Socioeconomic Status and Care Metrics for Women Diagnosed With Gestational Diabetes Mellitus

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IN BRIEF Appropriate management of hyperglycemia can significantly attenuate perinatal risks associated with a diagnosis of gestational diabetes mellitus (GDM). This article reports on a study evaluating the independent associations of maternal income and education with select measures of GDM management. This exploratory study demonstrates notable socioeconomic differences in select measures of GDM management. Additional studies are needed to determine the reasons for these differences and whether they exist in broader populations.

Gestational diabetes mellitus (GDM) is a serious complication of pregnancy that affects an estimated 2–10% of all pregnancies annually (1–3). It is characterized by glucose intolerance that begins or is first recognized during pregnancy. Increased maternal age, elevated BMI, nonwhite race, multiparity, and a history of GDM are associated with an increased risk of developing GDM during pregnancy (4). Hyperglycemia in pregnancy is associated with adverse perinatal outcomes, including fetal weight equal to or greater than the 90th percentile, primary Cesarean delivery, preeclampsia, shoulder dystocia or birth injury, neonatal hypoglycemia, neonatal hyperbilirubinemia, and admission to a neonatal intensive care unit (5).

Fortunately, studies have shown that appropriate management of hyperglycemia for women diagnosed with GDM significantly improves fetal outcomes, including rates of shoulder dystocia, birth-related nerve palsies and bone fractures, macrosomia (weight >4,000 g), and fetal death (6). The selection and escalation of the GDM treatment regimen is dictated by a patient's fasting blood glucose (FBG) values, self-monitoring of blood glucose (SMBG) results, and A1C values. Although some women only require changes in diet and exercise to maintain adequate blood glucose control, others require medication, typically with the oral sulfonylurea glyburide or insulin (7). Women most at risk for progression to medication-treated GDM are those with a higher BMI, higher point-of-care A1C at diagnosis, higher FBG (8), and strong family history of diabetes (9). Women who require insulin for the treatment of GDM also face an increased risk of type 2 diabetes after the GDM-affected pregnancy (10). A postpartum oral glucose tolerance test (OGTT) identifies patients who are persistently hyperglycemic after delivery, due to either prediabetes or previously undiagnosed type 2 diabetes. A diagnosis of GDM increases a woman's risk of developing type 2 diabetes to almost 20% by 9 years postpartum, compared to the average risk of 2% (11). Therefore, the postpartum visit represents a unique window to intervene early in women who may not otherwise seek care.

Few studies have described variation in care metrics for women with

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GDM, but income and educational disparities in the care of patients with type 2 diabetes are well established in the literature. For example, one study found that uninsured patients with type 2 diabetes receive less preventive care such as annual eye exams than patients with insurance (12). Another study demonstrated that lower-income patients with type 2 diabetes were less likely to visit any diabetes clinic (13). The association of lower socioeconomic status and care metrics has not been well characterized in the GDM population. The purpose of this study was to evaluate the association between maternal education level and annual income, separately, and select measures of GDM care, including time to specialty referral for GDM management, need for medication therapy for the treatment of GDM, time to the initiation of medication therapy, and completion of a postpartum OGTT.

Research Design and Methods

Vanderbilt Eskind Diabetes Center GDM Program

The GDM program at the Vanderbilt Eskind Diabetes Center (VEDC) has been recognized by the American Diabetes Association since 2009 and includes an integrated care team composed of endocrinologists and certified diabetes educators, including nurses and registered dietitian nutritionists (14). Women are referred to the VEDC for management of GDM at the discretion of their obstetric provider after diagnostic testing for GDM. At Vanderbilt University Medical Center, the diagnosis of GDM is made using a two-step strategy (15). Women with a positive screening 50-g OGTT (positive if 1-hour glucose value is ≥140 mg/dL) undergo a subsequent diagnostic 100-g OGTT. If the patient has two or more elevated glucose values on the 100-g OGTT using the Carpenter and Coustan criteria (fasting ≥95 mg/dL, 1-hour ≥180 mg/dL, 2-hour ≥155 mg/dL, or 3-hour ≥140 mg/dL), she is diagnosed with GDM (15,16). Women can also be diagnosed with GDM based on a single screening 50-g OGTT result of ≥200 mg/dL, per standard diagnostic criteria.

