ABSTRACT
Objective: To identify social and environmental barriers to nutrition therapy for diabetes management during pregnancy among a population of low-income, minority pregnant women.

Design: Prospective, in-depth, semi-structured interviews performed serially during pregnancy and continued until thematic saturation was reached.

Setting: Urban academic medical center.

Participants: Ten pregnant low-income, minority women with gestational diabetes and type 2 diabetes mellitus.

Phenomenon of Interest: Social and environmental barriers to nutrition therapy for diabetes management during pregnancy.

Analysis: Qualitative analysis of interview data using electronic coding software was performed using theme analysis.

Results: Participants perceived limited ability and self-efficacy to adopt nutrition recommendations. Specific themes identified as barriers included (1) feeling overwhelmed by the unfamiliar; (2) using and decoding nutrition labels; (3) managing nutrition choices and seeking control in the setting of food insecurity; (4) experiencing lack of control and motivation, and limited self-efficacy; (5) balancing recommendations with taste preferences and cultural food norms; (6) maintaining a healthy eating schedule; and (7) accommodating diabetes in family and social life.

Conclusions and Implications: Pregnant women with diabetes encounter a number of knowledge-based, attitudinal, and resource-related barriers that reduce capacity for nutrition therapy adherence. Provision of culturally informed, practical nutrition support that addresses the needs of women in low-resource communities is an important component of comprehensive diabetes care during pregnancy.

Key Words: pregnancy, medical nutrition therapy, gestational diabetes mellitus, type 2 diabetes mellitus, health disparities (J Nutr Educ Behav. 2016;48:170-180.)

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INTRODUCTION

Diabetes during pregnancy is a growing and significant clinical and public health problem, and as with the obesity epidemic, women in minority communities are disproportionately affected. Type 2 diabetes mellitus (T2DM) and gestational diabetes mellitus (GDM) are both associated with adverse perinatal outcomes and long-term maternal and child health risks. Thus, glycemic control during pregnancy is the primary goal of diabetes-related prenatal care in this setting, and nutrition therapy forms the foundation of care for pregnant women with...
diabetes. However, adoption of nutrition therapy, which requires intensive behavior change and mastery of complex information, is often a significant barrier to successful glycemic control for low-income minority women.

During a pregnancy with diabetes, many specific lifestyle adjustments are recommended over a short period of time. Pregnant women with diabetes must implement an extensive and tailored diet, monitor glucose levels, and attend frequent appointments beyond the usual routine prenatal frequency for maternal and fetal monitoring. Women are challenged to learn to regulate both the quantity and quality of carbohydrate consumption while simultaneously adopting new medication use and exercise behaviors. As clinicians providing care for pregnant women with diabetes, the authors have observed that women in medically and socially underserved communities are challenged with the complexities of diabetes self-management.

Limited existing data have explored barriers to adoption of nutrition recommendations during pregnancy, primarily in international settings. Whereas the literature suggests that women face logistical, social, and knowledge-based barriers while managing diabetes during pregnancy, few reports have investigated nutrition-specific barriers in a medically high-risk population of US women. Thus, this study aimed to investigate nutrition-specific barriers to diabetes self-care among pregnant, low-income, minority women in Chicago. The goal was to apply qualitative methodology to better understand women's experiences with nutrition recommendations during a pregnancy complicated by diabetes, ultimately to identify ways in which care teams can enhance adherence to nutrition therapy guidelines during pregnancy.

METHODS
This prospective observational cohort study used qualitative methodology to investigate the nutrition-related challenges of diabetes self-care during pregnancy. Pregnant women seen at their first visit for GDM or T2DM at an outpatient prenatal clinic in a large urban academic medical center were recruited. This clinic provides obstetric and gynecologic care for low-income women via residents and fellows of the Department of Obstetrics and Gynecology, with faculty supervision. All patients in this clinic received Medicaid-funded prenatal care. English-speaking women over age 18 with GDM or T2DM who were presenting for antenatal care before 30 weeks' gestation were eligible. A convenience sample of women meeting the inclusion criteria was recruited. Participants were identified via clinical care and were invited to participate by in-person interaction with a member of the research team. All women provided written informed consent before study participation. Participants were offered a gift certificate for newborn photography after study completion. Approval was received from the Northwestern University Institutional Review Board.

Sample size was based on the goal of saturation in qualitative research, in which data collected capture the range of experiences and variation in responses in a population. The research team planned a priori to conduct interviews until achievement of saturation. Groups of 2–4 interview transcripts were reviewed as the study progressed to identify and code common themes iteratively.

