



# Understanding Gestational Diabetes, Future Diabetes Risk, and Diabetes Prevention: A Qualitative Study of Patient, Provider, and Staff Perspectives

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Gestational diabetes mellitus (GDM) increases type 2 diabetes risk; however, postpartum diabetes screening rates are low. Using semi-structured interviews and focus groups, this study investigates the understanding of GDM and its relationship to future diabetes risk and diabetes prevention among patients with public or no insurance ( $n = 36$ ), health care providers ( $n = 21$ ), and clinic staff ( $n = 9$ ) from Federally Qualified Health Centers. Five main themes emerged: 1) general understanding of GDM diagnosis with focus on neonatal complications; 2) variable recall of diet, exercise, and weight recommendations; 3) overwhelming medication and self-monitoring routines; 4) short-term focus of type 2 diabetes risk and screening; and 5) limited understanding of all options for diabetes prevention. The results may inform diabetes screening and prevention interventions in primary care settings.

Gestational diabetes mellitus (GDM) affects 5–9% of U.S. pregnancies and is more common in racial and ethnic minority and lower-socioeconomic populations (1). GDM increases the risk of complications for pregnant women and their children. More than half of women diagnosed with GDM may develop type 2 diabetes (2).

Detection of GDM and postpartum screening for type 2 diabetes are crucial, especially given that initiating lifestyle changes or metformin therapy can significantly reduce the risk of developing type 2 diabetes (3,4). Diabetes screening for women who have had GDM is recommended 4–12 weeks postpartum and then every

## KEY POINTS

- » This study highlights perspectives on gestational diabetes mellitus (GDM) and postpartum diabetes risk, screening, and prevention in a previously understudied group of patients and integrates input from health care providers (HCPs), dietitians, and nurses who care for these patients in resource-limited settings.
- » Although type 2 diabetes risk persists and lifelong screening is recommended after GDM, patients, HCPs, and clinic staff tended to focus on more immediate complications and short-term risks.
- » Patients were often unaware of the roles of metformin and breastfeeding in diabetes prevention and were reticent to consider using a medication for prevention.
- » Women's understanding of different topics often reflected the reported focus.

1–3 years thereafter (2,5), but even among insured populations, only half of women with GDM are being screened in the first postpartum year (6), and there are few data on long-term screening rates.

Compared with privately insured populations, postpartum screening is lower in women receiving Medicaid during pregnancy (7,8). A study linking Medicaid and electronic medical record data from Missouri Federally

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This article contains supplementary material online at <https://doi.org/10.2337/figshare.15031746>

<https://doi.org/10.2337/cd21-0016>

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Qualified Health Centers (FQHCs) demonstrated screening in 9.7% of women in the first 12 weeks and 18.9% of women within the first year (8). In this population, access to public transportation and a prenatal visit with a certified diabetes educator were associated with receiving recommended postpartum screening (9). This finding highlights the importance of education and patient understanding in receiving follow-up care.

Relatively few qualitative investigations have explored women's understanding of GDM and its associated risks, while also including perspectives of health care providers (HCPs) and other clinic staff. Prior studies have found variable levels of understanding of the GDM diagnosis and complications (10–12). Themes of confusion surrounding the process of GDM diagnosis (10), as well as perceptions of the transient nature of GDM-associated risks (11,13–15) were common. Most prior studies have focused on privately insured populations. A study including patients and HCPs in an urban safety-net setting highlighted that mothers and HCPs focused mostly on neonatal outcomes and emphasized the difficulty HCPs face in communicating both risk and reassurance (16).

To our knowledge, prior studies have not included perspectives from nurses and dietitians providing diabetes education during pregnancy in resource-limited settings. The current study focuses on an understudied and high-risk population, aiming to characterize how women without private insurance understand GDM and postpartum type 2 diabetes risk, screening, and prevention. We also compare perspectives of women with GDM to those of HCPs and the clinic staff members providing patient education.

## Research Design and Methods

Women with a history of GDM were recruited from the St. Louis, MO, area using flyers at local FQHCs and community organizations, a local radio advertisement (on station WHHL FM 104.1), public transportation (MetroTransit) postings, and notification after delivery at an academic hospital. Women were eligible if they were 18–40 years of age and had had a pregnancy complicated by GDM within the past 10 years (defined by Carpenter and Coustan criteria [17] or chart documentation) and either on Medicaid, Gateway to Better Health (St. Louis safety-net coverage), an Affordable Care Plan marketplace insurance plan, or uninsured during the GDM-affected pregnancy. To ensure representation in the sample, women were stratified by time since GDM-affected pregnancy (<1 or ≥1 year since delivery) and postpartum screening status. Receipt of recommended postpartum screening was defined as a fasting

