Bridging Gaps and Understanding Disparities in Gestational Diabetes Mellitus to Improve Perinatal Outcomes

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IN BRIEF For a woman who is facing financial, cultural, psychological, or social challenges, discovering that she has gestational diabetes mellitus (GDM) represents a significant burden. By better understanding challenges underserved women with GDM face, multidisciplinary clinical teams can make essential changes in health care delivery to optimize outcomes not just during pregnancy, but also, equally importantly, beyond pregnancy to prevent long-term disease.

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Gestational diabetes mellitus (GDM), or glucose intolerance after 24 weeks' gestation, affects public health in the United States and worldwide (1). GDM increases maternal and neonatal risks, predisposing women and their children to chronic health problems such as type 2 diabetes, recurrent GDM in subsequent pregnancies, and cardiovascular disease (2). In the United States, GDM affects ~1–18% of pregnancies, with up to 70% of these women developing type 2 diabetes later in life (2–4). Minority women are up to two times more likely than white women to have GDM (2), and U.S. Native Americans, Asians, Hispanics, and African-American women are at higher risk for GDM (3,5–9), with similar patterns seen in Canada (10). Rates of GDM increased in the past 20 years by 10–100% among various ethnic groups (11). Low-income populations often lack affordable and dependable access to medical care and more frequently have concomitant diagnoses of GDM and obesity (12).

A study of the California Sweet Success program identified ethnic variations in perinatal outcomes of pregnancies complicated by GDM (13). Compared to whites, African Americans with GDM experienced higher rates of a primary cesarean delivery and higher odds of intrauterine fetal demise (13). Women with lower education levels diagnosed with GDM were more likely to deliver a macrosomic infant (14).

Because women in low-income, ethnic minority groups are more likely to have GDM, understanding how this diagnosis is experienced in these vulnerable populations helps to bridge gaps in health care delivery and promote positive behavior change (15). Patient narratives in several studies reveal that suboptimal diabetes care is influenced by limited medical access, financial concerns, poor postpartum follow-up, communication barriers, psychological stressors, low health literacy, and discordant perceptions between health care professionals and patients (2,8,15–19). Other obstacles cited include affordability of healthy foods, violence preventing food access and exercise, household instability, transportation challenges, demands of frequent medical appointments, and lack of a consistent schedule (18). Data suggesting a relationship between immigrant status and decreased odds of insulin treatment further illustrate potential barriers (16). Higher out-of-pocket cost for diabetes medications is strongly associated with poor medication adherence (20), and cultural traditions surrounding meals can affect adherence to medical nutrition therapy (MNT) (21).

Diagnostic Challenges

Diabetes professional societies and the American College of Obstetricians and Gynecologists (ACOG) publish risk factors for early GDM. The extensive list of risk factors includes a history of GDM in a previous pregnancy, conditions of impaired glucose tolerance (IGT) (e.g., polycystic ovary syndrome), a first-degree relative with type 2 diabetes, and a history of delivering an infant weighing ≥9 lb, among others (1). ACOG screening recommendations, adapted from those of the American Diabetes Association (ADA), recognize the lower BMI threshold for Asian Americans to be considered overweight (BMI 23 kg/m^2) (22). Risk factors alone may not identify patients who may develop GDM; in one cohort of >6,000 women, 44% of women diagnosed with GDM did not have a risk factor (23). Patient reporting may contribute to an underestimation of risk. Evidence suggests that nuances exist in assessing the risk for GDM with a family history of type 2 diabetes, with risk increasing twofold with a parental history of type 2 diabetes but fivefold with a sibling history of the disease (3). Other early predictors of risk for GDM include a chaotic lifestyle and receiving Supplemental Nutrition Assistance Program benefits (24).