Brief self-completed surveys identified demographic characteristics and obstetrical history. Participants completed 3 semi-structured, in-person, 30- to 60-minute interviews. Two members of the research team (LMY and JMM) with extensive research interviewing experience conducted all interviews. Both interviewers were multiracial female obstetrician-gynecologist physicians who were not specifically ethnicity-matched to participants; 1 interviewer was briefly involved in the care of patients but performed interviews separately from clinical care. Interviews occurred at study enrollment, after 35 weeks' gestational age, and in the immediate postpartum hospitalization. Longitudinal interviewing was performed optimally to identify barriers arising during the changing requirements of pregnancy. Interviews focused on the individual lived patient experience and her patient-centered perspectives on diabetes management and self-care. Interviews were conducted privately in outpatient clinical rooms, conference rooms, or postpartum hospital rooms. Participants were encouraged to speak freely about their experiences. They were informed there were no right or wrong answers, answers would not affect their medical care, and they were free not to answer questions. Interviews were recorded using a digital audio recorder and transcribed verbatim by the interviewer shortly thereafter. Iterative review of transcripts in early stages of interviewing informed later data collection; the process of reviewing interview responses and exploring emerging themes was performed until saturation occurred.

Cognitive load theory was used as the theoretical framework for this investigation. Cognitive load describes the amount of cognitive demand called for by a particular task. It refers to the amount of mental demand imposed on a person and is related to an individual's working memory and capacity to process novel information. Being a patient requires managing health in the setting of complex learning systems, and such situations can reduce decision-making capacity and present challenges to behavior change. Thus, the researchers proposed that the complexity and intensity of perinatal diabetes management is a high cognitive load state that can make it harder for patients to incorporate health behaviors. Interviews were designed as patient-driven explorations of experiences with the cognitive load elements of diabetes during pregnancy. The research team worked with perinatology specialists to identify the major domains of diabetes care requirements during pregnancy, which were identified as contributors to the cognitive load. The structured interview guide was then designed to address patient experiences with these domains, which included disease knowledge, nutrition management, logistics of care, blood glucose testing, and medication use (Table 1). With regard to the nutrition domain, participants were asked about their experiences with counting carbohydrates, knowing how to choose healthy food, affording a diabetic diet, and reading nutrition labels. This analysis
focused on the nutrition management topics of the interviews.

The researchers conducted qualitative data analysis, including coding, data management, and text retrieval, using ATLAS.ti 6 qualitative data analysis software (Berlin, Germany). Two trained investigators (LMY and SMT) conducted data coding to organize data by themes and sub-themes. The codebook was developed by the primary investigator after extensive familiarization with the data; it was not based on the interview guide. Coding was conducted using an analytical approach for theme generation in which themes emerged during systematic exploration of data rather than using pre-developed hypotheses.\textsuperscript{19,20} Using techniques drawn from the constant comparative method of grounded theory, investigators read and reread transcripts extensively to identify themes generated by the voices of participants. Coding and analysis took place simultaneously to generate a framework systematically to understand the experiences of participants.\textsuperscript{19} The constant comparison of emerging themes with those previously coded allowed for the improvement of existing themes, elucidation of sub-themes, and development of meaning within each theme.\textsuperscript{20} Codes were refined and grouped into larger themes with sub-themes after extensive familiarization with the data.\textsuperscript{21} Coded transcripts were reviewed for inter-reviewer agreement; discussion among the entire research team was used to resolve inconsistencies in interpretation.\textsuperscript{11} Ultimately all members of the investigative team confirmed agreement with the coding scheme. Emergent themes about nutrition-associated barriers were described using illustrative quotations.

**RESULTS**

During the study period (April to August, 2013), 46 new patients with diabetes were scheduled in this clinic.