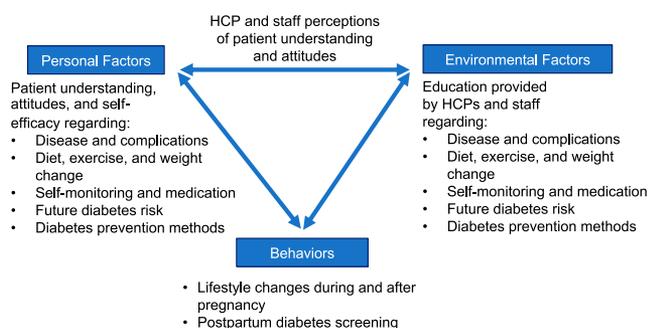
plasma glucose or 2-hour oral glucose tolerance test within 4–12 weeks, postpartum or an A1C from 12 weeks to 1 year postpartum, confirmed by medical record review. HCP and staff participants were stratified by their health care role and recruited from member FQHCs of the St. Louis Integrated Health Network (IHN). The IHN coordinates leadership and transitions of care among area FQHCs and hospital systems.

After obtaining informed consent, two trained research team members conducted semi-structured interviews with 36 women who had had a pregnancy complicated by GDM. Nine clinic staff (nurses and dietitians) who provide patient education were interviewed individually or in pairs. The team conducted four focus groups with 21 prescribing HCPs (physicians, nurse practitioners [NPs], and physician assistants [PAs]). HCP focus groups were completed within specialty (two for obstetrics and gynecology [OB/GYN], one for family practice, and one for internal medicine).

Community stakeholders provided input on interview guides. Interviews explored patient understanding, attitudes, and self-efficacy using multiple questions. These included: “What did it mean for you to have high blood sugar during your last pregnancy?,” “Please describe the advice you remember receiving during your pregnancy,” “Please describe what you know about how high blood sugar during pregnancy affects your health in the future,” and “Imagine you are telling your friends about ways to lower your risk of getting diabetes. What would you say?” Full prompts are provided in Supplementary Appendix S1.

OB/GYN and family practice HCPs and maternal-child clinic staff were asked to imagine that the interviewer was a patient just diagnosed with GDM and provide counseling. Internal medicine providers were asked, “Do you routinely ask your female patients about complications of pregnancy, and, if so, how does this alter your management?” They were also asked, “How important do you feel it is for your patients to be screened for type 2 diabetes after a pregnancy with gestational diabetes” (HCPs) or “What do you view as your role in helping patients get screened for diabetes after pregnancy?” (staff) and “What do you think your patients understand about gestational diabetes and the way it affects their future risk of diabetes?” (HCPs and staff).

Demographic information was collected, and interviews and focus groups were audiotaped and transcribed verbatim. Social cognitive theory underpinned our exploration of the interrelationships between personal factors



**FIGURE 1** Theoretical framework based on social cognitive theory of the relationships between education provided by HCPs and clinic staff; patient understanding, attitudes, and self-efficacy; and patient behaviors related to lifestyle changes and postpartum diabetes screening.

(patient-level understanding, self-efficacy, and attitudes in each theme), environmental factors (in this context, education provided by staff and HCPs on each theme), and patient behavior around lifestyle changes during and after pregnancy and postpartum screening for diabetes (Figure 1). In particular, we noted times when HCP and staff perceptions of patient understanding and attitudes may affect both patient understanding, attitudes, and self-efficacy and the education provided.

Using content analysis, two independent raters (R.C.W. and C.J.H.) developed one codebook for interviews with patient participants, and two independent raters (R.C.W. and L.N.H.) developed one codebook for HCP and staff focus groups and interviews. Each code had a definition, inclusion and exclusion criteria, and sample quotes. Two independent raters then coded all transcripts independently using the codebooks (R.C.W. and L.N.H. for patient participants and H.R.L. and R.C.W. for HCPs and staff). There was >80% agreement before discussion between the two raters, and discussion resolved remaining discrepant codes. A third rater (C.J.H.) was available but was not required to reconcile codes.

Using NVivo12 qualitative data analysis software (QSR International, Burlington, MA), the researchers compiled and analyzed codes related to understanding among patient participants and HCP and staff provision of education and perceptions of women's understanding to ascertain similarities and differences. The Washington University Human Research Protection Office approved the study on 6 June 2016. Interviews and focus groups occurred between May 2017 and April 2018.

