Evaluation of Care Cascade Outcomes for Patients with Gestational Diabetes Mellitus in a Specialist-Supported Primary Care Model at a Community Health Center in Rhode Island

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ABSTRACT

Gestational diabetes mellitus (GDM) is associated with significant maternal and neonatal morbidity. Timely diagnosis and appropriate management of GDM decreases adverse maternal and neonatal outcomes. This study sought to assess prevalence and management of GDM in an underserved federally qualified health center (FQHC) setting in Rhode Island using a care cascade framework. A three-year retrospective chart review of patients who initiated obstetrical care between 2019 and 2021 was conducted. Of this sample, 16.81% patients met criteria for a GDM diagnosis, two-thirds of whom ultimately required pharmacotherapy. In the analysis of care cascade outcomes, 96.8% of patient underwent the recommended screening for GDM and 79.5% were linked to care. This FQHC cares for high-risk obstetrical patients through a specialist supported primary care model and this study demonstrates that this model can facilitate appropriate GDM care in high-risk populations.

KEYWORDS: Gestational Diabetes Mellitus; Care Cascade; Specialist-Supported Primary Care

INTRODUCTION

Gestational diabetes mellitus (GDM), the onset of diabetes in pregnancy, is associated with increased morbidity during pregnancy, post-partum and over a lifetime.[1,2] GDM is associated with a higher risk of hypertensive disorders of pregnancy and delivery via cesarean section; approximately 70% of patients diagnosed with GDM in pregnancy will go on to develop type 2 diabetes later in life.[1,2] In 2020, GDM impacted approximately 7.8% of pregnancies in the United States, a 30% increase from 2016.[3]

Significant disparities exist for patients who develop GDM and experience adverse outcomes related to it.[4-7] Racial and ethnic minority populations diagnosed with GDM tend to have worse perinatal outcomes and patients of lower socioeconomic status are more likely to develop GDM.[7–9] These disparities may be exacerbated by limited access to care, structural barriers such as cost and transportation difficulties, limited English proficiency, and cultural barriers.[8,10]

Timely diagnosis and appropriate treatment of GDM can decrease adverse maternal and neonatal outcomes.[11] Management of GDM is challenging for many patients especially if financial constraints or social barriers exist.[12,13] Prior successful interventions for GDM care have therefore focused on patient engagement in care, reducing loss to follow-up and increasing adherence to treatment recommendations.[7,14-19]

The care cascade provides a framework to visually understand the points of loss to follow-up for patients from screening to diagnosis and treatment, thereby identifying gaps in management and informing targeted interventions.[20] The care cascade model has not been widely applied to obstetrical care, but may have value in analyzing management, especially for high-risk populations. The following study applies the care cascade framework to the management of GDM in a community health center in Rhode Island, quantifying losses throughout the care cascade from initial screening to one-year post-partum.

METHODS

Blackstone Valley Community Health Care (BVCHC) serves approximately 21,800 patients in Central Falls and Pawtucket. About 2,500 prenatal visits are conducted annually.[21] Prenatal care is provided by family physicians with obstetrical training, certified nurse midwives and obstetric-trained advance practice providers through a formal collaboration with maternal fetal medicine (MFM) specialists. This model allows for care delivery to high-risk prenatal patients who may face social barriers in accessing specialist care.

A retrospective chart review was conducted of patients who initiated prenatal care between January 1, 2019 and December 31, 2021. Sociodemographic variables, pre-conception risk factors, pregnancy outcomes, and variables related to GDM management were collected systematically from the electronic medical record. Ethical approval for this study was obtained from the Brown University Institutional Review Board and from BVCHC leadership.

Approximately 1,077 distinct patients who received prenatal care at BVCHC between January 1, 2019 and December 31, 2021 were identified through query of the NextGen[22] electronic medical record. A random sample of 402 patients from the initial query was selected for this study. This random sample was then further narrowed to include only patients who initiated prenatal care in the same time frame

– a total of 298 patients. Data were systematically extracted from the electronic medical record according to a database care map constructed prior to the start of data collection. A deidentified database was created using Microsoft Excel. All data files were password protected and housed on BVCHC servers to protect patient information. Deidentified data were exported to STATA 16 for analysis.