### Table 1. Domains of Diabetes-Specific Cognitive Load Addressed During Structured Interviews

<table>
<thead>
<tr>
<th>Cognitive load domain</th>
<th>Elements of cognitive load queried</th>
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</table>
| Counseling and disease understanding        | - Understanding basic concepts of diabetes  
- Understanding concepts of increased risk for maternal and fetal morbidity  
- Understanding the rationale and goals for treatment  
- Having a supportive home/cultural environment for diabetes care |
| Nutrition                                   | - Counting carbohydrates  
- Knowing how to choose healthy food  
- Affording a diabetic diet  
- Reading nutrition labels |
| Logistics of care                           | - Attending frequent appointments  
- Managing transportation and childcare needs for appointments  
- Coming to appointments fasting and bringing a breakfast  
- Scheduling appointments with other specialists: eye doctor, electrocardiogram, genetics, ultrasound, laboratories  
- Attending antenatal testing in the third trimester |
| Capillary blood glucose monitoring          | - Remembering the schedule of monitoring/timing with meals  
- Knowing how to check finger sticks  
- Adjusting work or home schedule to allow regular meals and postprandial finger sticks  
- Recording results/maintaining a log of monitoring results  
- Bringing log to clinic |
| Medication use                              | - Picking up prescriptions from pharmacy  
- Drawing up and administering insulin  
- Understanding goals of medication use  
- Timing insulin administration with meals  
- Distinguishing long-acting vs short-acting insulin  
- Understand hypoglycemic precautions/signs  
- Making frequent changes in medication regimen |
and all 22 eligible patients were approached. Ineligible patients were Spanish-speaking or late transfers of care. Of the 22 eligible patients, 12 declined participation owing to time constraints, relocation plans, or a dislike of research. Of the 10 women enrolled, the mean age was 28.5 years (Table 2). The cohort was evenly split between GDM and T2DM. One woman with GDM had experienced GDM in a prior pregnancy, and all of the women with T2DM had been diagnosed within 5 years of pregnancy. Women were largely multiparous (n = 8, 80%). Two of the 10 participants were college graduates.

After the enrollment of 10 participants who underwent 29 interviews (3 interviews per participant except for 1 participant with 2 interviews owing to second-trimester pregnancy termination), all 5 study team members agreed that saturation had been achieved. Participants identified multiple barriers to achieving the goals of nutrition therapy for diabetes self-management. Specific themes identified included (1) feeling overwhelmed by the unfamiliar; (2) using and decoding nutrition labels; (3) managing nutrition choices and seeking control in the setting of food insecurity; (4) experiencing lack of control and motivation, and limited self-efficacy; (5) balancing recommendations with taste preferences and cultural food norms; (6) maintaining a healthy eating schedule; and (7) accommodating diabetes in family and social life. Exemplary quotations are listed in Table 3. Each theme is subsequently discussed in depth.

### Feeling Overwhelmed by the Unfamiliar

Women reporting feeling overwhelmed by the quantity and complexity of unfamiliar nutrition recommendations. Although patients were universally counseled by a Registered Dietitian, diabetes nurse practitioner, and physician after initiation of care, women reported challenges incorporating this new knowledge. For some, this feeling of being overwhelmed was linked to feeling defeated and disengaged. One woman said, "I could eat a hard-boiled egg and my sugar levels will be over 300. How am I supposed to keep that under control?" This participant faced challenges modifying her diet owing to frustration and feeling defeated. Similarly, a multiparous woman with T2DM reported, "To actually go into the store, and it's like there are so many different varieties of things, you don't know which one will be the actual right one for you."

In addition to choosing healthy foods, patients with diabetes are asked to make behavior changes in response to blood glucose results. Despite nutrition education, understanding how to problem-solve these adjustments was difficult. Women were overwhelmed by the modifications they were expected to make in response to glycemic monitoring. In a third-trimester interview, 1 woman described how she was instructed to change her diet based on her glucose monitoring, yet she remained confused: "They gave me a meal plan but I wasn't understanding the total carbohydrates I had to have per meal ... I was a little bit confused."

### Using and Decoding Nutrition Labels

Women experienced multiple challenges with decoding and using nutrition labels. Some participants reported they knew how to count carbohydrates and read labels but chose not to do so because they felt these behaviors were unrealistic for their day-to-day lives. One woman reported a lack of desire to use nutrition labels:

I'm not going to say I didn't learn how to count carbs, but I didn't count carbs. So I just felt if I ate the right proportion and the right types of food that it would be okay.

Similarly, another patient felt that the use of labels was unrealistic for her life:

I don't look at labels and then once I'm ordering something, I'm not gonna be like, oh, how many calories are in that, but I know she gave me the sheet but, like I said ... I'm not gonna carry that paper with me just to order something.

Perception of label-reading skills was poorly aligned with true skills. An African American mother of 2 with T2DM reported that she knew how to read labels but also said,

I struggle. What's the point of counting, half the time I don't eat like that. So I look at [the label]... what's the point. ... She showed me how, but it's still ... 'cause it's like, 15 grams is a calorie or something like that ... I can't do that.

Another woman reported that she was improving at reading labels, yet said,

I got better at it [reading labels]. Like, the sodium. I know that it means salt and then salt turns into sugar if you don't. Well, not salt turns into sugar, but I know too much salt is bad for me.