## Results

Table 1 presents population demographics. Doctors and dietitians were the most common sources of informa-

**TABLE 1** Participant Demographics

Characteristic	Median (IQR)
<i>Women with history of gestational diabetes (n = 36)</i>	
Age at consent, years	30.5 (26.8-35.3)
Number of live births	3 (2-4)
	<i>n (%)</i>
Screening status	
Screened	18 (50)
Unscreened	18 (50)
Time since delivery, years	
<1	17 (47.2)
≥1	19 (52.8)
College graduate	11 (30.6)
Race	
Asian/another race/more than one race	4 (11.1)
Black or African American	26 (72.2)
White	5 (13.9)
Missing	1 (2.8)
Hispanic or Latina ethnicity	2 (5.6)
<i>HCPs and staff (n = 30)</i>	
Specialty	
OB/GYN	14 (46.7)
Family practice	8 (26.7)
Internal medicine	4 (13.3)
Missing*	4 (13.3)
Degree	
MD/DO	11 (36.7)
NP	7 (23.3)
PA	3 (10.0)
RN/BSN/LPN	5 (16.7)
RD	4 (13.3)
Years in practice	
0-9	18 (60.0)
≥10	12 (40.0)
Race	
Asian/another race/more than one race	1 (3.3)
Black or African American	3 (10.0)
White	26 (86.7)
Sex	
Female	28 (93.3)
Male	2 (6.7)

\*Dietitians had no specialty.

tion cited by women with GDM. However, many women also received information from their mother or other family members. A minority of women mentioned online sources as a prominent resource. Five main themes, each with several subthemes, were identified. These included 1) general understanding of GDM

diagnosis with focus on neonatal complications; 2) variable recall of diet, exercise, and weight recommendations; 3) overwhelming medication and self-monitoring routines; 4) short-term focus of type 2 diabetes risk and screening; and 5) limited understanding of all options for diabetes prevention. These themes are discussed in detail below with associated illustrative quotes. (Quotes with participant numbers ending in “PS” were from providers or staff, as opposed to patients.) Supplementary Appendices S2 and S3 provide additional quotes.

### General Understanding of GDM Diagnosis With Focus on Neonatal Complications

#### Variable Disease Understanding and Focus on Neonatal Complications

A few women used specific terminology, such as placenta and pancreas, in describing their GDM diagnosis, but a majority described that their blood glucose had been too high. Some were concerned that they had diabetes permanently. The majority of women recalled that the baby could be too large or could have other severe complications.

*“They were telling me if my blood sugar grows too high, I could go into a diabetic coma . . . It was possible I would have a stillborn baby, or my baby would be too big. I would have to get a C-section and stuff like that.” (Participant 35, screened, delivered  $\geq 1$  year)*

Additionally, many women recalled diagnosis later in pregnancy with some areas of confusion. Several women thought that the baby could have diabetes at birth, although others correctly remembered the immediate concern for the baby was low blood glucose at delivery.

*“They tested on my son to make sure that he was not diabetic because they said that he could be a diabetic baby.” (Participant 12, screened, delivered  $\geq 1$  year)*

*“My sugar will be high, but when he is born, his sugar will be extremely low, and that is exactly what happened.” (Participant 11, unscreened, delivered  $< 1$  year)*

#### Skepticism Among Patients

Regarding diagnosis, some women were skeptical about test timing, test method, and the advice they received.

*“I wish I could have found out earlier because I feel like [I] kind of was having signs . . . that I might I have had it.” (Participant 33, screened, delivered  $< 1$  year)*

*“I don’t know that I necessarily agree with how they even test for it . . . if I don’t even drink soda, if I don’t drink juice. If my normal drink is water . . . having to down the sugary drink that I wouldn’t normally ever drink anyway kind of works against my favor.” (Participant 34, unscreened, delivered  $< 1$  year)*

#### Perception that Diagnosis Is Overwhelming and Understanding Is cursory

HCPs and staff generally felt that too much information was overwhelming and chose to focus more on immediate treatment goals and complications.

*“I give them a variety of handouts. And I go through them, not in depth but just, you know, what does gestational diabetes mean . . . then I kind of hit heavier on the complications. ‘If you continue to have your diet be all crazy and your sugars are just, you know, 400s, your baby could be sick. The baby is going to be huge. He is going to have trouble getting out.’” (Participant 23PS, OB/GYN nurse)*

#### Perceived Extremes of Patient Reactions and Perception that Risk to the Baby Is Most Motivating

Many HCPs and staff tailored their initial counseling based on patients’ reactions to the diagnosis. Whereas some patients became very anxious and needed reassurance, others were not concerned and needed to focus on complications. Immediate pregnancy complications were more motivating than long-term risks.

*I try [to] also really hit hard; like, ‘You can have a great pregnancy and great outcomes and a healthy baby,’ because people freak out so much. And I try and walk the line because it depends on the patient. Some patients are not scared enough. (Participant 1PS, family practice NP)*

*“It seems to me that pregnant women are the most motivated to make changes. They usually do it for their baby . . . So, they’re not doing it for their own health.” (Participant 31PS, dietitian)*

Overall, commonalities arose among HCPs, staff, and patients around the recognition that the disease is complex and that the most motivating factor is the baby’s health. It is difficult to know whether the patients’ focus on neonatal complications derived from the education they were provided or whether the HCP and staff perceptions of the patients’ immediate concerns directed their focus in counseling. Patients’ skepticism also highlighted potential missed opportunities for

enhancing trust. For example, women needed more information on why the testing was done with a sugary drink, why it was often done later in pregnancy, and whether there were indications for earlier testing.