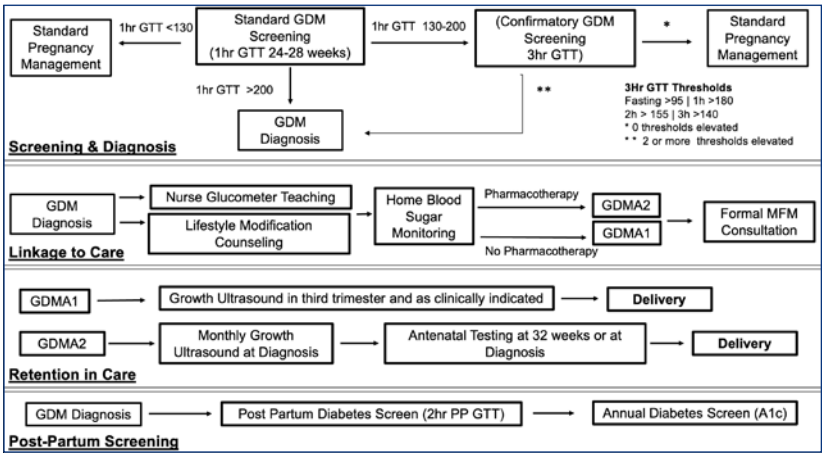
Sociodemographic variables, pre-conception risk factors, pregnancy outcomes and delivery complications were collected systematically from the electronic medical record. Sociodemographic variables collected included age, marital status, race, ethnicity, and preferred language. Risk factors included a history of GDM in a prior pregnancy, hemoglobin A1c level immediately pre-conception or at presentation to care, body mass index (BMI) at presentation to care, gravidity, and parity. Pregnancy outcomes included comorbid hypertensive disorders in pregnancy, fetal growth abnormalities, mode of delivery, and gestational age at delivery. Delivery complications included perineal lacerations and shoulder dystocia. All variables were selected based on literature review of GDM outcomes.[1,4,13,23,24]

The care cascade for GDM at BVCHC is based on recommendations from the American College of Obstetrics and Gynecology[1] and a collaborative care agreement as a specialist supported primary care model. Though complex, GDM management can be categorized into screening and diagnosis, linkage to care, retention in care, delivery and post-partum screening. The complete care cascade is shown in **Figure 1**.

To capture screening and diagnosis, values of a one-hour oral glucose tolerance test and gestational age at completion of this test were collected as a continuous variable. Where applicable, confirmatory three-hour oral glucose tolerance testing data were collected as a categorical variable based on the number of elevated thresholds in the test. GDM diagnosis was subsequently recorded as a categorical variable: GDMA1 (did not require pharmacotherapy for blood sugar control) or GDMA2 (required pharmacotherapy for blood sugar control). Glucometer teaching and lifestyle modification counseling were recorded as binary variables in order to capture linkage to care. Completion of recommended fetal surveillance, including serial growth ultrasound and antenatal testing was collected as a binary variable based on completion in order to capture retention in care. Timing of delivery was collected as a continuous variable. Information about induction and mode of delivery were also collected as categorical variables. Completion of post-partum diabetes screening, either early or at six weeks postpartum,[25] was collected as a categorical variable for those with a diagnosis of GDM. Hemoglobin A1c drawn one-year post-partum for patients with GDM was collected as a continuous variable.

Descriptive statistical analysis was performed for sociodemographic variables. Prevalence for GDM in this time frame was then calculated and further stratified by need for pharmacotherapy. A chi squared test of independence on categorical sociodemographic and pregnancy outcome variables and GDM diagnosis was performed. Given the exploratory nature of these analyses, a p-value of less than 0.1 was considered significant. A one-way ANOVA was performed to compare the effect of continuous variables on development of GDM. Continuous variables included initial hemoglobin A1c level, initial body mass index (BMI), gravidity, parity and gestational age at delivery. Losses along the care cascade were then quantified broadly based on the categories of screening and diagnosis, linkage to care, retention in care, delivery, and post-partum surveillance.

Figure 1. The Care Cascade for Gestational Diabetes Mellitus (GDM) at Blackstone Valley Community Health Care (BVCHC).



RESULTS

A sample of 402 pregnant patients who initiated care between January 1, 2019 and December 31, 2021 were randomly selected. Of those, 298 met inclusion criteria and were included in the sample; diabetes screening data were available for 232 patients. Of these, 39 (16.81%) had GDM. Of those with GDM, two thirds required pharmacotherapy [**Table 1**].