In accordance with the standard protocol of the VEDC GDM program, patients are advised at their first clinic visit to record daily fasting and 2-hour postprandial blood glucose values (a total of four values per day). After 1 week of recording these values, patients' blood glucose data are assessed by the clinic. Medication therapy is initiated based on the frequency of the blood glucose readings that are equal to or greater than the threshold values of 95 mg/dL fasting, 140 mg/dL 1-hour postprandial, and 120 mg/dL 2-hour postprandial (17). Medication typically is not initiated until at least 1 week after the initial clinic visit unless patients present to the clinic with previously documented blood glucose values that are outside of target ranges. The decision to initiate either an oral medication (glyburide) or insulin therapy is based on physician recommendations and patient preference after a discussion of the risks and benefits of each strategy. In general, postprandial hyperglycemia is treated with glyburide or a rapid-onset insulin analog, whereas fasting hyperglycemia typically is treated with intermediate- or long-acting insulin. Patients with both fasting and postprandial hyperglycemia are treated with intensive insulin therapy or multiple doses of glyburide. In patients diagnosed with GDM, a 2-hour 75-g OGTT is performed after delivery at a 6-week VEDC follow-up visit to evaluate for persistent hyperglycemia in the postpartum period.

Study Design

A retrospective chart review was conducted for a convenience sample of 245 women who received care through the VEDC GDM program from 2010 to 2015 and had income and education data available in the electronic medical record (EMR). Income and education were assessed using a standardized nurse clinic intake form. Six participants who did not meet the study inclusion criteria were excluded, leaving 239 charts available for final review. EMR data for each patient included in the final study sample were abstracted by a single reviewer (M.L.B.). Data for all participants were then independently verified by a second reviewer (G.D.C.). Reviewers abstracted the following data relevant to the present analysis: *1*) age, 2) race, *3*) BMI at first VEDC visit, *4*) hometown, *5*) patient-reported difficulty with transportation and barriers to care access, *6*) level of education, *7*) annual income, *8*) antepartum 50-g and 100-g OGTT results, *9*) screening A1C results at initial VEDC visit, *10*) time to VEDC appointment, *11*) initial treatment regimen, *12*) need for medication therapy, *13*) type of medication therapy, *14*) time to medication therapy, *15*) completion of a postpartum OGTT, and *16*) postpartum OGTT results.

Distance from the VEDC was calculated as the average radial distance from a patient's hometown city center to the VEDC. Difficulty with transportation and barriers to access were reported as either yes or no on the standardized nurse clinic intake form. Barriers to access included possible qualifiers of work or child care, cost, lack of family or social support, and other. Level of education was defined as the highest level of education achieved and was categorized as either did not complete high school, completed high school or earned a general education diploma (GED), completed some undergraduate coursework, or completed an undergraduate or graduate degree. Annual income was assessed categorically on the clinic nurse intake form as ≤$30,000, $30,001–50,000, $50,001–70,000, or ≥$70,001. Screening A1C was obtained at the initial VEDC appointment as either a point-of-care or serum test. Time to first VEDC appointment was defined as the time from the diagnostic OGTT to the first VEDC appointment and categorized as <6 days, 7–13 days, 14–20 days, 21–27 days, 28–34 days, 35–41 days, or ≥42 days. Initial treatment regimen was defined as the treatment prescribed at or within 1 week of the first VEDC appointment and categorized as lifestyle modification, glyburide, or insulin. Need for medication therapy was defined as the prescription of a diabetes medication at any point after GDM diagnosis. The type of medication therapy was categorized as either glyburide or insulin. A patient was categorized under insulin therapy if she required insulin use at any point in the pregnancy, regardless of her initial treatment regimen. Time to initiation of medication therapy was defined as the time from the first VEDC appointment to the initiation of medication therapy and categorized as <1 week, 1–4 weeks, 1–2 months, 2–3 months, or 3–4 months. Completion of the postpartum OGTT was defined as the patient returning for postpartum testing. The study underwent expedited review and was approved by the Vanderbilt institutional review board.

Statistical Analysis

The independent variables of interest were maternal level of education and annual income. The primary outcomes of interest were time to VEDC appointment, need for medication therapy, time to medication therapy, and completion of postpartum OGTT. Baseline characteristics were compared across education and income categories using Pearson χ^2 tests for categorical variables and proportional odds likelihood ratio tests for ordinal variables. For binary outcomes, we fit logistic regression models, and for ordinal outcomes, we fit proportional odds logistic models. Each model was adjusted for relevant prespecified covariates (i.e., age, race, BMI, distance to the VEDC, and screening A1C value), as indicated. The highest income bracket (≥$70,001) and the highest category for education level (completed undergraduate or graduate degree) were used as reference values. The effects were described as unadjusted and adjusted odds ratios (ORs) with 95% CIs. *P* values of <0.05 were considered statistically significant. Data were analyzed using R statistical software, version 3.3.0 (R, Vienna, Austria; www.r-project.org).

