

# Case Reports on Diabetes-Related Outcomes for Pregnant Women in the National Diabetes Prevention Program

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Previous interventions to lower diabetes risks among pregnant women have been largely ineffective (1–3), and the identification of effective prevention tools is needed to protect both maternal and child health (4). The National Diabetes Prevention Program (NDPP) is a widely disseminated translation of the highly successful lifestyle change intervention from the Diabetes Prevention Program research study (5,6). The NDPP promotes weight loss of  $\geq 5\%$  through diet and physical activity, benefiting individuals who participate regularly (6). Eighty percent of participants are women (6), but most are beyond child-bearing years (7), and those who are pregnant at enrollment are excluded (8). Increasing enrollment in the NDPP among women of childbearing age has been identified as a priority (7), yet outcomes for those who become pregnant during the year-long program are unknown. To explore whether the NDPP may support beneficial outcomes during pregnancy, we examined case studies of women who became pregnant while participating in the NDPP.

We delivered the year-long NDPP intervention in a Denver, Colo., health care system to eligible adults with diabetes risks (i.e.,  $\geq 24$  kg/m<sup>2</sup> and prediabetes, history of gestational diabetes mellitus [GDM], or positive score on a diabetes risk questionnaire [8]). Participants were largely referred by their primary care providers. Trained NDPP coaches led 22–25 group sessions over 1 year following

guidelines developed by the Centers for Disease Control and Prevention (9). From March 2013 to March 2018, 924 women participated. Five women who subsequently reported having become pregnant were able to continue, but were no longer prescribed the NDPP's weight loss goal. This article describes diabetes-related outcomes in pregnancy among three women using medical records available as of May 2018. An additional case was excluded because detailed records were unavailable, and another was excluded because of the early stage of the pregnancy. The Colorado Multiple Institutional Review Board designated the project as a program evaluation.

## Case Presentations

### Case 1

The first case is a 35-year-old, gravida 4, para 2 Latina. Diabetes risks at NDPP enrollment included obesity (BMI 34.6 kg/m<sup>2</sup>), prediabetes (A1C 5.7%), and a pronounced family history of diabetes, but no indication of previous GDM or other diabetes-related obstetric complications. Her weight had been increasing, and she had gained 10 lb in the 4 months before enrolling. She became pregnant 5 months into the program. Her weight steadied in the NDPP before pregnancy, but with no weight loss despite nearing the program's goal of 150 minutes/week of physical activity (mean 141.7 minutes [SD 65.6]). She continued to participate throughout the first trimester of pregnancy,

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attending 16 sessions over 231 days. She did not attend during her second trimester, and the NDPP classes ended before her third trimester.

Upon starting obstetric care, her A1C remained at 5.7%. Her 1-hour glucose tolerance test (GTT) screening was slightly elevated (142 mg/dL), as was the 1-hour result of a 3-hour GTT (184 mg/dL). She declined confirmatory testing but later had a normal fasting glucose (77 mg/dL), and third-trimester ultrasounds showed normal fetal growth. She gained 3 lb in pregnancy, falling below weight gain recommendations for obese women (10), but without related concerns. She proceeded to have a full-term pregnancy and uncomplicated vaginal delivery of a healthy neonate weighing 7 lb, 6 oz. Her weight decreased to 3 lb below her pre-pregnancy weight within 3 months of delivering. She reported breastfeeding with supplementation. Her most recent A1C since delivery was normal (5.5%).

### Case 2

The second case is a 29-year-old, gravida 3, para 2 Latina. Diabetes risks included obesity (BMI 32.5 kg/m<sup>2</sup>) and prediabetes (A1C 5.7%), but no reported family history of diabetes, past GDM, or history of other diabetes-related obstetric complications. Previous records noted her concern about obesity, followed by her achievement of a 5-lb weight loss in the 6 months before starting the NDPP. She did not lose any more weight in the NDPP over 2 months before becoming pregnant, although she routinely exceeded 150 minutes/week of physical activity (mean 207.2 minutes [SD 44.2]). She continued participating throughout her first and second trimesters and discontinued in her third trimester, attending 15 sessions over 238 days.

Upon starting obstetric care, the patient had a normal GDM screen per institutional protocol (A1C 5.2%, 1-hour GTT 106 mg/dL). She gained 26 lb during pregnancy,

exceeding the 20-lb recommended weight gain limit for obese women (10), but without related complications. She had a full-term pregnancy and uncomplicated vaginal delivery of a healthy neonate weighing 8 lb, 4 oz. Postpartum records indicated breastfeeding with supplementation. Her weight decreased to 7 lb above her pre-pregnancy weight within 2 months of delivering (later records were unavailable). Postpartum A1C was normal at 5.4%.