Low health literacy and numeracy for nutrition label understanding was voiced by several women. One woman reported, "I see the number, I see it, but how do you know [what it means]? ... Everything is challenging." Another stated, "It's [reading labels] difficult for me ... 'cause I'm not good at math. And

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### Table 2. Demographic and Clinical Characteristics of Pregnant Women With Diabetes (n = 10)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y (mean)</td>
<td>28.5</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>4 (40)</td>
</tr>
<tr>
<td>Latina</td>
<td>4 (40)</td>
</tr>
<tr>
<td>Native American</td>
<td>1 (10)</td>
</tr>
<tr>
<td>Asian</td>
<td>1 (10)</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
</tr>
<tr>
<td>Married or living with partner</td>
<td>1 (10)</td>
</tr>
<tr>
<td>Significantly involved, not living together</td>
<td>5 (50)</td>
</tr>
<tr>
<td>Single</td>
<td>3 (30)</td>
</tr>
<tr>
<td>Other</td>
<td>1 (10)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
</tr>
<tr>
<td>Less than high school degree</td>
<td>2 (20)</td>
</tr>
<tr>
<td>High school graduate</td>
<td>6 (60)</td>
</tr>
<tr>
<td>College graduate</td>
<td>2 (20)</td>
</tr>
<tr>
<td>Multiparous</td>
<td>8 (80)</td>
</tr>
<tr>
<td>Planned pregnancy</td>
<td>2 (20)</td>
</tr>
<tr>
<td>Diabetes diagnosis</td>
<td></td>
</tr>
<tr>
<td>Type 2 diabetes mellitus</td>
<td>5 (50)</td>
</tr>
<tr>
<td>Gestational diabetes mellitus</td>
<td>5 (50)</td>
</tr>
<tr>
<td>Theme</td>
<td>Sub-theme</td>
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<tr>
<td>------------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Feeling overwhelmed by the unfamiliar</td>
<td>Feeling overwhelmed</td>
</tr>
<tr>
<td></td>
<td>Lack of knowledge</td>
</tr>
<tr>
<td>Using and decoding nutrition labels</td>
<td>Lack of desire to use nutrition labels</td>
</tr>
<tr>
<td></td>
<td>Poor understanding of labels</td>
</tr>
<tr>
<td></td>
<td>Inadequate health literacy and numeracy</td>
</tr>
<tr>
<td>Managing nutrition choices and seeking control in setting of food insecurity</td>
<td>Expense of healthy food</td>
</tr>
<tr>
<td></td>
<td>Inadequate food access</td>
</tr>
<tr>
<td></td>
<td>Food deserts</td>
</tr>
<tr>
<td>Experiencing lack of control and limited self-efficacy</td>
<td>Denial of importance of diabetes</td>
</tr>
<tr>
<td></td>
<td>Low self-efficacy</td>
</tr>
<tr>
<td>Balancing recommendation with taste preferences and cultural food norms</td>
<td>Preference for unhealthy food</td>
</tr>
<tr>
<td></td>
<td>Culturally inappropriate nutrition education</td>
</tr>
<tr>
<td>Maintaining healthy eating schedule</td>
<td>Difficulty with regular meals</td>
</tr>
<tr>
<td></td>
<td>Food avoidance</td>
</tr>
<tr>
<td>Accommodating diabetes in family and social life</td>
<td>Social isolation</td>
</tr>
</tbody>
</table>
then I just be like, oh my god, this is so complicated … I just ignore it.”

Other women reported having an incorrect understanding of the numbers, such as a woman who reported, “Once in awhile, this is the only thing I read: sugars 23 grams, sugars 64 grams. Once I see it’s more than 23, I’m like, um, no, I can’t eat it.”

Managing Nutrition Choices and Seeking Control in the Setting of Food Insecurity

Access to healthy food posed a challenge to women in this community. As has been previously demonstrated among nonpregnant adults with diabetes, inadequate food access is associated with lower self-efficacy, lack of medication adherence, poor diabetes self-management, and higher rates of diabetes distress, particularly among younger low-income females. In this population, the inability to afford and access healthy food and prioritize themselves in the family budget was a significant contributor to ongoing unhealthy eating habits. A woman with T2DM stated that “We understand the diet, [but] fruits and vegetables are expensive. A bag of chips is 50 cents,” and “Just recently, the Link [Illinois Supplemental Nutrition Assistance Program] card was denied for us, so it’s been really hard for us to stay on an eating schedule.” In describing her stresses during pregnancy, 1 woman reported, “Worrying about we gotta get groceries, and just that was a hard thing, like being able to get the actual good, healthy food. It’s so expensive compared to everything else.” All participants reported that despite knowing the recommended foods, the cost of such choices was often prohibitive and would limit full adoption of recommendations. Notably, several participants reported being able to purchase healthier foods at the beginning of each month, when public assistance money was more available and thus families had more cash on hand for food.