Results

The mean age of women in our study was 30.65 years, and the mean BMI was 31.20 kg/m^2 at the time of referral to the VEDC (Table 1). The majority of women in our sample self-identified as white (66.11%). Patients were fairly equally distributed across the four income brackets, with similar proportions of patients having annual incomes ≤$30,000, $30,001–50,000, and $50,001–70,000 (21.34%, 22.59%, and 22.59%, respectively) and a slightly higher percentage of patients with annual incomes ≥$70,001 (33.47%). The largest proportion of patients in this cohort had an advanced educational degree (62.34%). The majority of patients did not require any medications for the management of GDM (61.93%); of the patients who required medication, 73.63% were eventually prescribed insulin, whereas 26.37% were prescribed only glyburide. A little more than half of patients (56.07%) returned for a postpartum OGTT.

Bivariate analyses of income and education with each prespecified outcome of interest are presented in Table 2 and Table 3. The time

TABLE 1. Clinical Characteristics of 239 Women With GDM at the VEDC

Clinical Characteristics	*n* or Mean	% or SD*
Age at diagnosis (years)	30.65	4.70
Race		
White/Caucasian	158	66.11
Black/African American	21	8.79
Hispanic/Latino	33	13.81
Asian/Pacific Islander	16	6.69
Middle Eastern	10	4.18
American Indian/Alaska Native	1	0.42
BMI (kg/m^2; total *n* = 229)	31.20	6.34
A1C screening (%, total *n* = 235)	5.35	0.43
Distance from VEDC (miles)	16.17	24.42
Annual family income		
≤$30,000	51	21.34
$30,001–50,000	54	22.59
$50,001–70,000	54	22.59
≥$70,001	80	33.47
Level of education		
Did not complete high school	27	11.30
Completed high school or GED	21	8.79
Completed some undergraduate coursework	42	17.57
Completed undergraduate or graduate degree	149	62.34

TABLE CONTINUED ON P. 220 →

TABLE 1. Clinical Characteristics of 239 Women With GDM at the VEDC, *continued from p. 219*

Clinical Characteristics	*n* or Mean	% or SD*
Time to VEDC appointment (days; total *n* = 227)		
<6	21	9.25
7–13	112	49.34
14–20	61	26.87
21–27	17	7.49
28–34	5	2.20
35–41	2	0.88
≥42	9	3.96
Initial treatment regimen		
Lifestyle modification	199	83.26
Insulin	33	13.81
Glyburide	7	2.93
Need for medication therapy		
None	148	61.92
Insulin or glyburide	91	38.07
Type of medication therapy (total *n* = 91)		
Insulin	67	73.63
Glyburide	24	26.37
Time to medication therapy (total *n* = 91)		
<1 week	40	43.96
1–4 weeks	33	36.26
1–2 months	15	16.48
2–3 months	2	2.20
3–4 months	1	1.10
Completion of postpartum OGTT		
Yes	134	56.07
No	105	43.93

Percentages may not sum to 100 due to rounding error.

to VEDC appointment (P = 0.003) and need for medication therapy (P = 0.033) were significantly associated with annual income in bivariate testing. The time to VEDC appointment (P <0.001), need for medication therapy (P = 0.008), and time to medication therapy (P = 0.027) were significantly associated with level of education in bivariate analyses. Neither income nor education was significantly associated with completion of the postpartum OGTT in bivariate analyses.

We subsequently fit logistic regression models to further evaluate the strength of the statistically significant bivariate associations by adjusting for relevant covariates. After adjusting for age, race, BMI, and distance from the VEDC, patients in the lower income brackets had significantly greater odds of experiencing a longer time to their VEDC appointment relative to patients in the highest income bracket (P = 0.009, Table 4). For example, the odds of experiencing a longer time to a VEDC appointment were 4.7 times greater for women reporting an annual income <\$30,000 than for those reporting an annual income >\$70,001. Likewise, patients with lower levels of education had significantly greater odds of experiencing a longer time to a VEDC appointment relative to patients with the highest level of education in the adjusted analyses (P <0.001, Table 4). For example, the odds of experiencing a longer time to a VEDC appointment were 7.1 times greater for women who completed high school or earned a GED than for women who completed an undergraduate or graduate degree.