### Variable Recall in Details of Diet, Exercise, and Weight Recommendations

#### Diet

Women accurately recalled the main points of counseling on diet, exercise, and weight gain during pregnancy. Many knew they should be eating more vegetables and fewer carbohydrate-heavy foods and limiting portion sizes. However, portion definitions varied, and serving size was mentioned infrequently. Many expressed surprise about less obvious sources of carbohydrates such as fruits, starchy vegetables, and sweetened beverages, especially juices and teas. There was a stronger focus on avoidance of certain foods than on inclusion of healthy foods. One participant thought the restricted diet contributed to low birth weight.

*“For a long time, I thought that Arizona [tea]—what does it say? Vitamin C—that it was actually healthy for you. So, I was drinking more of that, and the doctor actually told me that . . . it’s actually more sugar in it.” (Participant 30, unscreened, delivered <1 year)*

*“I had to substitute more vegetables. Certain vegetables I couldn’t eat. I couldn’t eat corn . . . My daughter was little . . . and I think the reason why she suffered [was] because I couldn’t eat certain things; I had to watch what I was eating, my carbs.” (Participant 37, screened, delivered <1 year)*

Almost all HCPs and staff focused on the basics when counseling their patients about diet and exercise: eliminating sodas and juices and getting patients to recognize and replace carbohydrate-heavy foods. Most HCPs also perceived that their patients lacked understanding of the basic nutrition concepts needed to manage their GDM.

*“I don’t want them to eat pancakes and muffins or drink orange juice. So, I try just to talk to them about things that they don’t realize that is sugar, right? And that carbs turn into sugar. So, I try to make sure they understand that.” (Participant 24PS, OBGYN nurse)*

*“I think that sometimes it’s easy for us, because we teach this every day, that we assume that everybody totally understands what bad food choices are. But they don’t, and it’s interesting, just the simple things like juice and soda. Things that we might not think*

*about that people would not necessarily know.” (Participant 6PS, OB/GYN NP)*

#### Exercise and Weight

Patients recalled exercise recommendations with limited detail, with a focus on walking and the positive impact it could have on lowering blood glucose after a meal. Recall of weight recommendations was also general in most cases, and where specific numbers were recalled, they were often higher than the Institute of Medicine recommendations (18).

HCPs and staff recognized that patients did not clearly understand recommendations for weight gain in pregnancy, but they also found it difficult to discuss weight.

*“I think the idea that it’s a free-for-all, pregnancy, you know, eat whatever you want, is very prevalent and people seemed shocked or surprised that maybe that’s not the best . . . My sense of obesity and body type and size is very, very different than my patients . . . I have no trouble talking about sex or STDs [sexually transmitted diseases], but I find weight a harder thing to talk about.” (Participant 12PS, OB/GYN physician)*

In summary, with regard to understanding of diet, exercise, and weight recommendations, the strongest focus among patients, HCPs, and staff was on dietary change, and specifically carbohydrate restriction. Some carbohydrate sources were a surprise to patients (e.g., fruit, juice, sweet tea, and starchy vegetables), and HCPs and staff recognized that education may need to start with very practical information with less focus on label reading. Exercise and weight recommendations were less specific, with patients recalling little about recommended exercise types and time outside of walking after meals. Patients also recalled little about the amount of weight gain recommended, with acknowledgment among HCPs and staff that weight can be difficult to discuss, and societal expectations of appropriate weight gain in pregnancy often exceed the recommendations.

### Overwhelming Medication and Self-Monitoring Routines

#### Fear of Hurting the Baby/Pain or Discomfort With Needles

Although many women expressed annoyance at having to change their diet during pregnancy, they were most frustrated with blood glucose monitoring and medication administration. Women were worried that they might hurt their baby, and almost every patient had negative responses to either the frequency of or

discomfort associated with checking blood glucose and/or administering insulin.

*“Nobody wants to stick themselves, and then four times a day . . . then my daughter was 3 or something . . . So, you have to keep it away from her. If I am out, I did not really want . . . everybody to know . . . I did not want to stop and go stick myself.” (Participant 43, screened, delivered <1 year)*

### Labor-Intensive Logging Process

Despite these concerns, the majority of patients had an accurate recall of the self-monitoring process. Many women also discussed keeping logs of blood glucose (and sometimes food) and discussing this with their HCPs. At least some felt that seeing the connection between blood glucose and food was helpful, but many felt that self-monitoring and charting were cumbersome. Several women reported that they felt anxious or scared when first learning to manage GDM, but many also reported that they grew accustomed to the process and recognized they needed to take this diagnosis seriously for their child.