Recently, a novel GDM risk prediction model using maternal lipid markers in the first trimester of pregnancy showed that expression of glucose, triglycerides, leptin, and lipocalin-2 was higher, and adiponectin and pregnancy-associated plasma protein-A levels were lower, in women with GDM (25). While promising, the strongest associations for GDM risk were family history, previous GDM, South East Asian ethnicity, parity, and higher BMI. This study contributed to the growing evidence of ethnic and racial differences in risk factors for and possibly the pathogenesis of GDM. For example, leptin was significantly higher in white women diagnosed with GDM, whereas triglycerides were significantly higher in South East Asians with GDM. Future predictive models with biochemical markers must evaluate for effectiveness across ethnic groups.

A systematic review found that postpartum IGT, insulin therapy during pregnancy, higher BMI, obesity, and postpartum weight gain were associated with developing type 2 diabetes after a GDM diagnosis (26). Although some of these studies examined type 2 diabetes risk across ethnic groups, none analyzed risk among African Americans or Arabic women (26). Traditional screening methods for type 2 diabetes use the same tests (A1C, fasting plasma glucose, and the oral glucose tolerance test [OGTT]) across all races and ethnicities, but conditions such as thalassemia, which tend to cluster in ethnic groups, can artificially raise A1C levels (27).

Professional societies disagree on the best method for testing and diagnosing GDM. The two most common methods are the one-step 75-g, 2-hour glucose challenge test or a two-step screening process starting with a 50-g screening glucose load, followed by a 100-g, 3-hour glucose challenge test. Recent data suggest that the one-step screening method may be more efficacious for decreasing maternal and neonatal morbidity (28–30). A 2017 Cochrane review examined these methods of administering the glucose load, with the only significant difference being that women screened with the 2-hour glucose test were 2.55 times more likely to be diagnosed with GDM than those screened with the two-step screening process (31). ACOG cites two diagnostic approaches, the Carpenter and Coustan conversion and the National Diabetes Data Group conversion (Table 1) (1). The cutoffs for each system differ but generally require that two or more values be at or above thresholds (1). Determining the ideal method of screening for GDM, as well as the best diagnostic criteria to use to optimize perinatal outcomes, is ripe for investigation (1).

For women with hourly-wage jobs, the convenience of a one-step test may alleviate the financial burden of prenatal care by decreasing the amount of work missed (31). The decreased time burden of the one-step test may be offset by the need to fast before the 2-hour test, which may decrease compliance. Outside the United States, universal screening may also be hindered in areas where the costs of

TABLE 1. Diagnostic Glucose Criteria for GDM

	Carpenter and Coustan Conversion	National Diabetes Data Group Conversion
Glucose, mg/dL		
Fasting	95	105
1 hour	180	190
2 hours	155	165
3 hours	140	145

screening are assumed by patients. A cross-sectional study from Germany found a markedly increased uptake in GDM screening when it was provided free of charge. This change resulted in higher rates of GDM diagnosis among low-income women (32). No reliable cost analysis comparing the two screening methods exists.

Women with GDM need evaluation for IGT 4–12 weeks postpartum (1). However, rates of postpartum testing are abysmally low, with one medical center reporting 23.4% of women receiving any glucose test within 6 months after delivery, and only 7% receiving the OGTT. Additionally, patients' low perception of their risk for future type 2 diabetes may hinder follow-up glucose testing (2); although 9 in 10 women in a large cohort study voiced understanding that GDM increases their risk of type 2 diabetes, less than half recognized that GDM placed them at a high risk of developing the disease (33). We must individualize GDM care considering not only patients' socioeconomic status, but also environmental barriers such as food insecurity, the level of chaos in a woman's life, and available support from family, community, or peers (19,24,34).

Optimizing Care

The ADA recommends that women diagnosed with GDM receive services addressing lifestyle management and, if necessary, pharmacologic therapy (35). MNT provided by a registered dietitian is recommended for all women diagnosed with GDM (35). Support programs should focus on patients' specific needs and on building confidence in tasks patients may feel ill-equipped for such as reading nutrition labels, making healthy choices when facing food insecurity, applying cultural preferences with diet recommendations, maintaining a schedule supportive of healthy habits, and incorporating diabetes care into existing family and social situations (18). Women with GDM need social support to achieve successful behavior modification and diabetes care goals (18,33,36). Minimal information exists regarding the impact of multidisciplinary care teams on GDM outcomes (37).