Not only did women face difficulty with choosing high-quality foods such as fruits and vegetables, food shortages were also described. A woman with GDM described how she cannot afford healthy food, and when she uses Supplemental Nutrition Assistance Program benefits, others eat her food:

“I can’t afford to eat right … the only thing helping me is getting a Link card, but sometimes that doesn’t even help since I’m living here [with family] and I don’t really have money for myself. ‘Cause I’m helping … get food for everybody else and then I’m not even there to eat. Then I have my WIC [Special Supplemental Nutrition Program for Women, Infants, and Children], I’m not eating anything out of it, or drinking any of my juice … ‘cause everyone else is drinking it. I have nothing for myself.

Budgeting for the month was an important goal, as described by the woman who stated, “It was so much more expensive, and it would be hard because I had to make sure I had enough for the whole month. I had to make sure I had enough food.” She reported that her family ran out of food at times:

“Yeah, we did [run out of food]. A couple of times we did, and what would happen would, you know, he’ll just, we’ll borrow from his dad or stuff like that. … Whenever we would run out, you know, my kids always had something to eat … my kids will eat and I’ll just be stuck …

Similarly, women living in low-income communities reported limited access to stores selling produce and unprocessed food and described food deserts in their urban Chicago neighborhoods.

In addition, participants reported that they experienced fear of using public transportation or walking to stores with healthy food because of neighborhood violence. This environmental barrier contributed to food insecurity and difficulty with maintaining diabetes control. For 4 women, urban community violence limited outdoor activities, including exercise and walking to markets. One woman reported,

“I live in the South Side, I am kind of afraid of the violence there. … I mean, there’s always innocent people dying … like, I wouldn’t go out there [to the neighborhood grocery stores].

This woman felt she would not be safe shopping or exercising in her neighborhood. Similarly, a patient who reported living in a “rough neighborhood” stated that she did not shop for groceries because of violence and that “My boyfriend goes out to the store, and it’s like, my God, anything could happen.” Because she never did the shopping, she reported having essentially no control over family food choices during her pregnancy.

Experiencing Lack of Control and Motivation and Limited Self-Efficacy

Self-efficacy, or one’s confidence in the ability to perform a particular set of behaviors, is particularly salient in diabetes, in which a patient must believe that she can perform recommended health tasks and health behaviors to be able to carry out those behavioral changes successfully. Participants described experiencing a lack of control, limited self-efficacy for nutrition changes, and a lack of motivation as barriers to the adoption of nutrition habits. For some women, this manifested as a lack of prioritization of diabetes or a denial of the gravity of the diagnosis. For example, a Hispanic multiparous woman with GDM in the current and 2 prior pregnancies felt reinforced in her lack of motivation for nutrition changes because her prior pregnancies had been successful without making such changes. She stated, “I never went on a diet and everything was fine. I didn’t do anything and then I just ate the same things I would eat and everything was fine.”

Poor self-efficacy and feelings of lack of control were common. Several women felt that they could not practically carry out recommendations; such a feeling of limited capacity resulted in a vicious cycle of subsequently having even less motivation to attempt improvement. For example, 1 woman described her guilt:

“Shame, shame on me, so it’s just like, you go to the grocery store, you just see all these things, and like, you can’t help yourself, and”
that’s basically what happens when I’m going to the grocery store. I need to control, learn some type of self-control.

Low self-efficacy to control cravings was also reported. One woman described the feeling of having no control over the sensory attractive properties of soda: “I’m just so used to it [soda]. I crave it, it’s like my fix. Kind of like a smoker has to have that cigarette, you know!” Similarly, a Hispanic nulliparous woman described her inability to control her cravings for sweet items:

Cravings! Yeah, like, I’m a sweet person. I love cakes and cookies … but I can’t [bake] because if I make a homemade cake, I’m going to sit there and eat the damn cake! And I’m not talking about a little piece, oh, how cute, no, I’m talking about how I will eat the whole damn cake!

The experience of not having control over these food desires resulted in feelings of guilt and helplessness. Participants reported knowing that they should limit certain foods but that they had no willpower to control their behaviors effectively.

Balancing Recommendations With Taste Preferences and Cultural Food Norms

Some women reported that they understood nutrition therapy recommendations but did not desire to follow them owing to taste preferences. Although this is similar to the theme of lack of motivation, these women reported that they ignored recommendations if the foods were unappealing. An African American multiparous woman reported,

Well, they want me to go on a diet … So that’s the most challenging thing that’s going on with this pregnancy, because I don’t really watch what I eat and the things that they’re telling me I should eat, I don’t really too much like.