*“I had to fill up the tally. Then, I had to turn [it] in to my doctor weekly. And they will look at it . . . If I saw it was too high, then I’ll put what I ate before . . . and that helped me to realize what I shouldn’t be eating.” (Participant 50, unscreened, delivered ≥1 year)*

*“It literally sucked . . . My first gut instinct was like, ‘Okay, whatever I have to do, I’m going to do it for my child.’ I just didn’t like pricking myself . . . but, I mean, it was beneficial for myself and my child.” (Participant 48, unscreened, delivered ≥1 year)*

HCPs and staff heavily emphasized blood glucose monitoring and medication administration, recognizing that time and pain were barriers to adherence.

*“You have to teach them how to use the meter. You make them check it five times a day, fasting in the morning, an hour after each meal, before bedtime. You have them come back in about a week to see how they’re doing . . . I would say the number of times and act of sticking themselves. They just don’t want to do it.” (Participant 24PS, OB/GYN nurse)*

*“My guess is it’s probably pretty overwhelming because most of these patients haven’t checked blood sugars before, so they’re getting all this new equipment, they’re getting all these papers to record on, they’re getting all the stuff about diet and telling them*

*they have to stick their finger a million times a day, and then they’re going to see us more frequently and have testing and everything else.” (Participant 12PS, OB/GYN physician)*

Almost universally, patients recalled the process of monitoring their blood glucose multiple times per day and taking medication during pregnancy in a negative way, despite recognizing that it was a necessity and displaying resilience in making this work for their baby’s health. Although a small number of patients minimized the impact on daily life, these negative reactions included pain and discomfort with needles, fears of harming the baby, anxiety related to future diabetes, and the inconvenience of incorporating checking and logging into daily routines. HCPs and staff acknowledged the fear and challenge associated with the multiple tasks required with this diagnosis.

### Short-Term Focus of Type 2 Diabetes Risk and Screening Recommendations

Almost all women in the screened group had an accurate understanding of their postpartum type 2 diabetes risk and the need for follow-up, whereas fewer than half of unscreened patients demonstrated this same understanding. Unscreened patients who had delivered <1 year before their interview understood their risk better than participants ≥1 year out from their GDM-affected pregnancy.

### Recall of Initial Screening

In general, most women understood that they were at a higher risk for developing type 2 diabetes and needed screening in the immediate postpartum period.

*It was his 2-month checkup . . . It was another drink . . . They called me maybe 2 or 3 days later, you know. What good news, you don’t have it . . . It was a quick conversation, so nothing else to say outside of, ‘You’re doing good, you know, just stay on the healthy track.’” (Participant 3, screened, delivered <1 year)*

### Long-Term Risk Discounted

However, whereas women understood the need for screening, there was less awareness of how screening needed to continue after the first postpartum screen. A few women felt strongly that diabetes was only a risk immediately after pregnancy and, if it was gone, they were okay.

*“But since I feel healthy, I guess it’s not, you know, even though I think about it, it’s not, like, dire. Then I was in the hospital. They were checking my sugar and everything, and they were okay. So, that’s another reason probably why I just been like . . . ‘Everything’s okay.’”*  
(Participant 28, unscreened, delivered <1 year)

### Role of Family History and Genetics

There was less universal understanding of what an increased risk for type 2 diabetes meant for patients. Many already perceived their risk to be high because of family history, so an additional increase in risk associated with GDM was not always clear. Related to this, women were unsure they could change their risk.

*“I believe that it is genetics. A lot of things that go on in our bodies or whatever are passed down through generation and generation. So, I believe it could be genetics. I do not believe that it’s an actual disease. It is something that’s probably just in someone’s family . . . You cannot prevent anything that could be genetics.”* (Participant 7, unscreened, delivered  $\geq 1$  year)

### Focus on Initial Postpartum Screen

The majority of HCPs and staff did not prioritize counseling on long-term type 2 diabetes risk unless patients were concerned. Counseling on risk typically occurred briefly at GDM diagnosis and in the context of scheduling patients for their follow-up appointments, without additional counseling about future risk and testing.

*“I bring it up initially just kind of because I think that’s a common question. It’s like, ‘Oh my God, am I going to have this for the rest of my life?’ So, we kind of briefly touch on it. Then . . . we see them at 2 and 6 weeks’ postpartum, so at the 2-week visit, we’ll talk a little bit about . . . how we’re going to do a 2-hour test at your next appointment and that will kind of confirm the diabetes has completely gone away or, you know, it is here to stay, and this is what we have to do about it.”* (Participant 2PS, family practice NP)

### Different Perceptions of Risk Among Patients

Just as HCPs and staff felt that patients’ concern regarding the GDM diagnosis seemed to be at one extreme or the other, a similar dichotomy existed with regard to future diabetes risk. Some HCPs and staff felt that patients were motivated to avoid diabetes, but many found women unmotivated by future risk.