The significant association detected between need for medication therapy and income in bivariate testing did not remain significant after adjusting for age, race, BMI, and distance from the VEDC in the logistic regression model (P = 0.731). Similarly, the significant association detected between need for medication therapy and education in bivariate testing did not remain significant in adjusted analyses (P = 0.523).

The significant association detected between time to medication therapy and education level remained significant after adjusting for age, race, BMI, and screening A1C in the proportional odds models (P = 0.043). To maintain consistency with the aforementioned analyses, Table 4 provides ORs for each level of education compared to women who completed undergraduate or graduate degree as the reference group. However, to facilitate interpretation of the results, we changed the reference group to women who did not complete high school because they were noted to have the lowest probability of having a longer time to medication therapy. Thus, relative to women who did not complete high school, the odds of having a longer time to medication therapy were 16.1 times greater for women who completed high school or obtained a GED (95% CI 2.23–116.39), 3.1 times greater for women who completed some undergraduate

TABLE 2. Associations Between Annual Income and Clinical Care Outcomes

Clinical Care Outcomes	≤$30,000 ($n$ = 51)		$30,001–50,000 ($n$ = 54)		$50,001–70,000 ($n$ = 54)		≥$70,000 ($n$ = 80)		*P**
	n	%	*n*	%	*n*	%	*n*	%	
Time to VEDC appointment (days; total n = 227)									
<6	1	2.17	6	11.77	4	7.55	10	12.99	
7–13	19	41.30	23	45.10	26	49.06	44	57.14	
14–20	13	28.26	12	23.53	17	32.08	19	24.68	
21–27	5	10.87	7	13.73	3	5.66	2	2.60	**0.003**
28–34	3	6.52	0	0.00	2	3.77	0	0.00	
35–41	0	0.00	2	3.92	0	0.00	0	0.00	
≥42	5	10.87	1	1.96	1	1.89	2	2.60	
Need for medication therapy (total n = 239)									
None	23	45.10	33	61.11	37	68.52	55	68.75	**0.033**
Insulin or glyburide	28	54.90	21	38.89	17	31.48	25	1.25	
Time to medication therapy (total n = 91)									
<1 week	12	42.86	9	42.86	9	52.94	10	40.00	
1–4 weeks	9	2.14	9	42.86	5	29.41	10	40.00	
1–2 months	6	21.43	3	14.29	3	17.65	3	12.00	0.842
2–3 months	0	0.00	0	0.00	0	0.00	2	8.00	
3–4 months	1	3.57	0	0.00	0	0.00	0	0.00	
Completion of postpartum OGTT (total n = 239)									
Yes	25	49.02	26	48.15	32	59.26	51	63.75	0.208
No	26	50.98	28	51.85	22	40.74	29	36.25	

**Bold denotes significant association.*

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TABLE 3. Associations Between Level of Education and Clinical Care Outcomes

Clinical Care Outcomes	Less Than High School (*n* = 27)		Completed High School or GED (*n* = 21)		Completed Some Undergraduate Coursework (*n* = 42)		Completed Undergraduate or Graduate Degree (*n* = 149)		*P**
	n	**%**	***n***	**%**	***n***	**%**	***n***	**%**	
Time to VEDC appointment (days; total *n* = 227)									
<67–13	0	0.00	0	0.00	4	10.00	17	11.89	
14–20	13	54.17	6	30.00	15	37.50	78	54.55	
21–27	5	20.83	5	25.00	13	32.50	38	26.57	
28–34	1	4.17	5	25.00	5	12.50	6	4.20	**<0.001**
35–41	1	4.17	2	10.00	0	0.00	2	1.40	
≥42	0	0.00	0	0.00	1	2.50	1	0.70	
	4	16.67	2	10.00	2	5.00	1	0.70	
Need for medication therapy (total *n* = 239)									
None	9	33.33	12	42.86	26	61.90	101	67.79	**0.008**
Insulin or glyburide	19	66.67	9	57.14	16	38.10	48	32.21	
Time to medication therapy (total *n* = 91)									
<1 week	12	66.67	2	22.22	8	50.00	18	37.50	
1–4 weeks	3	16.67	2	22.22	7	43.75	21	43.75	
1–2 months	3	16.67	4	44.44	0	0.00	8	16.67	**0.027**
2–3 months	0	0.00	1	11.11	0	0.00	1	2.08	
3–4 months	0	0.00	0	0.00	1	6.25	0	0.00	
Completion of postpartum OGTT (total *n* = 239)									
Yes	13	48.15	10	47.62	22	52.38	89	59.73	0.505
No	14	51.85	11	52.38	20	47.62	60	40.27	