In balancing recommendations with food preferences, women also described their cultural perspectives on food. A Hispanic woman reported,

We’re Hispanics, we love the rice, we’re not into the, oh, let’s be skinny, or let’s eat this, let’s eat that … well, I like it, I’m gonna eat it whether makes me feel better or not. As long as it tastes good.

Women reported that receiving culturally inappropriate nutrition education created difficulties with adopting recommendations. One woman said that nutritionists always recommended food that was not preferred by her African American community: “With the nutrition visits … I couldn’t follow it because a lot of things on there I couldn’t or wasn’t eating or didn’t like to eat, didn’t have a taste for …” Participants described disregarding nutritional advice if they felt as if the provider was not considering her cultural values and dietary preferences.

Maintaining a Healthy Eating Schedule

Women experienced challenges with maintaining a healthy eating schedule. Maintaining a regular eating schedule is critical for steady glycemic control, particularly when medications are required to control hyperglycemia during pregnancy. Employed women described working multiple jobs, limited employer flexibility, and balancing work with caregiving responsibilities, all of which lead to difficulty prioritizing one’s own meal schedule. Unemployed women described the absence of a daily routine and the inability to adopt the structure required for steady glycemic control. One woman reported at her final interview that she was significantly challenged by the need to eat meals at regular times: “The diet was the hardest thing … it was hard for me to put myself on that schedule.” Another said she was accustomed to grazing all day rather than eating nutrient-dense meals:

It could be a cereal bar, it could be a bowl of cereal, it could be a fruit, it could be just little things over the day. So I’m not eating meals, I’m just periodically snacking.

Several women stated that the burdens of managing glycemic control would be reduced by avoiding food even though they acknowledged that this was not recommended. For example, 1 participant reported that the schedule requirements of diabetes made it too exhausting to eat:

Sometimes I just don’t feel like eating. I don’t know if it’s because I have to take the insulin, I gotta check my sugars and I just, that’s stressful alone. I hate doing that, I hate pricking my finger, I hate sticking myself with the needles. I just, there are some days where I just don’t want to eat.

This patient experienced hyperglycemia and labile glucose control because she would eat large amounts of food once per day and avoid food at other times to avoid insulin administration. Like others, this patient felt that the schedule requirements of having diabetes during pregnancy stood in such stark contrast to her normal routine that she was unable to adopt the rigidity required for optimal glucose control.

Accommodating Diabetes in Family and Social Life

The final major barrier revealed by interviews was the challenge of accommodating diabetes in family and social life. Women reported that family members, although supportive of a healthy pregnancy, were unable or unwilling to change their own eating habits when with the pregnant woman. This led to women feeling isolated in their behavior change efforts. One woman reported she had weekly meals with her sister, who always ordered unhealthy food: “She [sister] ordered pizza, and I was like, ‘Yeah, my kryptonite!’ So I had like a little corner piece and I was literally, like, that was it, I couldn’t eat any of it.” She stopped family dinners because her sister was unable to change her own eating habits. Similarly, several women reported that eating their mothers’ cooking was a challenge because fried and greasy foods were considered comfort foods within the family. One said, “If I go to my mom’s house, she’s cooking all this good, like maybe enchiladas, stuff like that, that if I were to eat 3–4 of them.” Others reported trying to
balance improving their own eating habits (and that of spouses and children) while also not offending mothers and other caregivers who provided unhealthy home cooking.

Finally, as described previously, several women described social isolation because of the need to follow nutrition recommendations. One African American nulliparous woman with GDM reported that her social life revolved around eating and drinking. Thus, when she was pregnant, she reported:

*It affects my social life a little bit because I like to go out to restaurants and eat and ... it’s like I can’t go out and do those things anymore so it’s like I kinda just been a little bit to myself, so I haven’t been as social as I usually am.*

Food-related social isolation was noted both inside the home, such as when women would eat separately from spouses and children not following the diet, and outside the home, when women declined social events owing to dietary concerns. Moreover, food-related isolation was enhanced by environmental barriers such as neighborhood violence, which were described previously as contributing to food insecurity.

**DISCUSSION**

Pregnant women with diabetes are advised to incorporate multiple nutrition-related behaviors over a short amount of time, often while also engaging in other diabetes and pregnancy-related health behaviors. Nutrition therapy behaviors include choosing healthy fruits and vegetables, controlling carbohydrate intake, learning to prepare meals according to guidelines, and planning meal schedules to regulate glycemic control. Additional diabetes-related health behaviors include incorporating exercise to diabetes self-care, properly managing insulin administration, logging results of blood glucose checks, attending frequent appointments, and self-regulating behaviors based on results. Normal expected pregnancy health behaviors are myriad, but when compounded by diabetes, pregnancy care requires improvement and become more complex. In this analysis, the researchers attempted to improve their understanding of the patient-centered factors that affect a woman’s ability to adhere to nutrition therapy during a pregnancy complicated by diabetes. This population of pregnant women living in medically underserved, urban neighborhoods in Chicago demonstrated a number of barriers, including internal limitations with self-efficacy, motivation, and knowledge as well as external community-based issues regarding access to healthy food and decoding nutrition labels. Finally, balancing taste preferences and family and social life were additional challenges that precluded behavior change.

