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Addressing the Increased Prevalence of Gestational Diabetes among Hispanic/Latino Pregnant Persons in the Central Valley of California

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Abstract

Gestational Diabetes (GDM) is a preventable noncommunicable disease that has been on the rise over the last 60 years. Pregnant persons with gestational diabetes are 10 times higher of acquiring Type 2 Diabetes after pregnancy (Ionannou et al., 2024). There is an urgent need to address this public health threat because of its increase in mortality. To address this complex chronic disease, this literature review explored multi-level interventions using the socioecological model to mitigate GDM in the Central Valley’s, Tulare County. Tulare County is disproportionately affected by chronic diseases like diabetes especially among the Hispanic and Latinx communities. Therefore, it is the population of focus. The socioecological model helped illustrate and categorize the facilitators and barriers at each level. This literature review was able to identify ways to mitigate and improve GDM outcomes from different interventions levels. Furthermore, this review discovered gaps in current research to address environmental impacts on GDM and proposed recommendations to incorporate an environmental health assessment on all OB/GYN patients. The data collected from this scoping review can guide public health practitioners to implement effective programs and education supporting pregnant persons to reach a healthier lifestyle for themselves and their children.
Introduction

Gestational diabetes mellitus (GDM) is an urgent public health threat impacting pregnant persons and infants globally. GDM is a diagnosis of pregnant persons who have elevated blood sugar called hyperglycemia (HG) that is found at the onset of pregnancy or first recognized in pregnancy (Shepherd et al., 2017). GDM can include women who have hyperglycemia due to pregnancy specifically in the second trimester or pre-existing diabetes mellitus that is first diagnosed in pregnancy (Shepherd et al., 2017). It is estimated in 2021 that GDM has impacted 16.7% of pregnancies globally compared to 8.3% in the U.S (International Diabetes Federation, n.d.; CDC, 2023). Furthermore, rates of GDM diagnosis have steadily increased in the U.S., growing from less than 1% in 1961 to 8.3% in 2021 (CDC, 2023; Dłuski et al., 2022).

Health factors that predispose pregnant persons at risk of GDM include being overweight/obese, over 45 years of age, inactivity, having a poor diet, having a family history of GDM or Type 2 Diabetes Mellitus (T2DM), and a history of polycystic ovarian syndrome (PCOS) (International Diabetes Federation, n.d.). Health complications from GDM include increased risk of c-section, birth weight >90%, shoulder dystocia of newborn, NICU admissions, pre-eclampsia, and neonatal hypoglycemia (Buchanan et al., 2012). Pregnant persons with GDM have a ten-fold increase in developing T2DM, especially following the three to six years after GDM pregnancy (Ioannou et al., 2024).

The disease burden of GDM rests heavier in certain communities. The sociodemographic disparities associated with GDM are glaringly present in the Central Valley of California, specifically Tulare County. Tulare County’s population of race/ethnicity are Hispanic 63.8%, White 29.6%, Asian 3.1%, Multi-Race 1.4%, Black 1.2%, American Indian 0.7%, and Pacific Islander 0.1% (Community Health Assessment Tulare County 2023, 2023). Patient discharge data
showed that the top five most requested languages spoken in the emergency department and ambulatory surgery center included English, Spanish, Arabic, Portuguese, and Lao (Community Health Assessment Tulare County 2023, 2023). According to the U.S. Census’ American Community Survey (2016-2020) for people 5 years and older, 51% speak a language other than English at home (Community Health Assessment Tulare County 2023, 2023).

The income distribution among Tulare County’s married couples show an inverse relationship of having more low-income earners compared to the state. As incomes increase from 100,000 or more, married couples have a smaller income proportion than the state, see Appendix A (Community Health Assessment Tulare County 2023, 2023). For example, only 14.3% of married couples in Tulare County earn 150,000 or more per year compared to 33.1% statewide (Community Health Assessment Tulare County 2023, 2023). Tulare County has a larger proportion of its population covered by Medical compared to the state, 43.1% vs 25.4% respectively, see Appendix B (Community Health Assessment Tulare County 2023, 2023). However, the uninsured rate is higher compared to the state, 6.8% vs. 5.8% (Community Health Assessment Tulare County 2023, 2023). In 2019, the Migrant Policy Institute conducted data to find that 36% of undocumented immigrants were uninsured which could be reflected in this higher rate compared to the state (Community Health Assessment Tulare County 2023, 2023).