### Case 3

The third case is a 33-year-old, gravida 3, para 2 Latina. Risks included a positive score on the diabetes risk questionnaire and being overweight (BMI 27.4 kg/m<sup>2</sup>), although her weight had been stable for several years. She had a normal A1C (5.4%), no record of previous GDM or diabetes-related obstetric complications, and no family history of diabetes. She became pregnant upon starting the NDPP and attended regularly throughout the first trimester before dropping out, completing seven sessions over 63 days. She did not report physical activity, which is not routinely collected in early sessions.

The patient gained 14 lb in pregnancy, falling below the recommended weight gain amounts for overweight women (10), but without related concerns. She did not develop GDM (A1C 5.4%, 1-hour screening GTT elevated [135 mg/dL], follow-up 3-hour GTT normal). She had a full-term, vaginal delivery, including a 2-minute shoulder dystocia without neonatal complications. Neonate weight was 8 lb, 4 oz. At 2 months postpartum, she was 5 lb below her pre-pregnancy weight, and her glucose levels were normal. Records show she was breastfeeding.

### Questions

- Can the NDPP lifestyle change intervention support the health of pregnant women and their offspring?
- Should the NDPP be added to recommended clinical practice to

reduce diabetes risks for women who are pregnant or intending to become pregnant?

- What strategies may help pregnant women complete the year-long NDPP program?
- Should pregnant women continue to participate in the NDPP during their third trimester?

### Commentary

This is the first report to our knowledge on pregnant women in the NDPP. Case reports are preliminarily encouraging, although implications are uncertain, and findings are not generalizable. In summary, all three cases were multigravida Latina women without previous GDM but with other diabetes risks at enrollment. None were diagnosed with GDM, although one case remained unconfirmed. Weight-related obstetric outcomes were positive overall. One participant exceeded gestational weight gain recommendations, but neared her pre-pregnancy weight soon after delivery. Others gained less than recommended amounts, followed by complete pregnancy weight loss postpartum. Breastfeeding by all was likely a protective factor. Neonates' weights were normal. Two women who began pregnancy with prediabetes both achieved normal A1C levels postpartum. These women also participated beyond the national average of 172 days (6), which may be a driver of their positive outcomes. The third case attended relatively briefly but had the fewest diabetes risks at enrollment, and complications during her labor appeared unrelated.

Case studies preliminarily suggest that the NDPP is not harmful and may support behaviors that can limit gestational weight gain and promote a healthy pregnancy. However, findings may not be solely attributable to the NDPP. There was no evidence of weight loss in the NDPP before pregnancy, although Latino participants are known to have disparately low weight loss on average in the program (6,11). Both women

who began participating before pregnancy only maintained their starting weight despite regular physical activity (dietary adherence was not recorded), although one successfully halted a trajectory of recent weight gain. The other woman began losing weight before starting the NDPP, suggesting a potential benefit of previous lifestyle changes. During pregnancy, two cases exhibited gestational weight gain lower than recommendations without complications. This confirms earlier reports that limited gestational weight gain among overweight/obese women can occur without adverse maternal-fetal outcomes (12,13) and suggests that programs like the NDPP that promote healthy eating and increased physical activity may indirectly support positive pregnancy outcomes via weight management. None fully completed the program or participated in their third trimester. It is not known whether the dropouts were due to concerns about participating while pregnant or to other factors. Another limitation to this report is that it only included cases who reported pregnancy to the NDPP coaches; more participating women likely were pregnant than was known. Further study is needed in larger, more diverse samples and across all trimesters.

### Clinical Pearls

- Case studies preliminarily suggest that the NDPP is not harmful and may be a beneficial resource to help women with diabetes risks in pregnancy.
- Although not originally developed for pregnant women, the curriculum's focus on physical activity and healthy diet are consistent with general recommendations for gestational weight management and health promotion (14,15).
- Increasing engagement of women of childbearing age in the widely disseminated NDPP has previously been suggested (7).
- Potential implications are to encourage participating women who become pregnant to continue, while removing the weight loss emphasis and ensuring concurrent medical attention.
- Pending further study, it may also be advantageous to support initial enrollment of pregnant women to better protect maternal and child health.

### Duality of Interest

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

### Author Contributions

N.D.R. conceived the project, analyzed data, conducted medical chart reviews, and drafted the manuscript. S.F. and K.A.S. contributed to the evaluation design and reviewed/revised the manuscript. N.D.R. is the guarantor of this work and, as such, had full access to all the data reported and takes responsibility for the integrity of the data and the accuracy of the report.

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