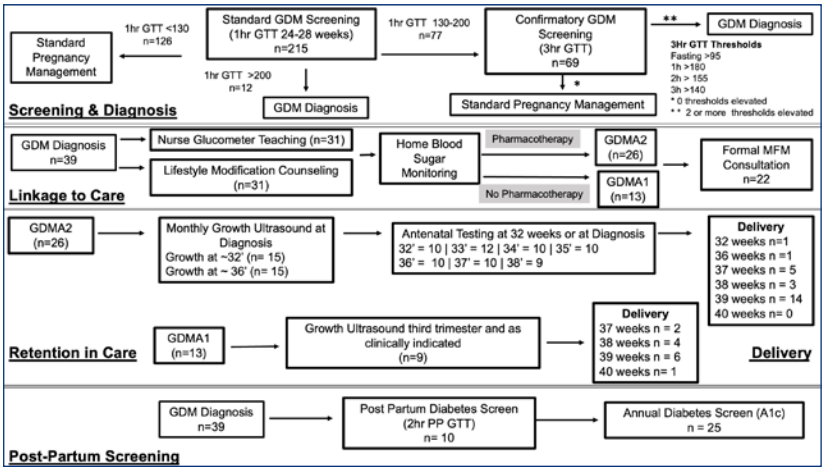
Sociodemographic data are summarized in **Table 1**. Patients with GDM were older than those without GDM at presentation to care: the median age of those without GDM was 26 years (IQR 22–32 years) and the median age of those with GDM was 31 years (IQR 29–35 years) – those with GDMA1 had a median age of 31 years (IQR 30–35 years) and those with GDMA2 had a median age of 31.5 years (IQR 28–34 years). A statistically significant difference in average age existed between at least two of the GDM groups ($F(2,221) = [11.82]$, $p < 0.001$). Statistically significant relationships

Table 1. Description of a sample of pregnant patients who initiated prenatal care at Blackstone Valley Community Health Care (BVCHC) between January 1, 2019 and December 31, 2021 (n=298)

	Total Sample (n = 298)	GDMA1 (n = 13)	GDMA2 (n = 26)	No GDM (n = 185)	ANOVA Chi- Squared *p-value*
Mean age at presentation (years)	28.36 (6.27)	33.08 (1.36)	31.27 (0.91)	27.04 (0.44)	F= 11.82 *P<0.001*
Marital Status					χ^2= 13.86
Single	51.34% (153)	46.15% (6)	42.31% (11)	50.27% (93)	*p=0.031*
Married	20.81% (62)	15.38% (2)	30.77% (8)	19.46% (36)	
Divorced/Separated	1.68% (5)	15.38% (2)	3.85% (1)	1.08% (2)	
Other	2.01% (6)	0% (0)	3.85% (1)	1.08% (2)	
Missing Data	24.16% (72)	23.08% (3)	19.23% (5)	28.11% (52)	
Race					χ^2= 9.3160
White	35.23% (105)	30.77% (4)	46.15% (12)	33.51% (62)	*p=0.157*
Black/African American	23.49% (70)	15.38% (2)	7.69% (2)	24.32% (45)	
Other Race*	2.01% (6)	0% (0)	0% (0)	2.16% (4)	
More than one race	6.71% (20)	23.08% (3)	7.69% (2)	5.41% (10)	
Missing Data	32.55% (9)	30.77% (4)	38.46% (10)	34.59% (64)	
Ethnicity					χ^2= 0.2703
Hispanic or Latino	65.77% (196)	76.92% (10)	69.23% (18)	68.11% (126)	*p=0.87*
Not Hispanic or Latino	28.19% (84)	23.08% (3)	23.08% (6)	27.03% (50)	
Missing Data	6.04% (18)	0% (0)	7.69% (2)	4.86% (9)	
Preferred Language					χ^2= 8.40
English	49.66% (148)	15.38% (2)	42.31% (11)	47.03% (87)	*p=0.40*
Spanish	43.75% (42)	69.23% (9)	50% (13)	45.41% (84)	
Portuguese	1.04% (1)	7.69% (1)	3.85% (1)	1.08% (2)	
Cape Verde Creole	7.29% (7)	7.69% (1)	3.85% (1)	5.95% (11)	
French	0.34% (1)	0% (0)	0% (0)	0.54% (1)	