*“I think, compared to the general population, they are actually a little bit more engaged because they had to do something specific for a number of months . . . They’re always, um, in my mind, the lucky proactive ones because they have an interest in avoiding it.”*  
(Participant 7PS, family practice NP)

*“It depends on the woman, um, well, [more] often than not, they’re almost, like, indifferent. It’s like, ‘Yeah, diabetes runs in my family and, you know, all of these people have diabetes and, I mean it’s a big deal, but not . . . I don’t know if it’s because it’s, like, in the future and it’s not really here, and it’s like okay I’m over. I got through this pregnancy.’”* (Participant 28PS, dietitian)

Similar to the theme of GDM understanding and focus on neonatal complications, there was a tendency among patients, HCPs, and staff to emphasize the short-term risks and immediate postpartum diabetes screening rather than examine long-term risks and the need for continued screening. Again, it cannot be determined whether the short-term focus of HCP and staff counseling influenced patients’ attitudes or whether the HCPs’ and staff’s perceptions of patients’ motivation constrained their patient education. Additionally, HCPs and staff perceived extremes in motivation to be the norm; patients were either highly concerned with or indifferent to risk without much middle ground. Finally, a lack of clear understanding of how lifestyle change could interface with family history to alter risk may have influenced motivation and engagement for some patients.

### Limited Understanding of Full Options for Diabetes Prevention

#### Diet and Exercise

Patients generally had an incomplete understanding of postpartum prevention of type 2 diabetes after their GDM-affected pregnancy. The majority of patients understood that maintaining the diet and exercise changes made during pregnancy could reduce risk for postpartum type 2 diabetes. Some women recalled broad guidance, whereas others were more specific.

*“Just be active. Just be mindful what you’re taking into your body, you know, as far as food and things of that nature. Just try to maintain a healthy lifestyle.”*  
(Participant 33, screened, delivered <1 year)

*“Stay away from the chips [laughs]. And the sugary drinks, sodas, juices . . . Eat more green foods like*

broccoli, and eat more salads and . . . just eat more vegetables. And drink lots and lots of water. If you don't like exercising, well, get up and do something that you like to do [laughs]." (Participant 12, screened, delivered  $\geq 1$  year)

However, women also recognized the challenges in maintaining these changes.

"I'm trying, but it doesn't work. My mom is trying to get me to . . . she was telling me, like, 'It is your portion.' So, once you get those little bites, and it's like, 'Oh my God, it's so good.' You want to get some more. That's what I struggle with." (Participant 10, unscreened, delivery  $\geq 1$  year)

Almost all of the HCPs and staff emphasized the maintenance of healthy diet changes in the postpartum period, both for type 2 diabetes prevention and weight loss, and they talked with their patients about the importance of setting achievable goals.

"That's not any kind of special diet . . . That's the way we want everyone to eat. Like, 'This is just healthy eating . . . It can help prevent you from developing diabetes later on if you continue to be eating this way and watching your portions.'" (Participant 28PS, dietitian)

"But I'll ask the patient, 'What's a healthy weight for you?' . . . If they're like, 'I'd like to be at 200,' and they're 250, then, 'We won't get there next month, but what would you like to be next month, and what do you think you could do?' You know, setting realistic goals. (Participant 17PS, internal medicine physician)

### Breastfeeding and Metformin

Although many patients recalled general counseling about breastfeeding for the health of the baby, few women knew that this may reduce their type 2 diabetes risk. Additionally, most women reported no counseling about metformin as an option for prevention and expressed concerns about side effects.

"I didn't hear that it can help you with diabetes. I thought breastfeeding was good for you anyway . . . and for the baby." (Participant 31, screened, delivered  $\geq 1$  year)

"I took metformin for about 6 months to a year, and it did wonders. But it also has side effects. So, I won't take that. No, I would rather do the regular exercise, eat healthy, and stuff like that than take that." (Participant 11, unscreened, delivered  $< 1$  year)

HCPs and staff also reported that most patients did not want to take a pill for prevention, and although the majority of HCPs and staff counseled on breastfeeding, they usually focused on the benefits for the baby or weight loss as opposed to type 2 diabetes prevention.

"I feel like nobody wants to go on a pill . . . They've heard through the grapevine that it is going to cause diarrhea, and what they don't realize is that usually goes away for most patients, if you stick with it . . . They feel like we're just pill slingers." (Participant 18PS, internal medicine PA)

"The breastfeeding is forefront at WIC [Special Supplemental Nutrition Program for Women, Infants and Children] . . . There is a long list of benefits when they have increased weight gain. We may mention the prevention, controlling weight, before they even get gestational diabetes." (Participant 30PS, dietitian)

Similar to recall of diet, exercise, and weight recommendations during a pregnancy complicated by GDM, the focus of diabetes prevention was mostly on diet, with some recognition of staying active and losing weight (without specific details). Regarding dietary changes recommended for diabetes prevention, some patients remembered very specific recommendations, whereas others recalled the importance of a healthy diet more generally. Notably, most patients did not understand the roles of breastfeeding and metformin in diabetes prevention, and there was a strong bias against using a pill for prevention. HCPs and staff noted this desire to avoid medications and, similar to the disease-understanding theme, focused most of their breastfeeding counseling on the immediate benefits for the baby because that was perceived to be the best motivator.