In 2017, Tulare County Community Health Assessment reported that the prevalence of diabetes was 13.7% compared to the state average of 8.6% (Tulare County 2017 Community Health Assessment, 2017). Furthermore, six out of ten focus groups of Tulare County residents who participated in a needs assessment stated diabetes as their greatest health concern (Tulare County 2017 Community Health Assessment, 2017). While mortality rates from diabetes in 2010-2014 were 77.9 per 100,000 in California, the comparable rate in Tulare County was far
higher at 119 per 100,000. Racial and ethnic disparities persisted as well with African Americans and Hispanics disproportionately impacted by diabetes in Tulare County with a mortality rate of 227.9 and 149.8 per 100,000 respectively (Tulare County 2017 Community Health Assessment, 2017).

Unfortunately, the cost to treat diabetes in California is estimated at $1.9 billion per year and an additional $800 million per year loss in productivity (Taylor, 2019). Medical expenses of diabetic patients are 2.3 more than those without diabetes (Taylor, 2019). The staggering costs associated with this diagnosis present challenges relating to access to quality care, particularly for the uninsured and under insured. Tulare County has a higher rate of uninsured at 6.8% compared to 5.8% in the state (Community Health Assessment Tulare County 2023, 2023). Additionally, Tulare County also has 1,000 more patients to primary care physicians in Tulare County than to California (Community Health Assessment Tulare County 2023, 2023). This could complicate both preventative care and chronic disease management when resources are strained.

This literature review will explore the increasing prevalence of GDM among the Hispanic/Latinx pregnant persons in the Central Valley region of California and provide recommendations to help mitigate the incidence and impact of GDM in this community. Due to GDM’s increasing incidence locally, nationally, and globally, this complex public health threat must be addressed from an intrapersonal, social, organizational, community, and policy level. Public health promotion interventions for GDM include individual lifestyle interventions like diet and exercise, however some of these programs may not be within one’s control due to employment obligations, lack of childcare, access to healthier food choices, and support systems. The struggle for current diabetes program sustainability could be due to its lack of reinforcing structure from the policy, organizational, community, and social level.
Lastly, there is little discussion in the broader OB/GYN field about the incorporation of environmental health assessments of pregnant patients to address GDM. There is substantial evidence that endocrine-disrupting chemical (EDC) exposure can cause metabolic syndromes, obesity and cancer. According to Janesick & Blumberg (2016), the American Journal of Obstetrics & Gynecology recommends taking environmental health assessments of patients before, during, and after conception to reduce the risk of further chronic disease development (Janesick & Blumberg, 2016). This literature review will explore evidence-based interventions like diet, exercise, and environmental health assessments that can reduce gestational diabetes from a SEM framework and explore gaps in the literature where further development is recommended.

**Methods**

**Research Strategy**

I conducted a literature review to identify evidence-based interventions to mitigate GDM and highlight further gaps in the literature addressing GDM interventions. This scoping review collected statistics on GDM prevalence, economic impacts, community-based needs assessments, SEM model studies, and evidence-based practice interventions applicable to the Tulare County community.

**Target Population**

The target population includes Hispanic/Latinx pregnant persons in the Central Valley, specifically in Tulare County, who are between 14-55 years of age, at risk to GDM (elevated BMI, obesity, or prediabetes) and have a diagnosis of GDM.
Databases

I explored multiple databases, including PubMed, Google Scholar, CINAHL Ultimate, and data collected from the California Department of Public Health and Tulare County Department of Public Health. The search terms included: Gestational diabetes mellitus (GDM), program interventions, social ecological model, prevention programs, environmental risk factors, obesogens, EDC, obesity, diabetes, California, and Tulare County. This keyword search included quantitative and qualitative research articles, state and county public health department reports on diabetes and health disparities. The findings from this literature review are separated between quantitative and qualitative findings for diet, exercise, and cumulative findings on environmental health exposures.

Time Frame and Sample

This literature review included 13 research articles ranging from 2013-2024.

Inclusion and Exclusion Criteria

Inclusion criteria consisted of Hispanic/Latinx pregnant individuals, a GDM diagnosis, ages 14-55 years, and being located in California’s Central Valley, specifically Tulare County.

Exclusion criteria included non-pregnant individuals, those under 14 years old or over 55 years old, individuals without diabetes, and those who are not obese. I did not exclude research outside of the U.S. because it was important to identify relevant recommendations that may be helpful toward mitigating GDM in California’s Central Valley. This work focused solely on Hispanic/Latinx pregnant persons with GDM, but I also included studies exploring similar themes among other racial/ethnic groups. The articles identified included diverse populations,
however, some of these research articles may not fully match that of the Central Valley demographic and their recommendations may not be fitting for this population.