* Other race includes American Indian/ Alaska Native (AI/AN), Asian, and Other Pacific Islander
Missing data >5% | *p<0.1* indicates statistical significance

Figure 2. Losses Along the Gestational Diabetes Mellitus (GDM) Care Cascade in a Sample of Pregnant Patients With and Without Gestational Diabetes Mellitus Who Initiated Prenatal Care at Blackstone Valley Community Health Care (BVCHC) Between January 1, 2019 and December 31, 2021 (n=298).



also existed between marital status and GDM status. A higher proportion of patients with GDM were divorced or separated (χ^2 (6, *N*=164) = 13.86, *p*=0.031). No significant association between GDM category and race, ethnicity, or preferred language was found.

Risk factor and outcomes data are summarized in **Table 2**. A higher proportion of patients with a history of GDM in a prior pregnancy were diagnosed with GDM in the pregnancy evaluated (χ^2 (6, *N*=164) = 13.86, *p*=0.031). In addition, patients with a higher initial body mass index (BMI) were diagnosed with GDM and required pharmacotherapy. Statistically significant differences in average gravidity and parity for at least two of the GDM groups existed – those in the GDM group had higher gravidity and parity. There was no statistically significant difference in average initial hemoglobin A1c and GDM diagnosis. A higher proportion of patients with GDM had comorbid hypertensive disorders in pregnancy (23.08% in GDMA1 vs 28% in GDMA2 vs 14.04% without GDM, p=0.16). A higher proportion of patients with GDM had large for gestational age fetuses (16.67% for GDMA1 vs 13.04% for GDMA2 vs 7.47% without GDM, p=0.274). Neither of these relationships were statistically significant. While the proportion of patients who had spontaneous vaginal deliveries were similar across all GDM categories, proportionately more patients with GDM had cesarean deliveries, both planned and unplanned, though this relationship was not statistically significant. The proportion of perineal laceration associated with vaginal delivery was similar across GDM categories and a statistically significant relationship did not exist.

Care cascade outcomes are illustrated in **Figure 2**. Of the 298 pregnant patients included in the sample, 222 patients were included in the care cascade evaluation as some patients in the sample had an early pregnancy loss or transferred out of the practice prior to GDM

Table 2. Description of risk factors and outcomes of a sample of pregnant patients with and without Gestational Diabetes Mellitus (GDM) who initiated prenatal care at Blackstone Valley Community Health Care (BVCHC) between January 1, 2019 and December 31, 2021 (n=298)

	Total Sample (n = 298)	GDMA1 (n = 13)	GDMA2 (n = 26)	No GDM (n = 185)	ANOVA Chi- Squared *p-value*
Risk Factors & Pregnancy Outcomes					
GDM in prior pregnancy	11.34% (22)	33.33% (4)	33.33% (6)	3.39% (4)	χ^2= 32.18 *p<0.001*
Initial Hemoglobin A1c**	5.48 (0.72)	5.44 (0.124)	5.49 (0.08)	5.31 (0.035)	F = 2.59 *p=0.08*
Initial Body Mass Index#	29.49 (6.93)	28.85 (1.50)	34.21 (1.53)	28.76 (0.53)	F = 6.81 *p=0.001*
Gravidity%	2.90 (1.63)	4.15 (0.41)	3.58 (0.37)	2.71 (0.11)	F = 8.37 *p < 0.001*
Parity%%	1.35 (1.34)	2.46 (0.60)	1.92 (0.34)	1.18 (0.08)	F = 9.30 *p = 0.001*
Comorbidities in Pregnancy					
Hypertensive Disorders of Pregnancy+	16.44% (37)	23.08% (3)	28% (7)	14.04% (25)	χ^2= 3.63 *p=0.16*
Large for Gestational Age Fetus++	6.71% (20)	16.67% (2)	13.04% (3)	7.47% (13)	χ^2= 5.13 *0.274*
Small for Gestational Age Fetus++	6.38% (19)	16.67% (2)	0% (0)	8.62% (15)	
Risk Factors & Pregnancy Outcomes					
Spontaneous Vaginal Delivery	72% (162)	61.54% (8)	66.67% (16)	75.28% (134)	χ^2= 2.84 *p=0.828*
Operative Vaginal Delivery+++	0.89% (2)	0% (0)	0% (0)	1.12% (2)	
C-Section (planned)	12.44% (28)	23.08% (3)	16.67% (4)	11.80% (21)	
C-Section (unplanned)	14.67% (33)	15.38% (2)	16.67% (4)	11.8% (21)	
Mean Gestational Age at Delivery (weeks)	38.68 (1.97)	38.46 (0.24)	38.04 (0.33)	38.94 (0.11)	F = 4.43 *p = 0.013*
Delivery Complications					
First or Second Degree Laceration	41.94% (91)	30.77% (4)	36.36% (8)	44.77% (77)	χ^2= 2.24 *p=0.691*
Third or Fourth Degree Laceration	1.38% (3)	0% (0)	0% (0)	1.74% (3)	