Prior literature in this context largely focuses on international settings. In a Canadian study, 4 barriers observed among women with GDM included personal food preferences conflicting with advice, lack of control over food in social settings, lack of nutrition knowledge and skills, and limited time. Participants in this study were not specifically asked about having limited time. In an Australian group, women described advice to replace preferred foods with more nutritious foods to be a major lifestyle change that caused emotional and practical difficulties. The same population identified time constraints, social constraints, and lack of comprehension to be additional challenges. Similarly, a separate Australian cohort identified taste preferences, nutrition knowledge, and time limitations as barriers to adoption of healthy nutrition behaviors in the postpartum period after a pregnancy with GDM. Although anecdotal clinical experience suggested that low-income, urban US women may experience barriers unique from those noted in international settings, little work had explored these issues, especially among medically underserved women.

This work highlights the needs of a disadvantaged US community of women experiencing diabetes during pregnancy. To the authors’ knowledge, in this community, patients appeared to encounter far more socioeconomic barriers than previously described in existing literature. Notably, the expense of healthy food and challenges with food insecurity were common themes. In the US, food insecurity remains a problem for a substantial minority of the population; in 2013, 14.3% of American households were food insecure, according to the US Department of Agriculture. Food insecurity is more common in large cities, for single parents, and for African American or Hispanic households, all of which were common features of this community. Outside of pregnancy, food insecurity has been associated with poor diabetes self-efficacy and self-management skills. During pregnancy, food insecurity has been linked to excess gestational weight gain as well as increased likelihood of overweight or obese status as a result of poor-quality dietary intake. Pregnant women in this study demonstrated this pattern in that some recommended foods, such as fresh fruit and vegetables, were often inaccessible, resulting in the choice of calorie-dense foods of low nutritional value, especially to ensure that their children were not left hungry. In this patient population, the social and economic burden of living in impoverished neighborhoods, coupled with the experience of violence in these neighborhoods, was both a direct barrier to successful nutrition-related behaviors and a psychosocial stressor, limiting the time, energy, and resources available to maintain nutrition therapy for the duration of pregnancy.

In addition, although a majority of this population had a high school education or greater, inadequate health literacy to operationalize nutrition labels was a barrier to successful nutrition therapy. Health literacy, or the skills needed to function in the health care environment, 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.” Health literacy includes the skills required to interpret and act upon basic nutrition label content. Other studies conducted in this same clinic demonstrated this population to have a high proportion of individuals with inadequate health literacy. A finding in this study was that women were frequently unable to function adequately in a healthy nutrition
environment because of the complexity of nutrition labeling; despite theoretically understanding the types of foods they were recommended to choose, patients reported being unable to carry out recommendations practically because of difficulty interpreting the available data. Although literacy was only 1 component of the barriers experienced by this population, inadequate health literacy coupled with other barriers to reduce women's ability for behavior change. Such findings warrant further investigation into how to improve nutrition understanding on an individual level and to address the complexity of nutrition labeling from a systems perspective.

This exploratory study has limitations. First, participants were primarily English-speaking African American and Latina women receiving care at a single urban academic medical center. Thus, findings may not be generalizable to all settings, including those with larger Spanish-speaking, Asian, or Native American populations. Future work is required to determine whether there are different patterns of nutrition-associated barriers experienced by women in different ethnic and cultural groups. In addition, although the study participants represented the demographics of the clinic population, these patients may experience different nutrition-associated barriers than may women who did not seek care at this referral center. Participants may be different from nonparticipants; women willing to participate in 3 in-depth interviews may face challenges different from those of patients in the same clinic who declined or were ineligible. Participants also included women with prior diabetes experience; owing to clinic population constraints, it was not possible to assess the differential experiences of women with GDM vs T2DM. Future work may investigate the challenges reported by women with prior diabetes exposure compared with those for whom the diagnosis was new during pregnancy.