**Bold denotes significant association.*

TABLE 4. Logistic Regression Models of Clinical Care Outcomes by Annual Income and Level of Education

Clinical Characteristics	Unadjusted Association		P*	Multivariate Association		P*
	OR	95% CI		OR	95% CI	
Time to VEDC appointment†						
≤$30,000	3.72	1.85–7.50		4.71	1.90–11.68	
$30,001–50,000	1.79	0.90–3.55	**0.004**	2.16	1.02–4.56	**0.009**
$50,001–70,000	1.76	0.91–3.40		1.92	0.97–3.79	
≥$70,001	—			—		
Did not complete high school	2.54	1.11–5.85		1.50	0.45–4.99	
Completed high school or GED	6.12	2.55–14.69	**<0.001**	7.10	2.82–17.88	**<0.001**
Completed some undergraduate coursework	2.14	1.10–4.18		2.48	1.22–5.04	
Completed undergraduate or graduate degree	—			—		
Need for medication therapy‡						
≤$30,000	2.68	1.30–5.54		1.73	0.61–4.90	
$30,001–50,000	1.40	0.68–2.89	**0.037**	1.30	0.53–3.22	0.731
$50,001–70,000	1.01	0.48–2.13		0.99	0.41–2.42	
≥$70,001	—			—		
Did not complete high school	4.21	1.76–10.05		2.16	0.57–8.12	
Completed high school or GED	1.58	0.62–4.00	**0.013**	1.92	0.64–5.78	0.523
Completed some undergraduate coursework	1.29	0.64–2.64		1.27	0.55–2.95	
Completed undergraduate or graduate degree	—			—		
Time to medication therapy‡						
Did not complete high school	0.37	0.12–1.12		0.19	0.03–1.14	
Completed high school or GED	3.83	0.97–15.16	**0.032**	3.07	0.60–15.66	**0.043**
Completed some undergraduate coursework	0.58	0.20–1.66		0.59	0.19–1.86	
Completed undergraduate or graduate degree	—			—		

**Bold denotes significant association.*
†Adjusted for age, race, BMI, and distance from the VEDC.
‡Adjusted for age, race, BMI, and screening A1C.

coursework (95% CI 0.47–20.7), and 5.3 times greater for women who completed undergraduate or graduate education (95% CI 0.88–31.52).

Discussion

Our study highlights significant associations between select maternal socioeconomic indicators and measures of GDM care after adjusting for relevant covariates. Women with lower annual income levels and lower levels of education had significantly greater odds of experiencing longer times to a VEDC appointment than women in the highest income and education levels after adjusting for age, race, BMI, and distance from the VEDC. Moreover, women from higher educational levels had significantly greater odds of having a longer time to medication therapy than women in the lowest education level after adjusting for age, race, BMI, and screening A1C.

Few studies have sought to evaluate the relationship between socioeconomic status and GDM care and management. One recent study examined a cohort of Irish women with GDM and evaluated the time from GDM screening to specialty referral for women screened at a rural general primary care practitioner versus a secondary hospital site where they were receiving prenatal care. The patients referred by the generalist providers waited 4.2 days longer than patients referred by secondary site providers to access specialist care, but the difference was not statistically significant (18). The significantly longer time to a VEDC appointment that we observed for women from lower income and education levels in our study is likely the result of a combination of patient, provider, and system level factors. For example, information available on the standardized nursing intake forms used at the VEDC revealed that women frequently cite work or child care, cost, lack of social or family support, and transportation to the VEDC as barriers to accessing care. These issues may disproportionately affect women from lower income and education levels.

