52−4.08)	
High school graduate	0.65 (0.18−2.28)	1.60 (0.53−4.80)	
Less than high school	1.58 (0.41−6.19)	1.18 (0.20−7.16)	
Insurance			.21
Private insurance	Ref	Ref	
Medicaid	1.99 (0.78−5.07)	1.01 (0.29−3.48)	
No insurance	2.43 (0.86− 6.84)	2.31 (0.95−5.65)	
Access to Care			.49
Had access	Ref	Ref	
Lacked access	1.22 (0.58−2.56)	0.70 (0.31−1.58)	
BMI			.27
Normal or underweight	Ref	Ref	
Overweight	1.83 (0.57−5.87)	2.68 (0.60−11.80)	
Obese	1.57 (0.49−5.04)	3.92 (1.07−14.41)	

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval.

[a]The base outcome is more effective contraception use. More effective contraceptive methods are tubal ligation/sterilization; vasectomy; IUD (intrauterine device), coil, loop; emergency IUD insertion; Norplant; birth control pills; Patch (Ortho Evra); ring (NuvaRing); and shot (Depo-Provera). Outcome modeled with multinomial logit regression.

[b]Less effective methods are condoms (rubbers); female condom; diaphragm, cap or shield; natural family planning (safe periods by temperature, cervical mucus test); rhythm or safe period by calendar; emergency contraception or “morning after” pill; withdrawal (pulling out); vaginal sponge; contraceptive film; and spermicide foam, jelly, creme, suppositories.

[c]Adjusted Wald Test conducted.

[d] Diagnosis status based on self-report or use of anti-hyperglycemic medications.

[e] Cell counts too small to report per Add Health guidelines.

Table 6.

Adjusted odds of less effective or no contraceptive use, instead of more effective contraceptive use, by glycemic control of women with diabetes ages 24–32 in Add Health, Wave IV (N=381)

	Less effective contraception[a,b]	No contraception[a]	P[c]
	aOR (95% CI)	aOR (95% CI)	
Glycemic Control			.03
A1C < 6.5%	Ref	Ref	
A1C ≥ 6.5%	2.04 (0.79−5.29)	0.62 (0.25−1.54)	
Race/ethnicity			< .001
Non-Hispanic white	Ref	Ref	
Non-Hispanic black	1.76 (0.68−4.53)	0.83 (0.35−1.93)	
Hispanic	2.85 (1.09− 7.49)	0.22 (0.06−0.81)	
Native American	*d*	*d*	
Asian	*d*	*d*	
Education			.58
College graduate or more	Ref	Ref	
Some college or vocational school	0.64 (0.26−1.62)	1.57 (0.55−4.50)	
High school graduate	0.63 (0.19−2.11)	1.75 (0.57−5.42)	
Less than high school	1.24 (0.26−5.79)	1.09 (0.17−7.02)	
Insurance			.13
Private insurance	Ref	Ref	
Medicaid	2.22 (0.84− 5.88)	1.08 (0.28− 4.17)	
No insurance	2.39 (0.87−6.54)	2.41 (0.98−5.95)	
Access to Care			.56
Had access	Ref	Ref	
Lacked access	1.23 (0.57−2.62)	0.8 (0.3−1.7)	
BMI			.27
Normal/underweight	Ref	Ref	
Overweight	1.79 (0.58−5.53)	2.69 (0.63−11.58)	
Obese	1.48 (0.49−4.51)	3.80 (1.05−13.77)	

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval.

[a]The base outcome is more effective contraception use. More effective contraceptive methods are tubal ligation/sterilization; vasectomy; IUD (intrauterine device), coil, loop; emergency IUD insertion; Norplant; birth control pills; Patch (Ortho Evra); ring (NuvaRing); and shot (Depo-Provera). Outcome modeled with multinomial logit regression.

[b]Less effective methods are condoms (rubbers); female condom; diaphragm, cap or shield; natural family planning (safe periods by temperature, cervical mucus test); rhythm or safe period by calendar; emergency contraception or “morning after” pill; withdrawal (pulling out); vaginal sponge; contraceptive film; and spermicide foam, jelly, creme, suppositories.

[c]Adjusted Wald Test conducted.

[d] Cell counts too small to report per Add Health guidelines.