### Discussion

Our data illustrate unique perspectives among urban women without private insurance who have had GDM and HCPs and staff caring for them. This population has been under-represented in many prior qualitative studies. Our approach allowed for an in-depth exploration of women's understanding about GDM both during and after pregnancy. By recruiting HCPs and staff with a wide range of training, roles, and experience, we were also able to provide a breadth of perspectives from health care personnel caring for women who live in a midsized city and do not have private insurance.

Previous qualitative investigations have primarily focused on barriers to follow-up and included mostly perspectives from patients (10–14,19–25). This study explored women's understanding of GDM and future risks in detail and compared this understanding with the education they received, as reported by HCPs and staff.

To our knowledge, this is the first qualitative study on this topic in the United States to include the perspectives of nurses and dietitians, as a prior study in a similar population limited professional interviews to physicians and nurse midwives (16). Nurses and dietitians provide an important perspective, as they spend the most time counseling patients about diet, exercise, and blood glucose monitoring. Triangulating the perspectives of women with GDM, HCPs, and clinic staff contextualizes information perception and provision, highlighting opportunities for intervention. It also raises awareness of practice variation, patient education, and patient understanding across the pregnancy-to-postpartum transition.

Our study found many similar themes to those highlighted in prior literature. Women and their care providers focused more on immediate neonatal complications than on long-term maternal risk (16). Regarding the initial diagnosis of GDM and the tasks of monitoring and self-management during pregnancy, women expressed feeling anxious and overwhelmed, and HCPs and staff acknowledged these common sentiments (11,12,16,21). Women remained motivated by the health of the baby during pregnancy, but they often desired to return to old habits afterward and were relieved to learn their initial postpartum type 2 diabetes screening was negative (11,13,16). Most women remembered that they should get an initial postpartum test, but few remembered goals for continued screening (15,20,25). Some women also felt that there was little focus on the postpartum period among HCPs (16,26), and the actual likelihood of developing diabetes was poorly understood and sometimes underestimated (10,11). A recent systematic review of multiple qualitative studies performed throughout the world noted this variation in future risk perception as well (13). In our analysis, women who were screened and those who were within 1 year of delivery had the most accurate understanding of postpartum risk and screening guidelines, highlighting an opportunity for HCPs and staff to continue to reinforce the importance of screening over time for women with a history of GDM.

Unique points raised in our interviews included the limited knowledge that women had about the potential benefits of breastfeeding or metformin for diabetes prevention. This was consistent with messaging from HCPs and staff. Additionally, most women were hesitant to consider preventive medication, preferring to focus on diet and exercise, despite noting that maintaining these lifestyle changes was difficult.

Some women in our study questioned whether lifestyle change would substantially change risk, attributing their likelihood of getting diabetes to genetics. In this way, our findings were similar to a study conducted among Native American women, who also experience high rates of GDM and type 2 diabetes (27). This is concerning in that, although genetics contributes to diabetes risk, there are multiple factors that affect development of type 2 diabetes, including potential environmental and social determinants. A perception of prevention efforts as futile could lower motivation to sustain difficult lifestyle changes, and HCP focus on genetic predisposition may perpetuate false attribution of racial differences to biology.

Regarding diet, some information was recalled accurately (e.g., the need to increase nonstarchy vegetables and limit high-carbohydrate foods), but there was less focus on the details of food label reading and serving size, likely because elimination of sugar-sweetened beverages was a predominant recommendation. Patients recalled exercise counseling and weight management instruction with less detail, and HCPs and staff may have felt less comfortable providing this education.

This analysis highlighted areas of accurate and inaccurate understanding that may improve counseling during and after a GDM diagnosis. Commonly, women expressed limited awareness of the need for continued lifelong diabetes screening, and even if they were aware of the risk, they focused on diet and exercise as their only options for prevention. Although it is understandable to emphasize the immediate risks to a pregnancy, our results underscore the importance of continued emphasis on diabetes screening, concrete and tailored recommendations for diet and exercise postpartum, and increased counseling on the roles of metformin and breastfeeding in diabetes prevention. Given that metformin was found to be as effective as intensive lifestyle intervention for type 2 diabetes prevention among women with a history of GDM (4), it is important to further explore the reticence to use metformin and to counsel about the role metformin can play in prevention.