The finding that women from higher education levels had significantly greater odds of having a longer time to medication therapy than women in the lowest education level is also noteworthy. The foundation of GDM management is diet modification, which includes a substantial emphasis on calorie and carbohydrate counting, as well as SMBG values (19). Previous studies of patients with type 2 diabetes have demonstrated that patients with low health literacy and/or numeracy frequently struggle with these types of activities (20). Health literacy is defined as "the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions" (21). Numeracy is defined as "the ability to use and understand numbers in daily life." Both of these constructs are well known to be positively correlated with education (22). If less educated women find it more difficult to complete the complicated tasks associated with diet modification for GDM management because of limited health literacy and/or numeracy, they may require more rapid initiation of medication therapy to control hyperglycemia relative to more highly educated women. The role of health literacy and numeracy in GDM management is an area in significant need of further study, particularly because escalation to medication therapy for patients with GDM may involve insulin administration, which also depends heavily on health literacy and numeracy skills (23,24).

Importantly, our adjusted analyses also demonstrated that, although there were significant differences in time to medication therapy, there were no significant differences in the overall need for medication therapy by education level. Taken together, these findings suggest that the need for medication is not solely dependent on patient behavior (i.e., the need for medication therapy does not reflect a "failure" of diet modification). Rather ,physiological factors such as the progressive decline in insulin sensitivity that occurs normally over the course of pregnancy likely necessitate medication therapy for some patients even after they make significant changes to their dietary intake (25). Of note, 38% of our cohort required medication therapy for glucose control, which is greater than the prevalence of 7–35% found in previous literature (26–28). This difference may be the result of a combination of factors, including the VEDC physician practice and the patient population treated at a single, large academic center.

Interestingly, we did not observe a significant difference in completion of postpartum OGTT by maternal income or education levels, despite a number of previous studies that have found these factors to be predictive of OGTT completion. Studies vary on predictors of postpartum follow-up. In one study, increased age, Asian or Hispanic race/ethnicity, and higher education level were shown to be independent predictors of postpartum screening completion (29). The need for antihyperglycemic medications during pregnancy has also been shown to be a positive predictor of completion of postpartum testing (30). Higher BMI and low formal education level are associated with poor postpartum follow-up (31). Limited time, inadequate childcare, the need to focus on the health of the baby (32), the emotional stress of having a new infant, lack of knowledge of the necessity of the test, and the fear of being diagnosed with type 2 diabetes (11,12) are frequently cited as barriers to completion of the postpartum OGTT. Studies have demonstrated that poor comprehension of the substantial increase in lifetime risk of type 2 diabetes after a GDM-affected pregnancy also hinders postpartum follow-up (33).

Interestingly, a recent study found that women with GDM seen by an endocrinologist, registered dietitian nutritionist, or certified diabetes educator during pregnancy were more likely to receive postpartum screening (30). All of the women in our study were already receiving specialty care in an integrated diabetes care center, and the majority of our participants had higher annual income and education levels relative to national averages. These characteristics of our patient population may have mitigated socioeconomic differences in postpartum follow-up that have been observed in previous studies (34,35). Notably, the overall rate of completion of the postpartum OGTT in our population was still less than ideal (56%), which is consistent with several previous studies (30).

Our study has some important limitations. For example, we used BMI measurement at the time of referral to the VEDC rather than at the start of pregnancy as a covariate in our logistic regression models. BMI at the time of referral is influenced by weight gain in the first 24–28 weeks of pregnancy; previous studies have demonstrated racial/ethnic variation in gestational weight gain among women with GDM (36). Additionally, the generalizability of our study findings may be limited because the data were obtained from a convenience sample of women diagnosed with GDM from a single institution. The racial distribution of our study population was similar to that of the community served by our medical center (37), but our study population had a slightly higher average income than the surrounding communities (38). The small sample size of this study also prevented us from including additional covariates of interest such as parity and prior GDM in the analyses.

To date, few studies have examined differences in the care and management of patients with GDM. This exploratory study demonstrates important differences in select measures of GDM management according to maternal income and education level. Our findings highlight a need to examine the extent of these differences in a broader population and to better understand the reasons for them. Indeed, variation in the care and management of GDM may have a substantial impact on glycemic control during pregnancy, which could ultimately have lifelong effects on mothers and their children.

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Duality of Interest

No potential conflicts of interest relevant to this article were reported.

Author Contributions

M.L.B., G.D.C., and S.M.J. designed the study. M.L.B. and G.D.C. conducted the chart abstraction. G.D.C., M.L.B., and R.J.C. managed and analyzed the data. All statistical analyses were conducted by L.W. M.L.B., G.D.C., L.W., S.M.J., and R.J.C. prepared the manuscript, and all authors approved the final document. M.L.B. is the guarantor of this work, and as such, had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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