**Background and Analysis of Literature Review**

Tulare County is disproportionately affected by GDM due to various factors, including limited access to care, a shortage of healthcare providers, immigration and insurance status, language barriers, limited diabetes knowledge, and lack of social support (*Community Health Assessment Tulare County 2023*, 2023). Many of these factors are barriers to GDM mitigation, but also create opportunities to improve outcomes of GDM diagnosis. Since Tulare County’s majority population is Hispanic at 63.8% and the mortality rate is second highest at 149.8 per 100,000, this is the population of interest. The incidence of GDM is 1.5 times higher in Hispanic women than in Caucasian women (Tang et al., 2015). There are several interventions that research has attributed to improving GDM outcomes globally which include lifestyle modifications (diet and exercise), social support systems, community infrastructure, and emerging evidence to suggest limiting environmental exposures. Due to the complex nature of these types of interventions, this literature review will explore each intervention under the lens of the social ecological model.

**Interventions Related to Diet and Exercise**

**Quantitative Results**

Diet and exercise have been the gold standard for addressing diabetes and are often regarded as a “lifestyle intervention.” In Shepherd and colleagues (2017), 19 out of 23 Randomized Control Trial (RCT) studies on lifestyle modifications of diet and exercise showed a reduction of GDM compared to those with no intervention average risk ratio (RR) 0.85, 95%
confidence interval (CI) 0.71 to 1.01 (Shepherd et al., 2017). Additionally, there was a possible reduction risk of caesarean sections with RR 0.95, 95% CI 0.88 to 1.02 (Shepherd et al., 2017).

In another lifestyle modification program by Ferrara and colleagues (2020), they performed a RCT at five antenatal clinics in California and allocated half the women participants into a 1:1 telehealth lifestyle intervention, and the other half to usual care (Ferrara et al., 2020). The intervention group had in person and telephone behavior strategies to improve weight, diet, physical activity, and stress management with the goal of gaining the lower limit of the Institutes of Medicines gestational weight gain (Ferrara et al., 2020). The intervention group that received telehealth support had a significantly lower weekly rate of gestational weight gain compared to those with usual care (P<0.0001) (Ferrara et al., 2020). The results of this study showed that telehealth medicine can be helpful in improving GDM management.

Mohebbi and colleagues (2019) shared a quasi-experimental study where the intervention group received a self-management GDM education and additional phone call follow-ups compared to the usual GDM education program (Mohebbi et al., 2019). The intervention group showed an improvement in self-management and HbA1c markers after three and six month follow-up (p<0.001) compared to the control group which had no difference (P>0.05) (Mohebbi., 2019). The result of this study validates that when patients participated in their own self-management program with support, they may feel more motivated to address their health concerns.

**Qualitative Results**

To explore the more nuanced challenges of GDM, qualitative data will be discussed to give a more well-rounded illustration of the health problem. Tang and colleagues (2015) conducted 23 interviews among an ethnically diverse group of women in the Chicago region and
discovered revealing themes (Tang et al., 2015). Mothers attributed their risk to T2DM to family history and health behaviors. Furthermore, some women were unclear about the association between GDM and T2DM (Tang et al., 2015). Mother’s felt that healthcare providers should use motivational tactics that could impact their children. For example, providers could say “These steps will mean you can be healthy to care for your children and be a healthy role model.” Mothers stated that motivation is challenging to sustain and strategies to increase social support would be helpful (e.g. peer support groups). Physical activity that involves children in the community would be beneficial for those without childcare and could help mitigate postpartum mental health disorders (Tang et al., 2015; White et al., 2023). Further barriers to GDM maintenance and understanding by Muhwava and colleagues (2019), was that there were a lack of counselling and education about GDM by healthcare providers, no detailed education materials on lifestyle changes, and a lack of time spent with provider because they were in a hurry (Muhwava et al., 2019). Additional barriers that mothers attribute to challenges include finding personal time for physical activity, access to healthy affordable food, and safe outdoor spaces to exercise in the community (Muhwava et al., 2019).