Missing data >5% | *p<0.1* indicates statistical significance

**Hemoglobin A1c is a mode of screening for diabetes mellitus. This value was obtained immediately pre-conception or at presentation to care. A value of <5.7 indicates no diagnosis of diabetes, a value ranging from 5.7 -6.5 indicates a diagnosis of pre-diabetes. A value greater than 6.5 is diagnostic for diabetes mellitus[2]. Those with a pre-pregnancy or initial A1c in the pre-diabetes range are considered at high risk for developing GDM[1]

Body mass index is a proportional measurement of weight to height and is used as a measurement of body fat[32]. Those with a BMI over 25 are considered at high risk of developing GDM[1].

% Gravidity is the number of times a person has been pregnant including the current pregnancy

%%Parity is the number of deliveries of a fetus greater than 24 weeks gestation

+Hypertensive disorders of pregnancy represent a spectrum of disorders associated with high blood pressure in pregnancy. This includes gestational hypertension, pre-eclampsia with or without severe features and eclampsia[33].

++Large for gestational age fetuses are those in greater than the 90th percentile for estimated fetal weight for gestational age. Small for gestational age fetuses are those in less than the 10th percentile for estimated fetal weight for gestational age[34].

+++Operative vaginal delivery includes vaginal delivery with vacuum or forceps assistance.

screening. Of the 222 patients included in care cascade evaluation, 215 (96.8%) underwent gestational diabetes mellitus screening. Seventy-seven people (35.8%) required additional three-hour glucose tolerance testing for screening, of which 69 people (89.6%) completed. A total of 39 people (17.57%) were diagnosed with gestational diabetes. Of those who underwent screening, 166 (77.2%) completed screening by 28 weeks gestation.

Of the 39 patients in this sample diagnosed with GDM, 31 (79.5%) underwent glucometer and lifestyle modification education. Ultimately, 26 (66.67%) required pharmacotherapy (GDMA2). For those managed with diet and lifestyle alone (GDMA1), 9 (80%) had documented completion of a growth ultrasounds by 36 weeks gestation. Approximately half of the patients diagnosed with GDMA2 had documented growth ultrasounds and antenatal testing according to guidelines. A total of 24 (92.3%) patients with GDMA2 had consultation with MFM and 3 (11.5%) patients required

transfer of care. All but one patient with GDM delivered by 39 weeks gestation; one patient delivered at 40 weeks gestation had declined induction of labor at 39 weeks.

Approximately a quarter (25.6%) of patients had documented post-partum diabetes screening with a two-hour glucose tolerance test. Twenty-five (64.1%) of the 39 patients with GDM had a hemoglobin A1c level drawn one-year post-partum. The average A1c one-year post-partum of patients with GDM was 5.6 (range 4.9–6.3; standard deviation of 0.41).

DISCUSSION

This three-year retrospective chart review sought to apply the care cascade framework to GDM management in a specialist supported primary care model at a community-based health center. The sample analyzed in this study represents a large underserved population in Rhode Island: 23% of patients identified as Black or African American, 65.8% of patients identified as Hispanic or Latinx and more than half had limited English proficiency. This represents a population with significant barriers to care and thus are at higher risk for not only developing GDM but also suffering adverse obstetrical outcomes related to this diagnosis.[7,8,10,26]

GDM complicated about 17% of pregnancies in this sample, more than twice that of 2020 national and state level estimates.[3,27] Prior studies that suggest patients who are non-US born or identify as racial and or ethnic minorities are more likely to develop GDM,[4–6] but there were no statistically significant relationships for race, ethnicity and preferred language and GDM in this study. This study did find that patients with GDM had proportionately more concurrent hypertensive disorders in pregnancy, fetal growth abnormalities, and delivery via cesarean delivery, consistent with known adverse effects of GDM in pregnancy.[1] These findings may be mediated by significant barriers to accessing culturally sensitive and linguistically competent care, however, this could not be tested within this study; Additionally, these findings might also point to the degree to which GDM management is a significant burden for the patient and the healthcare organization.[7]