Recommendations for self-care must be realistic and consider resources available to each woman (38) and that women who are obese may perceive an additional burden with a GDM diagnosis (39). Women with lower socioeconomic status who are diagnosed with GDM and obesity reported concern that expectations set by their health care providers were unrealistic; they also felt stigmatized not only by their health care professional, but also by society because they were both obese and diagnosed with GDM (39). Perceived major obstacles to GDM care across ethnic groups include communication barriers and the quality of the health care available (19). Diabetes nurse educators in Australia revealed gaps in the approach to supporting successful self-management of GDM, possibly attributable to the structure of the health care system (9). Diabetes educators may feel overwhelmed given limited resources and available time to adequately educate patients. Finally, at the community level, nurse educators can consider promoting awareness of GDM as a means of encouraging early behavior modifications (9).

The burden of GDM includes daily monitoring of fasting and 1-hour postprandial blood glucose for a total of four data points per day (1). Continuous glucose monitoring (CGM), more commonly used in patients with type 1 or type 2 diabetes, may potentially decrease the patient burden in a GDM pregnancy and provide effective monitoring after pregnancy. Some studies in the pregestational type 1 diabetes population have used CGM with promising results, but further investigation is needed (40,41). When blood glucose targets (Table 2) are not met with dietary changes, physical activity, and weight management strategies, then pharmacologic therapy is advised. Insulin is preferred when treating hyperglycemia in GDM; oral agents such as metformin or glyburide are not recommended as first-line agents because of a lack of long-term safety data (35). The multicenter, randomized Insulin Daonil (INDAO) trial investigated the use of glyburide versus insulin on perinatal outcomes of >900 women with GDM in France. Its results could not justify the use of glyburide as a first-line agent in treating GDM (42).

Current recommendations for exercise in GDM reflect standard care: 30 minutes of moderate-intensity aerobic exercise at least 5 days per week or a minimum of 150 minutes per week (1). One random-

TABLE 2. ADA and ACOG Glycemic Targets in Pregnancy

Blood glucose level, mg/dL (mmol/L)	
Fasting	95 (5.3)
and *either* 1-hour postprandial	140 (7.8)
or 2-hour postprandial	120 (6.7)

ized trial evaluating physical activity demonstrated that, in women at risk for GDM, implementing and sustaining activity was difficult for women who lacked support from family or others (43).

Technological methods can help patients manage GDM. An online dietary assessment tool showed promise for GDM care as a means to track food consumed throughout the day (44) but has limited generalizability because the demographic studied was largely white. The STAR MAMA program links mothers who are participating in a diabetes prevention program to telemedicine support (45). Programs such as Dulce Digital have shown success in a low-income Hispanic population by using cell phone technology to provide patient reminders about blood glucose monitoring and healthy eating (46). Web-based education on healthy diet and lifestyle also show potential but need to be studied in diverse populations (47).

Health coach–facilitated virtual visits and use of Cloud-based glucose monitoring systems provide cost-effective interventions to enhance access to intensive diabetes care in high-risk populations (48). EMPATHy, a program with interactive education models and integration within an established community health program, is hypothesized to improve medication adherence in a vulnerable Hispanic population (49).

Models for Care

Successful quality improvement initiatives addressing racial and ethnic disparities in adult diabetes care can serve as a model for GDM care. In a high-risk Latino population, a comprehensive program with diabetes-specific infrastructure such as certified diabetes educator visits, diabetes group visits, appointment of a diabetes director, and several other interventions demonstrated improved glycemic control and reduced racial/ethnic disparities (37). Other successful programs include REACH 2010 (Racial and Ethnic Approaches to Community Health 2010), Alliance to Reduce Disparities in Diabetes, the Health Disparities Collaborative, and the Diabetes Quality Improvement Project (27). A diabetes prevention program for Hispanic women with a history of GDM demonstrated notable improvements in lipid profiles, blood pressure, physical activity, nutrition, and attitudes toward preventive care (50).