A study by Dennison and colleagues (2022), showed most participants in the qualitative study believed additional advice and coaching was needed on how to eat healthy and exercise with a busy schedule so that they could sustain these efforts long-term (Dennison et al., 2022). A very insightful focus group study by Dasgupta and colleagues (2013) showed that the 29 women voiced a strong need for social support to achieve changes in diet and physical activity (Dasgupta et al., 2013). The participants preferred face-to-face support with peers and healthcare providers before using social media as supplemental education (Dasgupta et al., 2013). Facilitators to
support lifestyle interventions include spousal and familial support and barriers were work-related responsibilities and childcare (Dasgupta et al., 2013).

In Ionannou and colleagues (2024), the study explored the barriers and facilitators of physical activity postpartum in 12 GDM women utilizing the socioeconomic model (Ionannou et al., 2024). The study investigated the complex system of influences that affect postpartum women’s choice to exercise (Ionannou et al., 2024). Historically, studies have focused on individual level interventions to influence behavior change, however, there are system level factors beyond the individual that could help provide more sustainable interventions to reduce GDM (Ionannou et al., 2024). The study showed a range of barriers and facilitators from each of the socioeconomic levels including intrapersonal, social, organizational, community, and policy. The results of this study are show in Appendix C for visual representation. Furthermore, this socioeconomic model will be utilized to help visualize the facilitators and barriers from this literature review.

**Interventions Related to Environmental Exposure**

In 1993, EDCs emerged as a significant finding in the scientific literature (Janesick & Blumberg, 2016). During this time, adipose tissue was being recognized as an endocrine organ that is connected to steroid hormones (estrogen, androgen, and glucocorticoids) (Janesick & Blumberg, 2016). As a result, adipose tissue may be affected by EDC’s which subsequently could be contributing to obesity, diabetes, infertility, and cancer (Janesick & Blumberg, 2016). Most alarming, animal studies provide evidence to suggest that intrauterine exposure to EDC’s predisposes offspring to excessive fat development that permanently alters metabolic set point (Janesick & Blumberg, 2016). The results highlight the importance of healthcare providers in
teaching those with GDM about ways to reduce obesogenic exposure to themselves and their offspring.

In Cardenas and colleagues (2018), researchers conducted a prospective study over 15 years that confirmed exposure to the EDC, PFAS, was associated with higher weight and hip girth overtime, however, exposure to lifestyle interventions helped mitigate the worsening effects (Cardenas et al., 2018). However, Liu and colleagues (2018) discovered that a two-year diet-induced intervention showed higher than baseline levels of PFAS were associated with greater weight regain especially in the women participants and a slower return of resting metabolic rate (Liu et al., 2018). These findings suggest that EDCs could be making it harder for those to lose weight despite diet interventions (Liu et al., 2018). That said, this study did not factor in an exercise intervention which showed more protective benefits against weight gain shown in the Cardenas and colleagues’ study (Cardenas et al., 2018; Liu et al., 2018).

Persistent organic pollutants (POP) are another endocrine disruptor that have been linked to obesity, T2DM, and insulin resistance (Lee et al., 2014). POPs are lipophilic meaning they tend to be stored in adipose tissue and like to move around the body attached to lipids (Lee et al., 2014). These chemicals bioaccumulate in our environment and bodies overtime without degradation (Lee et al., 2014). Due to the persistence of these chemicals, consumption of animal fatty protein increases POP exposure putting people at risk to metabolic disease development (Lee et al., 2014). In a profound finding that is consistent in studies surrounding EDCs is the contradiction of traditional toxicology stating the higher the dose the more toxic (Lee et al., 2014). In the case of EDC’s, there is an inverse U shape curve meaning that low-dose exposures may be more harmful than high-dose exposures (Lee et al., 2014). In a study by Ruzzin and colleagues (2010), adult rats were exposed to a mixture of low-dose POPs and the rats developed
insulin resistance, abdominal obesity, and hepatosteatosis (Ruzzin et al., 2010). These findings point to an increasing concern that environmental exposures, even in low-dose exposures, play a significant role in GDM development and there is an urgent need for this to be included in prenatal and postnatal care.