This specialist-supported primary care model achieved timely screening and diagnosis of GDM, linkage to care, and retention in care during pregnancy. This study also showed this model achieved appropriate linkage to care. With respect to retention in care, 92.3% of patients with GDMA1 and 100% of patients with GDMA2 delivered by 39 weeks gestation in this care model, demonstrating high retention in care. In addition, more than 90% of patients with GDMA2 had documented consultations with MFM, also supporting high retention in care.

The greatest documented losses in the care cascade occurred post-partum. Of the 39 patients with GDM, only 25.6% had documentation of post-partum screening. Prior literature has also shown that barriers exist for patients in completing two-hour glucose tolerance testing postpartum, consistent with the findings in this study.[25] Given long term health risks associated with GDM,[28-30] post-partum screening and subsequent linkage to primary care represents a critical area of further inquiry.

Limitations

Two major limitations exist in this study. First, data was collected only from the health center electronic health record. For this reason, imaging and laboratory testing performed outside of the facility may not have been captured in this review. Similarly, labor and delivery records were inconsistently available in the health center electronic health records so limited maternal and neonatal outcomes could be studied. Electronic health center records also do not capture other potentially mediating factors, such as household income. Secondly, retrospective chart review is limited in that only losses in the care cascade can be identified, reasons for those losses cannot be systematically evaluated. Qualitative methods may be used in future research to more comprehensively explore the reasons for care cascade losses. One final limitation is that this study took place during the COVID-19 pandemic when hybrid services (e.g., telehealth and in person) were offered. Pregnant patients were prioritized for laboratory and diagnostic services, but it is possible that screening and imaging completion rates were impacted during this period. Further studies within other health centers are warranted to compare our cascade outcomes to other settings after the pandemic.

CONCLUSION

This study sought to assess GDM care cascade outcomes in a large underserved patient population in a specialist supported primary care model. Many of the patients included identify as racial and ethnic minorities, are non-US born, and many prefer a language other than English, all known risk factors for the development of GDM and for adverse outcomes related to GDM. This study specifically focuses on timely diagnosis and screening, appropriate linkage into care including referral to MFM, and retention through the care cascade. Literature clearly shows that timely diagnosis and adequate treatment of GDM can reduce adverse maternal and neonatal outcomes, and thus this is an important study to add to the growing literature about GDM outcomes among high-risk populations.

Moreover, the Association of American Medical Colleges estimates that 50% of counties in the United States lack an obstetrician.[31] Community health centers exist as part of the United States healthcare safety net and serve patients in rural regions and those who face other structural barriers to care. Specialist-supported primary care models like the one studied here may provide a key to managing the growing

population of patients with GDM in light of specialist shortages. Future research must account for long-term health risks associated with GDM and therefore must also assess linkage to primary care in order to improve outcomes not just in pregnancy but over a lifetime.