Lifestyle interventions have demonstrated positive outcomes in the prevention of GDM. The RADIEL (Finnish Gestational Diabetes Prevention Study) trial showed that women who received counseling on diet and exercise and met with a registered dietitian were more physically active and had improved quality of dietary intake. The women who received the diet and exercise intervention had a lower incidence of GDM than those in the control group (51). Similarly, assigning an exercise program to Chinese pregnant women who were overweight or obese early in gestation reduced rates of GDM without an increase in preterm birth (52). Other interventions include a "coached care" model, which matches coaches to a patient's language and ethnicity in a disadvantaged Mexican-American cohort to assist with patient engagement at medical visits (49) and a community health worker model to provide education, community resources, and navigation through the health care system for low-income individuals with type 2 diabetes (53). Emphasizing disease prevention, peer-led education sessions for Hispanic women at high risk for type 2 diabetes improved dietary behavior and stress and reduced depression symptoms (54). There is potential in the GDM population to mirror successful interventions demonstrated in patients with type 2 diabetes with the goal of offering culturally appropriate diabetes care through lifestyle modification and coaching.

African-American women with GDM are at higher risk for breastfeeding cessation (19), and patients with GDM in general may not understand the relationship between breastfeeding, glycemic control, and type 2 diabetes prevention (19). Mood disorders affect a woman's self-care during pregnancy and beyond, and minority women are more likely to experience postpartum depression (55,56). In low-income Hispanic patients, a decline in depressive symptoms predicted improvement in self-efficacy and compliance with diabetes management (57). This finding suggests that effective GDM care incorporates collaboration with mental health specialists, especially in disadvantaged populations.

Conclusion

GDM programs focusing on education, patient engagement, and improving patients' experience positively influence maternal and fetal outcomes and future disease prevention (48,58). Possible interventions include online dietary trackers (44), smartphone applications for glucose management (59), Web-based education resources to promote healthy behavioral modifications (47), and family- and community-based programs (60). A comprehensive GDM program would ideally be woman-centric, focused on the unique social, financial, and medical concerns and situation of individual patients (Table 3).

Without standard programs for GDM care and with no system to ensure that women with GDM receive appropriate post-delivery monitoring and care for future disease prevention, minority and low-income women with GDM face higher risks for perinatal and long-term poor health outcomes. Innovative programs can harness pregnancy as a time of change to improve patients' health. One study reported that minority women were more likely to make positive health behavior modifications after a GDM diagnosis (10), suggesting that pregnancy offers a window of opportunity for women to make favorable changes in health habits with long-term impli-

TABLE 3. Key Attributes Desirable in a Comprehensive GDM Program

- Affordable and easily accessible diagnostic testing (preconception, antepartum, and postpartum)
- Culturally tailored intervention and education
- Available behavioral health services
- Individualized care
- Support provided for women who need to bring children to health care visits
- Promotion of continuity of care
- Access to transportation for medical care
- Assessment of health literacy and formulation of an appropriate care plan
- Inclusion of lifestyle intervention
- Communication delivered consistently and via a method the woman can consume and understand (e.g., electronic, face-to-face oral, or written)
- Social support and resources to assist with issues of access to healthy foods, violence, and other factors
- Technology used to decrease the burden of traditional face-to-face visits (e.g., telemedicine, virtual visits, or texting)
- Resources available to perform home visits
- Medical care available in geographically accessible locations

cations. Development of standardized programs has the potential to decrease the unequal burden faced by minority women with GDM.

Duality of Interest

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

Author Contributions

S.S.D., S.S., R.M., and A.F. all participated in completing a comprehensive literature search and contributed to writing and reviewing/editing the final manuscript. S.S.D. is the guarantor of this work and, as such, had full access to all of the literature cited and takes responsibility for the integrity and accuracy of the article content.

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