Pregnancy is a vulnerable time for women, but it also represents a crucial window for diabetes prevention. In our study, women reported, and HCPs and staff perceived, more motivation for lifestyle changes during pregnancy, when maternal health directly affects the baby. Women may receive or retain less information on type 2 diabetes screening and prevention postpartum.

### Study Limitations

Scheduling challenges necessitated the use of focus groups instead of individual interviews with HCP participants. This strategy allowed us to include the perspectives of more HCPs, but we acknowledge that a group setting may have influenced the responses collected. HCP and staff participants came from just two FQHC systems in the St. Louis area with whom we were able to establish a partnership. Although this recruitment strategy will allow for continued collaboration with these FQHCs, it limited generalizability.

Notably, HCP and staff participants in this study were predominantly White (86.7%), whereas women with a history of GDM were predominantly Black (72.2%). Though our participants are representative of the patient population served by St. Louis-area FQHCs (73.7% Black) (28), we suspect that current and historical racial dynamics in the United States and in St. Louis could have affected our data in multiple ways. First, the interviews did not explicitly explore the role of structural racism in distrust of the health care system that may have influenced patient, HCP, and staff experiences. Second, although our interviews were conducted by both White and Black study personnel, racial discordance between interviewer and interviewee and the fact that the White interviewer was also a physician may have complicated the already difficult task of establishing trust within a 90-minute interview and limited what participants were comfortable sharing.

Despite these limitations, there are multiple important implications for clinical practice. First, it is important for women to understand that diabetes risk continues in the long term after an affected pregnancy and that screening should continue every 1–3 years throughout life. It is crucial for primary care providers to know patients' pregnancy history and incorporate it in their prevention and screening counseling. Next, counseling, beginning in pregnancy and continuing to the postpartum period, must focus on building agency and self-efficacy in diabetes prevention to help women understand that diabetes is preventable even in the context of family history and GDM history and equip them to sustain

lifestyle changes. Additionally, messaging about the diabetes prevention benefits of both metformin and breastfeeding must be clearer, with additional discussion of the barriers patients perceive to using medication for prevention. Finally, given the importance of baby's health as a motivator for maternal action, interventions both during and after pregnancy should support both maternal and child health, extending beyond the clinical encounter to address social determinants of health that may play a role.

### Conclusion

Our findings provide important insights into women's understanding of GDM and future diabetes risk and prevention. Additionally, we present further information on the education provided by HCPs and clinic staff across disciplines and the way these individuals perceive women's understanding of these topics. Future interventions that capitalize on motivation during pregnancy may help women manage their GDM and transition to healthy postpartum behaviors for type 2 diabetes prevention.

### ACKNOWLEDGMENTS

The authors thank all of our study participants for their time and invaluable insights. They acknowledge Rana Rahaman and Reeti Pal for their role in transcript deidentification and Samantha Williams for her role in early interviews, recruitment, and transcript deidentification. They thank Kendra Copanas and the Making Change Happen Leadership Group at Generate Health for their review and feedback on the interview guide and the Center for Community Health Research and Partnership Community Advisory Board for advice on recruitment materials. Finally, they acknowledge Karen Bradshaw, the Network Community Academic Partnership group, and the Transitions of Care Task Force with the St. Louis Integrated Health Network for providing important input on the development of the study and the interpretation of its results.

### FUNDING

This work was funded by the National Center for Advancing Translational Sciences (grant number KL2TR002336) and a Barnes Jewish Hospital Foundation/WU Institute of Clinical and Translational Sciences pilot grant. H.R.L. received funding from the National Heart, Lung, and Blood Institute Short-term Training Grant program (grant number T35HL007815). L.N.H. received funding from a National Institute of Diabetes and Digestive and Kidney Diseases training grant (grant number T32DK007120). C.J.H. is funded through the National Institute for Child Health and Development (grant number K23HD096204). A.S.J. and G.A.C. are supported in part through funding from the Site-man Cancer Center and the Barnes Jewish Hospital Foundation.

## DUALITY OF INTEREST

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

## AUTHOR CONTRIBUTIONS

H.R.L. was involved in codebook creation, transcript coding and reconciliation, data interpretation, and manuscript preparation. R.C.W. recruited and interviewed participants, created codebooks, coded and reconciled transcripts, and edited the manuscript. L.N.H. coded transcripts and edited the manuscript. B.J.-J. and H.B.M. were involved in study conception, interview guide design, community engagement, and manuscript review. A.S. facilitated community engagement with data interpretation and edited the manuscript. G.A.C. was involved in study conception and design, interpretation of findings, and manuscript editing. A.S.J. mentored C.J.H. in study design and implementation, assisted in interpretation of the results, and edited the manuscript. C.J.H. conceived of and designed the study, conducted interviews and analysis, and edited the manuscript. C.J.H. is the guarantor of this work and, as such, had full access to all of the data and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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