Second, 1 interviewer was briefly involved in the care of patients, which may have affected the responses generated. In any research in which a caregiving physician is recruiting participants or performing interviews, participants may be biased by the interaction with a caregiver who is simultaneously a researcher. In the current work, a number of measures were taken to attempt to reduce these biases, but it is impossible to fully evaluate or eliminate the effect of the physician interviewer. Participants were interviewed separately from clinical care encounters and were informed that their responses would not affect their clinical care. Thus, although it is possible that the interviewer's role may have affected some responses, the authors attempted to minimize these effects as much as possible. Third, information was not collected about the use of other forms of public assistance beyond Medicaid funding of prenatal care; further work could investigate differences in barriers based on whether women have used supplemental nutrition services. Furthermore, although this small sample size is typical for qualitative data, it is possible that additional interviews may have yielded novel themes; however, data from these 10 participants achieved thematic saturation. Finally, future work is warranted to understand whether and how these nutrition-related experiences of pregnant women change across pregnancy; such themes were unable to be explored in this population owing to the small study size. Despite its limitations, the findings from this exploratory study provide valuable insight into an understudied area and delineate a framework for future applied research.

Finally, an additional feature of this work is that the researchers focused primarily on the patient as the unit for improving health behaviors and addressing behavior change. The perspective adopted in the interview process centered on the woman herself rather than the larger cultural and sociopolitical framework. The interview guide was designed to assess participant experiences with individual behaviors. Yet, it became clear that beyond the individual patient or the patient–provider unit, many other aspects of the sociopolitical context, health care system, and greater social backdrop are important contributors to health and well-being. Other work in this realm has highlighted the importance of the “political economy of the disease” and of considering the broader health care environment as powerful forces in health behaviors. The authors propose that the best applications of these findings may not be solely in changing the behaviors and knowledge of the individual patient, but in addressing the larger system in which she lives. Future work regarding pregnancy must also look beyond the individual patient unit to identify further areas to improve health for pregnant women.

**IMPLICATIONS FOR RESEARCH AND PRACTICE**

Interventions addressing these identified challenges should be multifaceted. All pregnant women with diabetes deserve culturally informed, tailored nutrition education materials that address guidelines at a level appropriate for each individual and educators who understand the contextual and environmental factors in which they live. Providing nutrition education that is inclusive of an individual’s cultural framework and food preferences is critical to gaining patient acceptance of recommendations. Low literacy–level nutrition literature may benefit all patients, because data suggest that educational interventions benefiting patients in low literacy populations benefit individuals in higher literacy groups as well. Such education can include developing the skills needed to use nutrition labels, along with supportive strategies that enhance pregnant women’s motivation to employ tools such as nutrition labels. In addition, addressing the isolation that can occur when behavior changes disrupt family and social life may support women in maintaining health behaviors during this intensive period. Incorporating family and support persons in nutrition counseling may reduce this burden of isolation and improve the health of the family unit. Such interventions deserve further investigation.

While much focus has been on patient education and individual-level interventions, the current data also offer several areas for interventions beyond individual patient interactions. Flexible employment schedules for pregnant and postpartum women
may address the health care visit scheduling issues many women face. School-based education may address knowledge and health literacy challenges, and improved social support programs for pregnant women can reduce the burden of access to healthy food. Home- and employment-based support and health care may promote sustainability of the behavior changes recommended during pregnancy. Ethnicity or culturally matched peer mentoring may help address issues of motivation and culture-driven food preferences and reduce the social isolation women experience during a complicated pregnancy. These data suggest that each of the challenges demonstrated in this small population may be potential areas for intervention both in the individual patient encounter and in the broader social context of the patient’s life; further work must explore how structural social and environmental changes can reduce these barriers for low-income pregnant women.

Women with diabetes during pregnancy are advised to adopt potentially novel, complex, and expensive nutritional behaviors as a part of their diabetes therapy. Yet, women in this medically underserved, urban community reported multiple internal and external barriers to success with nutrition changes. Providing culturally appropriate, patient-centered prenatal care for women with diabetes requires understanding women’s lived experiences and contextual and environmental factors. These data highlight the many reasons why women may not achieve their nutrition goals. Health care providers, including diabetes and nutrition educators, are encouraged to perform individualized assessments of barriers to care and use findings such as these to develop interventions that support women with diabetes during pregnancy. Providers and public health professionals should apply these types of patient experiences to develop community-based resources and support services that can improve maternal and fetal health during a pregnancy complicated by diabetes. Next steps include exploring factors that ameliorate these barriers and enable women to adopt healthy nutrition behaviors during pregnancy. These data may be used to generate evidence-based interventions that reduce the informational, social, motivational, and financial burdens that disproportionately affect low-income, minority pregnant women.

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CONFLICT OF INTEREST

The authors have not stated any conflict of interest.