**Recommendations and Implications**

The recommendations to address the Central Valley’s GDM epidemic includes looking at the chronic disease at different levels of a person’s life. This section will illustrate the facilitators that will help improve GDM outcomes and the barriers that have created challenges in addressing GDM. Utilizing the socioecological model, Table #1 included in the Table section of this paper, will provide the overarching results from this literature review. After reviewing the facilitators that could mitigate GDM and diabetes in the Central Valley, there are many ways to adopt prevention programs in the community. The overall theme from this literature review was that a balanced diet, exercise, decreased environmental chemical exposures, social support systems, and community and healthcare resources can help mitigate the GDM crisis. The search also highlighted a few actionable recommendations that incorporated more diabetes health educators with telehealth options into healthcare organizations. Additionally, subsidized parent/baby and parent/toddler exercise programs would be helpful for those parents lacking social support and an opportunity to create a social support system. In addition, having more gyms in the region to provide childcare support would help families without social support. GDM peer support groups and exercise groups would be beneficial and could be recommended by the diabetes health educators. On the policy level, there is a need to provide more exercise-friendly parks and recreation especially in the more rural cities of Tulare County. Furthermore, it is important to promote public transit options and active transport infrastructure to reduce
environmental exposures and promote physical activity. Lastly, our health depends on legislation to responsibility regulate consumer products to prevent exposure to harmful substances (A Story of Health, n.d.).

Regarding environmental health recommendations, a dearth of scholarly papers explore environmental health screening in the OB/GYN community. Such discussions and screening for parents at their first prenatal visit or first OB/GYN visit may minimize reproductive harmful exposures in their future or current pregnancy. An example by the Western States PEHSU, A Story of Health (n.d.) e-book series, provides an environmental health screening questionnaire to give patients, see Appendix D. Additionally, factsheets about EDC exposures could be provided at OB/GYN and primary care offices to address the environmental reproductive threats and provide an opportunity for education and discussion. An example of a reproductive-specific factsheet related to EDC’s is in Appendix E.

Taken together, the research explored during this literature review revealed the all-encompassing need to address the complexities of chronic conditions, like GDM, from a systematic level. The results show that there are multiple levels of interventions needed at the interpersonal, social, organizational, community, and policy level. Furthermore, the environmental health impacts are not being addressed in current GDM program interventions and should be considered in further research due to its propensity to cause insulin resistance, obesity, and further complicating diabetic conditions. There is a need for healthcare providers to expand their education on the causes and solutions of these chronic conditions beyond an individual-only solution approach.
Conclusion

GDM is a chronic disease impacting many pregnant persons globally and has increased over the last several decades. Globalization has contributed to the use of ultra-processed foods, less active transportation, dependence on automobiles, and the use of modern-day conveniences that expose humans to toxic chemicals. While many of these examples are a part of our daily life, they are contributors to the chronic conditions plaguing the United States and world’s health. This literature review provides an important list of opportunities that can be adapted to local communities to address GDM from a social ecological viewpoint. It takes community stakeholders, healthcare professionals, legislators, and engaged community members to address complex diseases like GDM. If stakeholders, healthcare professionals, legislators, and community members work together to address GDM at each level of the SEM model then the outcomes of GDM mitigation could have profound results on a community’s health.
References


mellitus. *The Cochrane Database of Systematic Reviews, 11*(11), CD010443. 10.1002/14651858.CD010443.pub3


http://hhsawebdocs.tchhsa.org/File.ashx?id=4245&v=1&x=pdf&r=HHSA_Webdocs

Tables

Table #1. Social Ecological Model to address GDM

<table>
<thead>
<tr>
<th>Facilitators/Recommendations</th>
<th>Barriers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interpersonal level factors</strong></td>
<td><strong>Social level factors</strong></td>
</tr>
<tr>
<td>o Diet and exercise adoption work collaboratively (Sheperd et al., 2017)</td>
<td>o Finding time for personal physical activity (Muhwava et al., 2019)</td>
</tr>
<tr>
<td>o A self-management program following a health behavior model with telehealth support (Mohebbi et al., 2019)</td>
<td>o Exposure to PFAS in diet (Liu et al., 2018)</td>
</tr>
<tr>
<td>o Lifestyle interventions decrease worsening effects of EDC’s (Cardenas et al., 2018)</td>
<td>o Doctors can motivate postpartum parents to make health changes by explaining it’s an opportunity to be a role model (Tang et al., 2015)</td>
</tr>
<tr>
<td>o Supportive husband and family to give mother breaks for exercise (Dasgupta et al., 2013)</td>
<td>o Supportive husband and family to give mother breaks for exercise (Dasgupta et al., 2013)</td>
</tr>
</tbody>
</table>
Gestational Diabetes Among Hispanic/Latinx Pregnant Persons in the Central Valley

- Healthcare organizations providing telehealth support and peer educators (Ferrara, 2020)
- Exercise classes for parent/babies and parent/toddlers (Tang et al., 2015)
- Childcare located inside gyms (Ionannou et al., 2014)
- Doctors hurrying to provide care and unable to provide education (Muhwava et al., 2019)
- Limited childcare and work responsibilities (Dasgupta et al., 2013)