References

1. ACOG Practice Bulletin No. 190: Gestational Diabetes Mellitus. Obstetrics and gynecology 2018;131(2):e49–64.
2. Association AD. 14. Management of Diabetes in Pregnancy: Standards of Medical Care in Diabetes–2021. Diabetes Care [Internet] 2021 [cited 2021 Nov 13];44(Supplement 1):S200–10. Available from: https://care.diabetesjournals.org/content/44/Supplement_1/S200
3. Gregory ECW, Ely DM. National Vital Statistics Reports Volume 71, Number 3 July 19, 2022. National Vital Statistics Reports 2016;71(3).
4. Shah NS, Wang MC, Freaney PM, et al. Trends in Gestational Diabetes at First Live Birth by Race and Ethnicity in the US, 2011-2019. JAMA [Internet] 2021 [cited 2022 Sep 17];326(7):660–9. Available from: https://pubmed.ncbi.nlm.nih.gov/34402831/
5. Yuen L. Gestational diabetes mellitus: Challenges for different ethnic groups. World J Diabetes 2015;6(8):1024.
6. Venkatesh KK, Lynch CD, Powe CE, et al. Risk of Adverse Pregnancy Outcomes Among Pregnant Individuals With Gestational Diabetes by Race and Ethnicity in the United States, 2014-2020. JAMA [Internet] 2022 [cited 2022 Sep 17];327(14):1356–67. Available from: https://pubmed.ncbi.nlm.nih.gov/35412565/
7. Daneshmand SS, Stortz S, Morrisey R, Faksh A. Bridging Gaps and Understanding Disparities in Gestational Diabetes Mellitus to Improve Perinatal Outcomes. Diabetes Spectr [Internet] 2019 [cited 2022 Dec 1];32(4):317. Available from: /pmc/articles/PMC6858080/
8. Nguyen BT, Cheng YW, Snowden JM, Esakoff TF, Frias AE, Caughey AB. The effect of race/ethnicity on adverse perinatal outcomes among patients with gestational diabetes mellitus. 2012 [cited 2022 Nov 19];Available from: http://dx.doi.org/10.1016/j.ajog.2012.06.049
9. Esakoff TF, Caughey AB, Block-Kurbisch I, Inturrisi M, Cheng YW. Perinatal outcomes in patients with gestational diabetes mellitus by race/ethnicity. J Matern Fetal Neonatal Med [Internet] 2011 [cited 2025 Apr 16];24(3):422–6. Available from: https://pubmed.ncbi.nlm.nih.gov/20642385/
10. Kragelund Nielsen K, Andersen GS, Damm P, Andersen AMN. Gestational Diabetes Risk in Migrants. A Nationwide, Register-Based Study of all Births in Denmark 2004 to 2015. J Clin Endocrinol Metab [Internet] 2020 [cited 2022 Nov 19];105(3):e692–703. Available from: https://academic.oup.com/jcem/article/105/3/e692/5707566
11. Crowther CA, Hiller JE, Moss JR, McPhee AJ, Jeffries WS, Robinson JS. Effect of treatment of gestational diabetes mellitus on pregnancy outcomes. N Engl J Med [Internet] 2005 [cited 2022 Sep 17];352(24):2477–86. Available from: https://pubmed.ncbi.nlm.nih.gov/15951574/
12. Kaptein S, Evans M, McTavish S, et al. The Subjective Impact of a Diagnosis of Gestational Diabetes Among Ethnically Diverse Pregnant Women: A Qualitative Study. Can J Diabetes 2015;39(2):117–22.
13. Asiedu-Danso M, Kretchy IA, Sekyi JK, Koduah A. Adherence to Antidiabetic Medications among Women with Gestational Diabetes. J Diabetes Res [Internet] 2021 [cited 2022 Sep 21];2021. Available from: https://pubmed.ncbi.nlm.nih.gov/34395632/
14. Nicholson WK, Beckham AJ, Hatley K, et al. The Gestational Diabetes Management System (GooDMomS): Development, feasibility and lessons learned from a patient-informed, web-based pregnancy and postpartum lifestyle intervention. BMC Pregnancy Childbirth [Internet] 2016 [cited 2022 Sep 21];16(1):1–13. Available from: https://bmcpregnancychildbirth.biomedcentral.com/articles/10.1186/s12884-016-1064-z
15. Yee L, Taylor S, Young M, Williams M, Niznik C, Simon M. Evaluation of a Text Messaging Intervention to Support Self-Management of Diabetes During Pregnancy Among Low-Income, Minority Women: Qualitative Study. JMIR Diabetes [Internet] 2020 [cited 2022 Feb 12];5(3):e17794. Available from: http://www.ncbi.nlm.nih.gov/pubmed/32773367
16. Yee LM, Leziak K, Jackson J, et al. Patient and Provider Perspectives on a Novel Mobile Health Intervention for Low-Income Pregnant Women With Gestational or Type 2 Diabetes Mellitus. J Diabetes Sci Technol 2020;15(5):1121–33.