<table>
<thead>
<tr>
<th>Community level factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Facilitators/Recommendations</strong></td>
</tr>
<tr>
<td>- Peer support groups (e.g. walking or exercise classes) (Tang et al., 2015)</td>
</tr>
<tr>
<td><strong>Barriers</strong></td>
</tr>
<tr>
<td>- Limited green spaces and unsafe parks and recreation (Muhwava et al., 2019)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Policy level factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Facilitators/Recommendations</strong></td>
</tr>
</tbody>
</table>
| - WIC may help with access to affordable and healthy food (English - Women, Infants and Children (WIC), n.d.)
- More walkability in cities and safe for active transportation (Ionannou et al., 2014) |
| **Barriers** |
| - Access to healthy affordable food, especially in rural food deserts (Muhwava et al., 2019)
- Lack of PFAS and other EDC regulation prior to entering consumers hands (Liu et al., 2018) |
Appendix

Appendix A

**Figure 27. Income Distribution Among Married Couple Families**

<table>
<thead>
<tr>
<th>Income Range</th>
<th>Tulare County</th>
<th>California</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under $15K</td>
<td>5.2%</td>
<td>2.5%</td>
</tr>
<tr>
<td>$15K to $24.9K</td>
<td>7.5%</td>
<td>3.8%</td>
</tr>
<tr>
<td>$25K to $34.9K</td>
<td>9.5%</td>
<td>4.8%</td>
</tr>
<tr>
<td>$35K to $49.9K</td>
<td>12.5%</td>
<td>8.0%</td>
</tr>
<tr>
<td>$50K to $74.9K</td>
<td>18.9%</td>
<td>13.9%</td>
</tr>
<tr>
<td>$75K to $99.9K</td>
<td>14.8%</td>
<td>13.0%</td>
</tr>
<tr>
<td>$100K to $149.9K</td>
<td>17.4%</td>
<td>14.8%</td>
</tr>
<tr>
<td>$150K to $199.9K</td>
<td>7.5%</td>
<td>13.0%</td>
</tr>
<tr>
<td>$200K +</td>
<td>6.8%</td>
<td>20.1%</td>
</tr>
</tbody>
</table>

*Source: American Community Survey 2016-2020, Table S1901, US Census Bureau*

Appendix B

**Table 40. Type of Health Insurance, 2020-2022**

<table>
<thead>
<tr>
<th>Health Insurance Type</th>
<th>Tulare County</th>
<th>California</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medi-Cal (alone or with Medicare)</td>
<td>43.1%</td>
<td>25.4%</td>
</tr>
<tr>
<td>Employment based</td>
<td>36.2%</td>
<td>50.0%</td>
</tr>
<tr>
<td>Medicare (alone, or with others excluding Medi-Cal)</td>
<td>10.6%</td>
<td>13.1%</td>
</tr>
<tr>
<td>Privately purchased</td>
<td>2.4%</td>
<td>4.7%</td>
</tr>
<tr>
<td>Uninsured</td>
<td>6.8%</td>
<td>5.8%</td>
</tr>
</tbody>
</table>

*Source: California Health Interview Survey, askchis.ucla.edu*

Source: SEM model exploring interventions themes of those with GDM. From “Beyond the individual: Socio-ecological factors impacting activity after gestational diabetes mellitus”, by Ionannou, E., Humphreys, H., Homer, C., & Purvis, A. 2024, Diabetic Medicine, 41(6), p.5, Copyright 2024 by CC.
Appendix D

Environmental History Form

What do you do for work?

Are you exposed to any of the following at work:

- Metals
- Solvents
- Chemicals (including those for cleaning)
- Radiation
- Pumps
- Lead or other heavy metals storage, especially in babies and children
- Are you exposed to any of the following at home:

- Metals
- Solvents
- Chemicals
- Radiation
- Pumps

Have you or anyone living in your home ever been treated for hypertension?

Have you or anyone living in your home ever been treated for a heart condition?

Are there any pets in your home?

Have you moved from one area to another in the last year?

Does your family use natural or organic cleaning products?

Have you used more than one remedial supplement during pregnancy?

Have you had more than one miscarriage?

Have you ever had more than one abortion?

Do you use any of the following?

- Chlordane
- Dust mite spray
- Insecticide
- Pesticides

Does your baby have a history of

Smoke detector?

Carbon monoxide detector?

Do you have any other concerns or questions?

Do you have any other recommendations or questions?


Appendix E