17. Koivusalo SB, Rönö K, Klemetti MM, et al. Gestational Diabetes Mellitus Can Be Prevented by Lifestyle Intervention: The Finnish Gestational Diabetes Prevention Study (RADIEL): A Randomized Controlled Trial. Diabetes Care [Internet] 2016 [cited 2025 Apr 16];39(1):24–30. Available from: https://pubmed.ncbi.nlm.nih.gov/26223239/
18. Seol H, Thompson M, Kreider KE, Vorderstrasse A. Diabetes Self-management Quality Improvement Initiative for Medically Underserved Patients. J Nurs Care Qual [Internet] 2017 [cited 2025 Apr 16];32(3):272–9. Available from: https://pubmed.ncbi.nlm.nih.gov/27875381/
19. Laurie JG, Wilkinson SA, Griffin A, McIntyre HD. GDM care re-imagined: Maternal and neonatal outcomes following a major model of care change for gestational diabetes mellitus at a large metropolitan hospital. Aust N Z J Obstet Gynaecol [Internet] 2023 [cited 2025 Apr 16];63(5):681–8. Available from: https://pubmed.ncbi.nlm.nih.gov/37101250/
20. Ali MK, Bullard KMK, Gregg EW, Del Rio C. A cascade of care for diabetes in the United States: Visualizing the gaps. Ann Intern Med 2014;161(10):681–9.
21. Mudge J, Amado D. MARCH 2022 Blackstone Valley Community Heath Care Service Area Report 2.
22. NextGen Healthcare: EHR/EMR and RCM Software Solutions [Internet]. [cited 2022 Oct 4];Available from: https://www.nextgen.com/
23. Yee LM, McGuire JM, Taylor SM, Niznik CM, Simon MA. "I was tired of all the sticking and poking": Identifying barriers to diabetes self- care among low- income pregnant women. J Health Care Poor Underserved 2015;26(3):926–40.
24. Yee LM, McGuire JM, Taylor SM, Niznik CM, Simon MA. Factors promoting diabetes self-care among low-income, minority pregnant women. J Perinatol [Internet] 2016 [cited 2022 Feb 12];36(1):13–8. Available from: https://pubmed.ncbi.nlm.nih.gov/26513455/
25. Carter EB, Martin S, Temming LA, Colditz GA, Macones GA, Tuuli MG. Early versus 6-12 week postpartum glucose tolerance testing for women with gestational diabetes. Obstet Gynecol Surv 2018;73(7):389–91.
26. Kragelund Nielsen K, Andersen GS, Damm P, Nybo Andersen AM. Migration, Gestational Diabetes, and Adverse Pregnancy Outcomes: A Nationwide Study of Singleton Deliveries in Denmark. J Clin Endocrinol Metab [Internet] 2021 [cited 2022 Nov 19];106(12):e5075–87. Available from: https://academic.oup.com/jcem/article/106/12/e5075/6323255
27. Giang L, Gjelsvik A, Cain R, Paine V. Gestational diabetes in Rhode Island. R I Med J (2013) 2013;96(4):45–8.
28. Minhas AS, Countouris M, Ndumele CE, et al. Association of Gestational Diabetes With Subclinical Cardiovascular Disease. JACC Advances [Internet] 2024 [cited 2025 Apr 16];3(8). Available from: https://pubmed.ncbi.nlm.nih.gov/39105123/
29. Minhas AS, Ying W, Ogunwole SM, et al. The Association of Adverse Pregnancy Outcomes and Cardiovascular Disease: Current Knowledge and Future Directions. Curr Treat Options Cardiovasc Med [Internet] 2020 [cited 2025 Apr 16];22(12). Available from: https://pubmed.ncbi.nlm.nih.gov/35296064/

30. Echouffo-Tcheugui JB, Guan J, Fu L, Retnakaran R, Shah BR. Incidence of Heart Failure Related to Co-Occurrence of Gestational Hypertensive Disorders and Gestational Diabetes. JACC Adv. 2023 Jun;2(4):100377. doi: 10.1016/j.jacadv.2023.100377. Epub 2023 Jun 30. PMID: 37476567; PMCID: PMC10358333.
31. Labor pains: The OB-GYN shortage | AAMC [Internet]. [cited 2022 Dec 1];Available from: https://www.aamc.org/news-insights/labor-pains-ob-gyn-shortage
32. Calculate Your BMI - Standard BMI Calculator [Internet]. [cited 2022 Dec 10];Available from: https://www.nhlbi.nih.gov/health/educational/lose_wt/BMI/bmicalc.htm
33. Gestational Hypertension and Preeclampsia: ACOG Practice Bulletin, Number 222. Obstetrics and gynecology 2020;135(6):e237–60.
34. Moraitis AA, Wood AM, Fleming M, Smith GCS. Birth weight percentile and the risk of term perinatal death. Obstetrics and Gynecology 2014;124(2 PART1):274–83.

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